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

In the Matter of	)	
	)	
Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems	)	WT Docket No. 22-323
	)	

REPORT AND ORDER

Adopted: August 21, 2024 **Released: August 29, 2024**

By the Commission: Chairwoman Rosenworcel and Commissioner Starks issuing separate statements; Commissioner Gomez not participating.

TABLE OF CONTENTS

APPENDIX C — List of Commenters

I. INTRODUCTION

1. Unmanned aircraft system(s) (UAS) are an increasingly prevalent and important technology in the United States. In 2021, there were 2 million UAS in the United States, and, by 2030, that number is anticipated to triple to 6.5 million.[1] This technology has a diverse range of beneficial public and private uses, including aiding in search and rescue missions, assisting law enforcement, helping farmers grow better crops in a more sustainable and cost-effective manner, inspecting infrastructure, gathering news and enhancing the public's access to information, and delivering medicine to rural locations. UASs are becoming more integrated into everyday life, as evidenced by their use in the delivery of consumer packages.[2] Further, the UAS market is projected to grow at a rate of 14.6 percent, and by 2027 is expected to be valued between $29 billion and $54.2 billion.[3]

2. Achieving the extraordinary potential of UAS technology will require integrating UAS operations into the National Airspace System (NAS), including in the controlled airspace in which commercial passenger flights operate and in circumstances with heightened risk, such as flights involving large aircraft or carrying passengers or flights beyond line of sight of the remote pilot. To ensure that these flights are sufficiently safe for routine operation, highly reliable wireless two-way communications for flight control and telemetry are required.

3. In this Report and Order, we enable UAS operators to access dedicated spectrum for control-related communications with the required reliability. Specifically, we adopt new UAS service rules under new rule part 88 that provide operators the ability to obtain direct frequency assignments in a portion of the 5030-5091 MHz band. Under these rules, one or more dynamic frequency management systems (DFMSs) will manage and coordinate access to the spectrum and enable its safe and efficient use, by providing requesting operators with temporary frequency assignments to support UAS control link communications with a level of reliability suitable for operations in controlled airspace and other safety-critical circumstances. To provide this level of safety and reliability, we are adopting technical requirements drawn from minimum operational performance standards that were developed by an aviation industry standards body specifically to support UAS control links in the 5030-5091 MHz band and were approved by the Federal Aviation Administration (FAA) for this purpose. To address concerns regarding the impact of these aeronautical operations on adjacent services, we locate these operations, for now, in the central part of the band, with substantial separation from the bands adjacent to the 5030-5091 MHz band. We find wide support for enabling early, direct access to a portion of the band for protected assignments under DFMS coordination, and anticipate that such access will facilitate the safe integration of UAS operations into the NAS so that the United States can realize the enormous potential benefits that UAS operations can provide.

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[1] International Civil Aviation Organization, *Increased Use of Unmanned Aircraft Systems (UAS), Annual Report 2021*, https://www.icao.int/annual-report-2021/Pages/emerging-and-cross-cutting-aviation-issues-increased-use-of-unmanned-aircraft-systems-uas.aspx (last visited Aug. 19, 2024).

[2] Amazon, *11 Photos of Amazon's New Prime Air Drone That Can Fly in Light Rain and Deliver Packages Up to 5 Pounds in Under an Hour* (Oct. 18, 2023), https://www.aboutamazon.com/news/transportation/amazon-prime-air-drone-delivery-mk30-photos; Walmart, *Walmart and Wing Team Up to Provide the Convenience of Drone Delivery* (Aug. 24, 2023), https://corporate.walmart.com/news/2023/08/24/walmart-and-wing-team-up-to-provide-the-convenience-of-drone-delivery.

[3] International Civil Aviation Organization, *Increased Use of Unmanned Aircraft Systems (UAS), Annual Report 2021*, https://www.icao.int/annual-report-2021/Pages/emerging-and-cross-cutting-aviation-issues-increased-use-of-unmanned-aircraft-systems-uas.aspx (last visited Aug. 19, 2024); IndustryARC, *Unmanned Aircraft Systems Market Overview*, https://www.industryarc.com/Report/15014/unmanned-aircraft-systems-market.html (last visited Aug. 19, 2024); *see also* International Trade Administration, *Unmanned Aircraft Systems*, https://www.trade.gov/unmanned-aircraft-systems (last visited Aug. 19, 2024).

4. As the Federal Communications Commission (Commission or FCC) anticipated in the underlying Notice of Proposed Rulemaking (*UAS NPRM*), we are addressing service rules for UAS operations in the 5030-5091 MHz band in phases.[4] In this initial step, we open a portion of the band for non-networked operations to enable early, low-cost access to the benefits of dedicated spectrum for UAS control communications. We anticipate that subsequent phases will address broader and more intensive use of the band, potentially with the assistance of a Federal Advisory Committee or other efforts to further assess and engage stakeholders on the potential uses of the band and the appropriate regulatory measures to enable such uses, including but not limited to studies pursuant to the implementation of the National Spectrum Strategy.[5] In subsequent phases, we intend to resolve issues including (1) the final band plan for the 5030-5091 MHz band, which may include changing the amount of spectrum designated for non-networked operations or the location in the band of these operations; (2) measures to ensure compatibility between UAS stations operating at and near the edges of the 5030-5091 MHz band and services in adjacent spectrum; and (3) service rules for exclusive-use licenses enabling network-supported services in the band, including the scope of such services.[6] We further intend to continue close coordination with our federal partners, including the FAA and the National Telecommunications and Information Administration (NTIA), to ensure that UAS operations supported by this band remain compatible with aviation safety concerns, and to develop an appropriate long-term framework for the accommodation of federal agencies seeking access to the federal allocation in the band for their own UAS operations.

II. BACKGROUND

5. At the 2012 World Radiocommunication Conference (WRC-12), the United States proposed that the 5030-5091 MHz band be allocated to the aeronautical mobile (route) service (AM(R)S) on a primary basis in order to support terrestrial control links for UAS.[7] Consistent with the United States

[4] *See Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems*, WT Docket No. 22-323, Notice of Proposed Rulemaking, 38 FCC Rcd 474, 475, para. 2 (2023) (*UAS NPRM*) ("[W]e anticipate that service rules sufficient to facilitate UAS operations will likely require development in phases"); *see also id.* at 485, para. 23.

[5] *See* Federal Advisory Committee Act, Pub. L. No. 92-463, 86 Stat. 770 (1972) (codified at 5 U.S.C. § 1001 *et seq.*); NTIA, National Spectrum Strategy at 6 (2023), https://www.ntia.gov/sites/default/files/publications/national_spectrum_strategy_final.pdf. The National Spectrum Strategy stated that, following near-term Commission action to facilitate limited deployment of UAS in the 5030-5091 MHz band, "this 61 megahertz of spectrum will be studied so that the FCC can optimize UAS spectrum access across the band while avoiding harmful interference to other protected in-band and adjacent-band operations." *Id.*

[6] We will also address at a later time those issues raised in the *UAS NPRM* regarding the use of flexible-use spectrum and existing networks as platforms for UAS operations. Given the evolving use of flexible-use spectrum for UAS operations reflected in the record, we believe that continuing review is advisable. *See* AERPAW Comments at 4-5 (stating that more detailed studies are necessary to understand interference patterns for different bands, altitudes, and scenarios). We anticipate that further experience with such operations as well as developing standards work to integrate UAS operations will help to illuminate whether any additional measures are warranted to promote compatibility between UAS operations and other uses, and conversely whether the aeronautical restrictions that currently prevent UAS operations in certain bands should be relaxed. In addition, we defer action on whether to authorize ground station licenses for UAS operators in the aeronautical VHF band (117.975 MHz -137 MHz) that would enable such operators to communicate directly with Air Traffic Control (ATC). We find that further consideration, including coordination with the FAA, is warranted before taking action on this issue given the critical nature of the aeronautical VHF band, the potential impacts of permitting a ground-based license on that band, and the potential for the nascent option of ATC relay to make a ground station VHF license unnecessary. For the present, UAS operators that require authorization for ground-based VHF radios to meet an FAA flight condition or for other valid reasons may continue to request it through the waiver process as before.

[7] *See Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 80, 87, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (WRC-07), Other Allocation Issues, and Related Rule Updates et al.*, ET Docket No. 12-338 et al., Report and Order, Order, and Notice of Proposed Rulemaking, 30 FCC Rcd 4183, 4263, para. 225 (2015) (*WRC-12 NPRM*).

proposal, WRC-12 allocated the 5030-5091 MHz band internationally to the AM(R)S on a primary basis in all Regions.[8]

6. In 2017, the Commission mirrored the WRC-12 allocation in its rules, allocating the 5030-5091 MHz band to the aeronautical mobile route service (AM(R)S) on a primary basis for both federal and non-federal use.[9] The Commission found that adopting the new AM(R)S allocation would "support the anticipated growth of UAS and promote their safe operation."[10] The Commission stated that "[t]echnical and operational rules relating to altitude, weight, or other requirements will be addressed in the service rules for this band, which will be promulgated in a separate proceeding."[11]

7. On February 8, 2018, the Aerospace Industries Association (AIA) filed a petition for rulemaking recommending licensing and service rules for control-and-non-payload communications (CNPC) links in the 5030-5091 MHz band to support UAS operations in the United States (AIA Petition).[12] The Commission put the AIA Petition out for comment on April 26, 2018.[13] The Wireless Telecommunications Bureau (WTB) sought further comment in a *Refresh Public Notice* on August 20, 2021.[14]

8. On January 4, 2023, the Commission released a Notice of Proposed Rulemaking (*UAS NPRM*) that, *inter alia*, sought comment on service rules for the 5030-5091 MHz band that would provide UAS operators spectrum access with the reliability necessary to support safety-critical UAS communications links.[15] The Commission proposed definitions for key terms including UA, UAS, and CNPC, and sought comment on an appropriate band plan for communications to support the growth and safety of UAS operations.[16] In particular, the Commission proposed to partition the band between two different use cases, Non-Networked Access (NNA), in which spectrum would be available and governed by rules appropriate to support direct, non-networked communications links, and Network Supported

[8] *See WRC-12 NPRM*, 30 FCC Rcd at 4263, para. 226.

[9] *See Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012)(WRC-12), Other Allocation Issues, and Related Rule Updates*, ET Docket No. 15-99, Report and Order, 32 FCC Rcd 2703, 2717, paras. 41, 42 (2017) (*WRC-12 R&O*). Under the Commission rules, "AM(R)S" is defined as "[a]n aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes." 47 CFR § 2.1(c). The Commission defines the term "aeronautical mobile service," in relevant part, as "[a] mobile service between aeronautical stations and aircraft stations, or between aircraft stations[.]" *Id.* An aeronautical station is defined as "[a] land station in the aeronautical mobile service." *Id.* An aircraft station is defined as "[a] mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft." *Id.*

[10] *See WRC-12 R&O*, 32 FCC Rcd at 2717, para. 42; *see also id.* at 2704, para. 1 (stating that "AM(R)S use of the 5030-5091 MHz band will support unmanned aircraft systems").

[11] *See WRC-12 R&O*, 32 FCC Rcd at 2717, para. 42.

[12] *See* Petition of AIA for Rulemaking to Adopt Service Rules for Unmanned Aircraft Systems ("UAS") Command and Control in the 5030-5091 MHz Band, RM-11798 (filed Feb. 8, 2018) (AIA Petition).

[13] *See Consumer & Governmental Affairs Bureau Reference Information Center Petition for Rulemakings Filed*, Public Notice, Report No. 3089 (CGB Apr. 26, 2018), https://docs.fcc.gov/public/attachments/DOC-350441A1.pdf; *see also* Docket No. RM-11798.

[14] *See Wireless Telecommunications Bureau Seeks to Refresh the Record on Unmanned Aircraft Systems Use of the 5 GHz Band*, RM-11798, Public Notice, 36 FCC Rcd 12706 (WTB 2021) (*Refresh Public Notice*). We refer to comments filed in response to the *Refresh Public Notice* as *Refresh Public Notice* Comments and a filed reply as *Refresh Public Notice* Reply.

[15] *See, generally, UAS NPRM*.

[16] *See id.* at 481-86, paras. 13-25.

Service (NSS), in which the spectrum would be available under rules appropriate for the provision of commercial network services supporting UAS control links.[17]

9. With regard to NNA, the Commission proposed or sought comment on rules governing scope of permissible services, eligibility, and technical rules, and also proposed to implement a license-by-rule authorization for both aircraft and ground stations.[18] It further sought comment on whether to locate these rules in a new rule part or in an existing part such as part 87, and on the potential application of existing rules governing Wireless Radio Services or Aviation Services.[19] The Commission proposed that spectrum access by NNA operators be managed by one or more dynamic frequency management systems (DFMSs).[20] Under this proposal, a UAS operator seeking NNA spectrum for a particular UAS operation would submit a frequency assignment request to a DFMS, which would then assign to the requesting operator, through an automated process, protected use of certain frequencies for a particular geographic area and time period tailored to the operator's submitted flight plan.[21] In response to the *UAS NPRM*, the Commission received 51 comments and 16 reply comments.[22]

III. DISCUSSION

A. Non-Networked Access (NNA) Service Rules

1. Designation of Sub-band for NNA Operations

10. In the *UAS NPRM*, the Commission proposed to adopt certain band and service rule definitions, including definitions for unmanned aircraft systems and unmanned aircraft, as well as other terms, including non-networked access operations, and control and non-payload communications.[23] Noting consistency with FAA definitions, the Commission proposed to define an unmanned aircraft system as "an unmanned aircraft (UA) and its associated elements (including communication links and the components that control the UA) that are required for the safe and efficient operation of the UA in the airspace of the United States," and an unmanned aircraft as "an aircraft operated without the possibility of direct human intervention from within or on the aircraft."[24]

11. We conclude that it is appropriate to adopt these definitions. As noted, these definitions are consistent with those used by the FAA,[25] and are also consistent with statutory definitions of these terms.[26] Further, there was no opposition to these definitions in the record. Accordingly, we will adopt our proposed definitions. We acknowledge, however, as noted by AIA and other commenters, that the UAS umbrella, and the definitions we adopt today, can encompass a variety of operations, including

[17] *See id.* at 481-82, paras. 13-16.

[18] *See id.* at 495-505, paras. 47-69.

[19] *See id.* at 505-07, paras. 70-73.

[20] *See id.* at 486-87, para. 26.

[21] *See id.* at 486, para. 26.

[22] Parties that filed comments and replies in the proceeding are listed in Appendix C.

[23] *See UAS NPRM*, 38 FCC Rcd at 481, para. 13.

[24] *Id.*

[25] *See* 14 CFR § 1.1 (defining "unmanned aircraft" as "an aircraft operated without the possibility of direct human intervention from within or on the aircraft" and "unmanned aircraft system" as "an unmanned aircraft and its associated elements (including communication links and the components that control the unmanned aircraft) that are required for the safe and efficient operation of the unmanned aircraft in the airspace of the United States").

[26] 49 U.S.C. § 44801(11), (12) (defining "unmanned aircraft" and "unmanned aircraft system"); *see* FAA Modernization and Reform Act of 2012, Pub. L. 112-95, § 331(8).

Urban Air Mobility and Advanced Air Mobility.[27] We find that we do not need to distinguish among such operations in the rules at this time.[28] Additionally, AIA advocates for expanding the definition of unmanned aircraft to include "Optionally Piloted Aircraft" when operated without a pilot on board, but does not provide an explanation for doing so.[29] Because it is not clear how and in what circumstances this term applies, and because such operations would seem to fall within the scope of the definitions adopted herein, we decline to add this term to the definition of unmanned aircraft.

12. However, while we adopt these definitions as proposed, we find it in the public interest to revise the terminology. Certain commenters advocate changing "unmanned" to "uncrewed." For example, in its comments, AIA proposes that we use the phrase "uncrewed aircraft systems" and "uncrewed aircraft" as opposed to "unmanned aircraft systems" or "unmanned aircraft."[30] AIA argues that the "uncrewed" terminology is more inclusive and better describes use cases for carrying passengers on board remotely piloted aircraft.[31] Similarly, uAvionix supports the use of "uncrewed."[32] While others in the record do not expressly request the adoption of the term, several of the commenters use "uncrewed" in place of "unmanned" in their comments.[33] Further, there appears to be increasing use of "uncrewed" by others in industry as well as by governmental entities. For example, certain standards bodies such as RTCA, Inc. (RTCA) and 3rd Generation Partnership Project (3GPP) are increasingly using "uncrewed" rather than "unmanned,"[34] and certain federal agencies such as the National Oceanic & Atmospheric Administration have adopted the term.[35] We agree that the term "uncrewed" is more inclusive and could better reflect future use cases for the spectrum, such as uncrewed passenger flights, and thus find that it is

[27] AIA Comments at 9 ("Other terms used by the UAS community, such as Urban Air Mobility ('UAM') and AAM refer to specific roles and operating environments that fall under the UAS umbrella. Similarly, Small UAS ('SUAS') are differentiated by the size of the aircraft (usually defined as under 55 lbs. operating weight), and in many cases are subject to different operating and authorization rules.").

[28] *See* AIA Comments at 9 (stating that "[t]hese subdivisions of UAS need not be considered separately in this proceeding").

[29] AIA Comments at 9.

[30] AIA Comments at 8-9.

[31] AIA Comments at 8-9.

[32] *See* uAvionix Comments at 10, n.15 (supporting the substance of the Commission's proposed definitions of "unmanned aircraft" and "unmanned aircraft system," but preferring the use of gender-neutral terms "uncrewed aircraft" and "uncrewed aircraft system.").

[33] *See generally* AIA Comments; AURA Comments; AUSVI Comments; CDA Comments; Inmarsat Comments; Lockheed Martin Comments; NUAIR Comments; MAAP Comments; Pyka Comments; Zipline Comments; AURA Reply; CTIA Reply; uAvionix Reply.

[34] For example, RTCA's Special Committee 228 has changed its committee name to "SC-228, Minimum Performance Standards for Uncrewed Aircraft Systems" and has begun using the term "uncrewed" in committee documents. *See* SC-228, Minimum Performance Standards for Uncrewed Aircraft Systems, https://www.rtca.org/sc-228/ (last visited Aug. 19, 2024); *see also* 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking, Stage 2 (Release 18); 3GPP TS 23.256 V18.2.0 (2023-12). The 3rd Generation Partnership Project (3GPP) is an umbrella organization consisting of standards organizations that develop protocols for mobile telecommunications, including the Long-Term Evolution standard (LTE). *See* 3GPP, *Introducing 3GPP*, https://www.3gpp.org/about-3gpp/about-3gpp (last visited Aug. 19, 2024).

[35] *See, e.g.*, National Oceanic and Atmospheric Administration, *Uncrewed Aircraft Systems*, https://www.omao.noaa.gov/uxs/uncrewed-aircraft-systems (last visited Aug. 19, 2024); U.S. Department of Interior, *DOI Uncrewed Aircraft Systems*, https://www.doi.gov/aviation/uas (last visited Aug. 19, 2024); National Institute of Standards and Technology, *Uncrewed Aircraft Systems*, https://www.nist.gov/ctl/pscr/research-portfolios/uncrewed-aircraft-systems (last visited Aug. 19, 2024).

appropriate to substitute "uncrewed" in place of "unmanned." We therefore adopt the use of "uncrewed aircraft system" and "uncrewed aircraft" in place of "unmanned aircraft system" and "unmanned aircraft," respectively.[36]

13. In the *UAS NPRM*, the Commission identified two broad use cases for determining the appropriate band plan and service rules: non-networked operations, or those communications occurring within radio line of sight, and network-supported services, which rely on network infrastructure to go beyond radio line of sight of the operator.[37] The Commission proposed establishing the term Non-Networked Access (NNA) to "indicate spectrum or licenses (e.g., NNA blocks) that would be governed by service rules appropriate to support non-networked communications."[38] The *UAS NPRM* further proposed the use of "Network-Supported Services" (NSS) to indicate that the relevant spectrum or licenses would be governed by service rules appropriate to support the provision of networked-based services.[39] The Commission also proposed "to use NNA and NSS in the rules to designate the spectrum allocated for non-networked and network-supported use cases, respectively."[40]

14. AURA and others argue against the Commission's proposal to divide the spectrum into NNA and NSS blocks, instead suggesting that the Commission should divide the band by license type along exclusive use and shared use lines and allow both non-networked and network-based services in all portions of the band.[41] Both AURA and Federated Wireless argue that "a rigid limitation on the type of network deployed and service offered is unnecessary" and that "instead, the Commission should maximize flexibility to provide a variety of services within the confines of the exclusive use or shared spectrum rules."[42] Other commenters also stress permitting operators flexibility to choose the type of operations they wish within a shared use band. Boeing/Wisk, for example, argue that making spectrum blocks available based on license exclusivity will help realize the full potential of the 5030-5091 MHz for the UAS industry.[43] They assert that the flexibility afforded throughout the band will allow industry demand to dictate whether operations will occur over networked sites or direct links, leading to a more efficient use of spectrum.[44] At this time, we decline to adopt this suggestion to re-frame the spectrum blocks for this band. Our goal for this band is to allocate the 5030-5091 MHz band in a way that fosters the establishment of networks to support complex UAS deployment, yet does not leave behind relatively simpler, short term-use interests. The purpose in setting out an NNA-specific block is to ensure that non-networked, direct link operations have ready access to dedicated, safety-of-flight spectrum. As noted,

[36] While we change the terminology, the substance of the definitions remains consistent with FAA and statutory definitions for "unmanned aircraft" and "unmanned aircraft systems" as discussed above.

[37] *UAS NPRM*, 38 FCC Rcd at 481, para. 13. References to "line of sight" in this context correspond to radio line of sight. This is in contrast to FAA regulations, which consider whether UAS operations are within visual line of sight rather than radio line of sight. *See* 14 CFR § 107.31. As noted in the *UAS NPRM*, the concept of radio line of sight is relevant in this context because the suitability of the different licensing approaches we consider here (direct link connections as opposed to network-based connections) appears to depend to a greater extent on whether an operation is within radio line of sight of the operator than on whether or not an operation is in visual sight of the operator. A UA that is beyond-visual line of sight but within radio line of sight can still be controlled by a direct wireless link between the controller's radio and the UA. *See UAS NPRM*, 38 FCC Rcd at 481 n.39.

[38] *UAS NPRM*, 38 FCC Rcd at 482, para. 14.

[39] *Id.*

[40] *Id.*

[41] *See* AURA Comments at 11; *see also* AIA Comments at 9-10; Boeing/Wisk Comments at 3; Federated Wireless Comments at 15.

[42] AURA Comments at 11; Federated Wireless Comments at 15.

[43] Boeing/Wisk Comments at 15.

[44] Boeing/Wisk Comments at 15-16.

there is a limited amount of such channels; organizing spectrum in a way that would permit any type of use may complicate the process by which NNA operations access the 5030-5091 MHz band. Without prioritizing non-networked uses within a portion of the band, the ability of a non-networked operator to easily access protected spectrum may be hindered. We therefore find it in the public interest for Non-Networked Access to indicate spectrum or licenses that would be governed by service rules that both support and prioritize direct link operations as well as to designate an initial block of spectrum for non-networked use cases. We note, however, that the measures taken in this Report and Order are initial steps; as we gain additional experience through initial operations and develop final rules for this band, we may determine that it is in the public interest to provide greater flexibility with regard to NNA spectrum. Further, although the rules we adopt in this Report and Order relate to NNA operations, we find that it is appropriate for Network-Supported Services to indicate spectrum or licenses that would be governed by service rules appropriate to support the provision of network-based services.

15. Additionally, the *UAS NPRM* sought comment on a suggestion made by AIA that we adopt the RTCA terminology for these uses.[45] Specifically, RTCA uses the term "point-to-point" for non-networked communications, and "Command-and-Control Communications Service Providers" to describe network-supported services.[46] The NPRM tentatively concluded that the NPRM's proposed terminology is more descriptive of the use cases that the Commission seeks to support.[47] After further review, we decline to use the RTCA terminology. As the Commission observed, the "non-networked access" and "network supported services" terms more accurately reflect the intended services.[48] Further, as noted by the *UAS NPRM*, the term "point-to-point" has long been used in Commission rules and orders to reference systems providing a data communication link between two fixed stations, and the use of the term may cause confusion if applied to UAS. We find it problematic to apply the same term to two different and somewhat opposing uses (i.e. the historical, strictly fixed use versus operations where one end point is highly mobile). Accordingly, we adopt the Non-Networked Access and Network-Supported Service terms as discussed above.

16. *NNA Block Configuration.* The *UAS NPRM* sought broad comment on the appropriate configuration for the 5030-5091 MHz band.[49] The Commission suggested, as an example, a band plan which would dedicate 10 megahertz of spectrum for NNA operations, with five megahertz blocks at the bottom (5030-5035 MHz) and top (5086-5091 MHz) of the band.[50] This band plan would set aside 40 megahertz of spectrum for NSS operations, divided into four licensed blocks of 10 megahertz each, with NNA opportunistic access being permissible.[51] The remaining 11 megahertz would be available for temporary, opportunistic use by either NNA users or NSS licensees.[52] The *UAS NPRM* also sought comment on two industry-submitted proposals:

- AIA's proposal that the Commission allocate and license the 51 megahertz between 5035 MHz and 5086 MHz on a geographic area basis in a phased, incremental manner over a period of years,[53] and

[45] *UAS NPRM*, 38 FCC Rcd at 482, para. 15.

[46] *Id.* (citing AIA *Refresh Public Notice* Comments at 5).

[47] *Id.*

[48] *Id.*

[49] *UAS NPRM*, 38 FCC Rcd at 481-86, paras. 13-25.

[50] *UAS NPRM*, 38 FCC Rcd at 484, para. 22.

[51] *Id.*

[52] *Id.*

[53] *UAS NPRM*, 38 FCC Rcd at 485, para. 23 (citing Letter from Karina Perez, Director, Unmanned and Emerging Aviation Technologies, Aerospace Industries Association, to Marlene Dortch, Secretary, FCC, RM-11798, at 1 (continued….)

- Qualcomm's recommendation that 20 megahertz of spectrum be allocated for direct UA-to-UA communications (including Detect-and-Avoid (DAA) and Broadcast Remote ID uses), with the remaining 41 megahertz of spectrum in the band to be licensed to network providers for NSS CNPC services.[54]

Additionally, the *UAS NPRM* sought comment on whether the Commission should establish internal guard bands between blocks, or whether appropriate technical rules may be relied upon to ensure that UAS operations in one block do not cause harmful interference to adjacent blocks.[55] The Commission also sought comment on whether guard bands at the ends of the 5030-5091 MHz band are necessary to protect operations in adjacent spectrum.[56]

17. Review of the industry comments submitted in response to the Commission's example band plan reveals a lack of agreement on many aspects of the band plan, with commenters divided on issues such as the distribution between NNA and NSS operations in the band, placement of services within the band, as well as size of spectrum blocks. As the record reflects, industry opinion is continuing to evolve regarding the appropriate uses and technologies for the band. Although we have determined that it is premature to establish a permanent band plan in light of continuing developments and evolution of the industry, there is sufficient record support and basis to enable us to establish rules to allow early access for non-networked, direct link operations without compromising any future action the Commission may take with respect to UAS operations in the 5030-5091 MHz band.[57] We thus establish a temporary placement for NNA operation—with a permanent band plan, including final locations for NNA and NSS as well as potential provisions for opportunistic use by NNA users or NSS licensees, to be resolved in the future. As one example, as we gain more insight into industry utilization of and congestion in the block we dedicate for NNA, our permanent band plan may revisit the possibility of more flexible use (*e.g.*, NSS operations) in that block.

(Continued from previous page)
(filed Sept. 14, 2021) (AIA Sept. 14, 2021 *Ex Parte*); Letter from Karina Perez Molina, Director, Unmanned and Emerging Aviation Technologies, Aerospace Industries Association, to Marlene Dortch, Secretary, FCC, RM-11798 (filed Feb. 1, 2022) (AIA Feb. 1, 2022 *Ex Parte*), Attach. at 6-7 (arguing that "[a] phased implementation preserves large sections of the band for future licensing or use," with the opportunity to open the band to new uses and updated technologies and standards)).

[54] *UAS NPRM*, 38 FCC Rcd at 485-486, para. 24 (referencing Qualcomm *Refresh Public Notice* Comments at 1). DAA involves a range of still-developing technologies to enable UAS or their operators to detect other aircraft or structures and avoid collisions. *See, e.g.*, S. Ramasamy & R. Sabatini, A Novel Approach to Cooperative and Non-Cooperative RPAS Detect-and-Avoid, SAE Technical Paper 2015-01-2470, at 1 (Sept. 15, 2015), available at https://www.sae.org/publications/technical-papers/content/2015-01-2470/ (last visited Aug. 19, 2024). DAA can rely on transmissions in a variety of ground-based or aircraft-based implementations, for example non-cooperative detection methods such as on-board sensors or cooperative methods that involve the communication between UAS to facilitate cooperative collision avoidance. *See id.* Remote ID, as required by FAA rules is the ability of a UA in flight to broadcast identification and location information that can be received by other parties. *See* FAA, *Remote Identification of Drones*, https://www.faa.gov/uas/getting_started/remote_id/ (last visited Aug. 19, 2024). FAA rules currently require Remote ID to be broadcast using devices authorized under the Commission's part 15 rules. *See* 14 CFR § 89.320(g).

[55] *UAS NPRM*, 38 FCC Rcd at 486, para. 25.

[56] *Id.*

[57] As discussed above, the 5030-5091 MHz band is allocated to AM(R)S for both federal and non-federal use. We defer addressing a comprehensive framework for federal and non-federal sharing of the band, given that we are designating only a portion of the band for NNA, and that even in this portion, federal agencies may continue use of the spectrum for federal UAS operations subject to the coordination process discussed elsewhere. *See infra* Section III.B.6.

18. In response to the *UAS NPRM*'s proposal to dedicate 10 megahertz for NNA operations, commenters submitted comments supporting a wide range of spectrum block sizes. For example, while Lockheed Martin, UTC, and Verizon support a 10 megahertz NNA block,[58] AURA and Federated Wireless advocate for 5 megahertz in the context of "shared use" spectrum along with the ability to aggregate spectrum blocks.[59] Similarly, Boeing/Wisk state that they would support segments as small as 5 megahertz (with aggregation of blocks permitted),[60] while ENTELEC/API seek a 20 megahertz NNA segment divided into four 5-megahertz blocks.[61] Further, uAvionix supports NNA block sizes of 2.5 megahertz,[62] arguing that narrowing the block size "increase[s] the options available for channel availability and accessibility across the entire band, meaning that more UAS operators could take advantage of the availability of safety-critical spectrum."[63] Moreover, both AURA and Federated Wireless support the idea of using one or more Dynamic Frequency Management Systems (DFMSs) and argue that the DFMS should be allowed to authorize the appropriate amount of bandwidth requested for each operation.[64]

19. We find that these comments align with the proposal to dedicate 10 megahertz of spectrum for NNA operations. In allotting 10 megahertz for near-term NNA access, we are not mandating that 10 megahertz of spectrum be assigned for each NNA operation. As both AURA and Federated Wireless suggest, we would expect a DFMS to be able to determine the applicable amount of spectrum sufficient for a given operation.[65] We anticipate that a DFMS will be able to accommodate varying spectrum bandwidths for an operation—including those identified by commenters—depending on the availability of frequencies at the time and location of the specific operation. Accordingly, we find that making available 10 megahertz within the 5030-5091 MHz band will adequately meet spectrum demands by NNA operators. We reiterate, however, that the permanent configuration of this band remains to be determined and it is possible that the Commission may adopt a different NNA segment size as part of the final band plan.

20. We also find that it is appropriate to dedicate the 10 megahertz of NNA spectrum as a single, contiguous block. In the *UAS NPRM,* the Commission sought comment on whether we should place all dedicated NNA spectrum together in one contiguous block instead of designating separate upper and lower NNA blocks.[66] The Commission asked whether providing the spectrum in a single contiguous block would better support certain channelizations of the band or important use cases that may require channel bandwidths of more than 5 megahertz.[67]

[58] Lockheed Comments at 5 (stating that "[it supports] the identification of a 10 MHz segment of the spectrum for the initial NNA deployments."); Verizon Comments at 3-4 (proposing that the separate 5 megahertz NNA blocks discussed in the *UAS NPRM* be combined into one contiguous block); UTC Reply at 9 (agreeing with the *UAS NPRM*'s proposal to allocate 10 megahertz for shared access).

[59] AURA Comments at 11-12; Federated Wireless Comments at 15-16; AURA Reply at 10.

[60] Boeing/Wisk Comments at 16 (supporting up to 5 megahertz for a "shared use" block).

[61] ENTELEC/API Comments at 2 (arguing that a band plan consisting of a greater number of lower bandwidth channels has the advantage of offering a better ability to avoid interference as compared to a band plan consisting of fewer higher bandwidth channels).

[62] uAvionix Reply at 3-4.

[63] uAvionix Reply at 4.

[64] AURA Comments at 11-12.

[65] We discuss the DFMS and its requirements in detail below. *See infra* Section III.B.

[66] *UAS NPRM*, 38 FCC Rcd at 483, para. 19.

[67] *Id.*.

21. Those commenting on this issue generally agree that the NNA spectrum should be made available in one contiguous block. For example, RTCA states that there is no technical advantage gained from separating NNA spectrum into two or more blocks,[68] while Verizon similarly argues against splitting the 10 megahertz into separate blocks, stating that "the narrowband splits do not add any value…."[69] We conclude that making NNA spectrum available as a single block would provide for more efficient use of the spectrum. A single contiguous block provides greater flexibility with respect to the amount of spectrum that may be requested for an NNA operation, and also may provide a DFMS with more flexibility in managing access to the band. Further, while we are not adopting rules regarding NSS spectrum at this time, commenters observe that use of contiguous spectrum would aid in avoiding harmful interference that could occur between incompatible NSS and NNA uses. The FAA, in comments submitted by NTIA, states that, in the context of NNA and NSS block adjacency, contiguous spectrum "would allow the use of radio frequency filters to reduce the emissions from one type of service to the other" thereby "reduc[ing] radio interference to a level that allows UAS that employ NNA services to operate in the same airspace as a UAS that employ NSS services."[70] A single block of spectrum would also reduce the need for internal guard bands that might otherwise be necessary between interleaved blocks that have potentially incompatible uses, thereby retaining spectrum available for NNA operations.

22. Accordingly, we find that we should designate the NNA spectrum as a single block and also conclude that we should place the NNA block away from the edges of the 5030-5091 MHz band. In the *UAS NPRM*, the Commission requested comment on the placement of the NNA spectrum, asking whether, instead of placing NNA operations on the band edges, the NNA spectrum should be placed elsewhere internal in the band.[71] The Commission observed that an RTCA analysis indicated that filters that sufficiently protect services in the adjacent bands "would necessitate guard bands unusable by terrestrial CNPC at both ends of the 5030-5091 MHz bands, reducing the 61 MHz of usable passband width to 42-52 MHz depending on the case."[72] Accordingly, the Commission sought comment on whether guard bands on one or both ends of the band are necessary to protect adjacent band operations.[73] In response, commenters including AIA, NTIA/FAA, and Lockheed Martin assert that guard bands are likely necessary to protect adjacent band operations and note the need for continuing analysis regarding interference mitigation measures.[74]

23. Given the concerns raised by commenters regarding the interference potential posed by UAS to adjacent band operations, we conclude that we should place NNA spectrum away from band edges at this time. Until we make a determination regarding a permanent band plan, we find that it is appropriate to locate the 10 megahertz NNA block at 5040-5050 MHz while further review and analysis continues regarding the potential impact of UAS on other services, as well as the appropriate permanent

[68] RTCA Comments at 4.

[69] Verizon Comments at 3 (stating that splitting spectrum into non-contiguous blocks precludes later evolution to newer digital systems with wider bandwidths, and the narrowband splits do not add any value for the currently proposed narrowband interim solutions"); Verizon Reply at 4.

[70] NTIA Comments, Attach. (hereinafter NTIA/FAA Comments) at 2.

[71] *UAS NPRM*, 38 FCC Rcd at 483, para. 18.

[72] *Id.* (citing RTCA DO-362A, Appx. T at T.5, T.6).

[73] *Id.*

[74] *See, e.g.*, ENTELEC/API Comments at 3 (identifying a 0.5 megahertz guard band at both ends of the band); NTIA/FAA Comments at 1 (observing that RTCA DO-362A proposes a 4.5 megahertz guard band at each end of the band, and stating that unwanted emissions will likely require guard bands as well as filtering.); Lockheed Martin Comments at 5 (generally supporting the RTCA analysis); AIA Reply at 9 (stating that the edges of the 5030-5091 MHz band may require significant protections for adjacent services, including guard bands); uAvionix Reply at 4 (stating that guard bands are necessary); *see also* Boeing/Wisk Comments at 20 (arguing that not all services such as AeroMACS require protective guard bands).

location of both non-networked and network-based operations in the band. As discussed in more detail *infra*, we find that this interim placement is sufficiently removed from the band edges and adjacent band operations to permit NNA use at this time.[75] Additionally, placing the initial NNA block here is consistent with FAA practice as the FAA has previously permitted temporary operations in the 5040-5050 MHz block consistent with technical specifications set forth in the FAA's initial Technical Standards Order TSO-C213.[76]

24. Further, as discussed below, we are adopting an interim access mechanism (IAM) to enable NNA entities to begin operations in the band during the interim period before the DFMS is operational.[77] Because we anticipate that it will be challenging to effectively manage and coordinate operator use of the NNA spectrum during this period, we find it in the public interest to allow access to additional spectrum beyond the 10 megahertz to facilitate the management and deconfliction of NNA operations. Accordingly, we will allow NNA entities access to 20 megahertz of the band, at 5040-5060 MHz, during the IAM period.[78] Once a DFMS becomes operational, the NNA operations will be limited to the 10 megahertz at 5040-5050 MHz.[79]

2. Scope of Permissible Uses

25. As discussed below, we limit the scope of NNA communications in the 5030-5091 MHz band to CNPC consistent with the Commission's *UAS NPRM* proposal.[80] This approach is in the public interest and is well-supported by the record. As noted, we are taking an incremental approach to this band, and are seeking further review and consideration of issues regarding permanent service rules for this band. Pending the determination of a final band plan and rules, we are limiting NNA communications to flight safety purposes only. However, by taking this step, we do not foreclose the possibility that future actions may allow more flexibility by permitting non-CNPC uses.

26. As noted, the Commission added an AM(R)S allocation in the 5030-5091 MHz band to support UAS communications.[81] Under the Commission's rules, AM(R)S is reserved exclusively for communications relating to the safety and regularity of flight, primarily along national or international civil air routes.[82] Consistent with this allocation, the *UAS NPRM* proposed to permit only CNPC in the

[75] *See infra* Section III.C.

[76] TSO-C213 established minimum performance standards for UAS radios using the 5040-5050 MHz spectrum. *See* Federal Aviation Administration, Aircraft Certification Service, Technical Standard Order C213, Unmanned Aircraft Systems Control and Non-Payload Communications Terrestrial Link System Radios (2018) (TSO-C213). TSO-C213 was updated to TSO-312a in December 2022. *See* Federal Aviation Administration, Aircraft Certification Service, Technical Standard Order C213a, Unmanned Aircraft Systems Control and Non-Payload Communications Terrestrial Link System (2022) (TSO-C213a).

[77] *See infra* Section III.B.6.

[78] As in the case of operations to be managed by the DFMS, we anticipate that NNA operators will be assigned spectrum in the amount and in the area necessary for their operation. Because the additional 10 megahertz is being made available solely for the purpose of aiding in deconfliction of operations in the period before a DFMS is operational, NNA users should not assume that during the IAM period they may be assigned frequencies greater than what would be available once the DFMS is in use (i.e. 10 megahertz or less depending on availability).

[79] As discussed in more detail in Section III.B.6, WTB will announce the dates operators may begin to access the NNA block using the IAM process, as well as the date on which a DFMS becomes operational and the IAM period ends. *See infra* Section III.B.6.

[80] *See UAS NPRM*, 38 FCC Rcd at 495, para. 47.

[81] *WRC-12 NPRM*, 30 FCC Rcd at 4183, para. 225.

[82] *See* 47 CFR §§ 2.1, 2.106.

band and to define CNPC as "any UAS transmission that is sent to or from the UA component of the UAS and that supports the safety or regularity of the UA's flight."[83]

27. We find it appropriate to limit NNA operations to CNPC functions as proposed and to adopt a definition for CNPC that largely mirrors the language proposed in the *UAS NPRM*. As the *UAS NPRM* noted, limiting NNA operations to CNPC is consistent with the safety-of-flight nature of the AM(R)S allocation.[84] UAS operators have a critical need for spectrum that offers greater reliability for control and other safety-related functions, particularly in the case of higher risk operations such as those carrying passengers or heavy cargo, or that travel into controlled airspace.[85] Narrowing the scope of permissible operations in this band will help to ensure access to safety-critical, interference-protected spectrum necessary for UAS operations, including those requiring the highest level of safety and regularity.

28. Numerous commenters agree with the proposal to limit the band to CNPC functions to ensure flight safety.[86] For example, the federal agency with primary responsibility for aviation safety—the FAA—argues that the band should be used for CNPC purposes.[87] Similarly, ALPA, which describes itself as "the largest non-governmental aviation safety organization in the world," with 67,000 members flying for 39 airlines worldwide, supports the Commission's proposal to limit the band to CPNC, and states that "enabling UAS to use protected aeronautical spectrum for safety critical CNPC services" will help achieve safety in aviation.[88] Additionally, FPL, a critical infrastructure entity, argues that "[b]ecause unreliable links between a UA and a remote pilot could jeopardize other aircraft and the general public, it is imperative that CNPC have a safe spectral home" and that "[p]ermitting only CNPC is the best way to provide one."[89]

29. Certain commenters, however, argue that the 5030-5091 MHz band should also be available for non-CNPC uses. For example, rather than establishing channel blocks for NNA use,

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[83] *UAS NPRM*, 38 FCC Rcd at 495, para. 47.

[84] *Id.*

[85] "Controlled airspace" is defined by the FAA as "an airspace of defined dimensions within which air traffic control service is provided to [instrument flight rules] flights and to [visual flight rule] flights in accordance with the airspace classification. NOTE: Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace." 14 CFR § 1.1 (General Definitions). More simply, controlled airspace is found around some airports and at certain altitudes where air traffic controllers are actively communicating with, directing, and separating all air traffic. *See* FAA, *Airspace 101 - Rules of the Sky*, https://www.faa.gov/uas/getting_started/where_can_i_fly/airspace_101 (last visited Aug. 19, 2024).

[86] *See, e.g.*, ALPA Comments at 3; ASRI Comments at 9-12 ("[l]imit[ing] this band to [CNPC] . . . will ensure that [it] is maintained for the critical functions of unmanned flight."); AURA Comments at 7-8; Boeing/Wisk Comments at 4 (stating that the 5030-5091 MHz band should be limited to providing safety and regularity of flight); NTIA/FAA Comments at 3 (recommending that the current scope of the 5030-5091 MHz band allocation be kept); FPL Comments at 3-4; Lockheed Martin Comments at 4 ("[L]icensing the 5030-5091 MHz band specifically for UA CNPC will have important public interest benefits"); uAvionix Comments at 8 (arguing that [t]he FCC should restrict permissible services in the 5030-5091 MHz band to only [CNPC]"); AURA Reply at 7-8 (supporting the idea of CNPC only); Boeing/Wisk Reply at 10; FPL Reply at 2; UTC Reply at 5 ("limiting the 5 GHz band for CNPC would remove incentives for other incompatible operations that could compromise mission critical communications"); Xcel Reply at 6 (stating that "any interruption of or harmful interference to [CNPC] links could jeopardize the safety of either the UA, the pilot, any other aircraft, utilities facilities infrastructure, or even the public" and the interest of preventing such harm is sufficient basis to limit use to CNPC).

[87] *See* NTIA/FAA Comments at 3.

[88] *See* ALPA Comments at 1, 3-4, 12.

[89] FPL Comments at 3; *see also* FPL Reply at 2; Letter from William P. Cox, Senior Counsel, Florida Power & Light Co., to Marlene H. Dortch, Secretary, FCC, at 3 (filed Mar. 29, 2024) (FPL Mar. 29, 2024 *Ex Parte*).

Qualcomm and a number of other commenters encourage us to allocate spectrum for direct UA-to-UA communications, which will support DAA and collision avoidance functionality and Broadcast Remote ID capability.[90] Specifically, Qualcomm states that the Commission should allocate 20 megahertz of spectrum for 3GPP standards-based UA-to-UA communications, which UAs will use to communicate directly with one another for priority DAA purposes, CNPC for local ground-to-air communications, and Remote ID functions.[91] Additionally, other commenters believe that the band should be used for ancillary payload communications such as video.[92] In response, commenters argue that UA-to-UA operations and payload communications are not compatible with CNPC and that permitting other uses would reduce the availability of spectrum for CNPC communications. Both RTCA and NTIA/FAA note that the RTCA DO-362A standard does not consider UA-to-UA transmissions or Broadcast Remote ID and that such use is not compatible with the standard.[93] NTIA/FAA argue that setting aside 20 megahertz of spectrum for these functions would prevent the UAS community from realizing the planned usage of this band to support CNPC and would require additional measures such as filtering to prevent interference between services,[94] while RTCA asserts that allocating 20 megahertz for UA-to-UA communications and Broadcast Remote ID would reduce the capacity for CNPC by approximately 50 percent due to the need for guard bands.[95] Additionally, Boeing/Wisk observe that AM(R)S use of the 5030-5091 MHz band is limited to internationally standardized aeronautical systems, and assert that there are no such systems designed for UA-to-UA or DAA communications.[96] Other commenters, such as UTC, agree that permitting these uses would increase the risk of interference and constrain availability of spectrum for CNPC,[97] and that allowing non-CNPC functions in the band will incentivize UAS operators to use the band for other communications, making less spectrum available for CNPC. [98]

30. While the actual demand and usage of the band for non-networked and networked control operations are uncertain at this time, we agree with commenters that allowing non-CNPC uses reduces the available amount of spectrum that was specifically allocated to provide flight safety-specific channels for UAS. Further, as NTIA/FAA and RTCA note, uses such as UA-to-UA communications are not compatible with the RTCA DO-362A-based technical rules that we are adopting in this Report and Order.[99] Allowing such non-compatible uses increases the risk of harmful interference, potentially

[90] ATIS Comments at 5; AUSVI Comments at 2; Dimetor Comments at 1-2; ModalAI Comments at 2; NUAIR Comments at 2; Qualcomm Comments at 4-7; Zipline Comments at 2-3; Small UAV Coalition Reply at 2.

[91] Qualcomm Comments at 4-7. Additionally, Qualcomm, ATIS and ModalAI urge the Commission to allocate the remaining spectrum for networked communications through which UAs will communicate using 3GPP standards-based wireless networks for CNPC. *See* ATIS Comments at 6; ModalAI Comments at 2-3; Qualcomm Comments at 14-15. AUSVI and Skydio also suggest that the Commission set aside spectrum for UA-to-UA operations, but appear to advocate an RTCA-standards based (AUSVI) or 802.11 technology-based (Skydio) approach. AUSVI Comments at 3-4: Skydio Comments at 6.

[92] *See, e.g.*, ENTELEC/API Comments at 4-5 (advocating use of NNA for limited video feeds for flight guidance and safety of flight but also additional bandwidth for video or data reporting).

[93] NTIA/FAA Comments at 2; RTCA Comments at 9-10.

[94] NTIA/FAA Comments at 2.

[95] RTCA Comments at 9.

[96] Boeing/Wisk Reply at 6. NTIA/FAA and Boeing/Wisk also note that the Footnotes 5.444 and US444 of the Table of Frequency Allocations limit aeronautical radionavigation systems in the 5030-5091 MHz band to microwave landing systems. NTIA/FAA Comments at 2; Boeing/Wisk Reply at 6.

[97] UTC Reply at 6.

[98] FPL Comments at 3; UTC Reply at 6.

[99] NTIA/FAA Comments at 2; RTCA Comments at 9-10. RTCA DO-362A is the second version of the RTCA minimum operational performance standards (MOPS) for the 5030-5091 MHz band. *See* RTCA, Command and

(continued….)

requiring the use of mitigation measures such as guard bands, which further reduces the amount of spectrum available for CNPC communications. As noted, our purpose in establishing an NNA block is to ensure that non-networked operations have access to protected, safety-of-flight spectrum. Permitting the use of non-CNPC communications as requested would result in reducing or eliminating protected NNA-specific channels. Further, the 5030-5091 MHz band's AM(R)S allocation may not currently contemplate all such UA-to-UA communications and, at this time, UAS operations in the band are bound by the current scope of allocations. While we believe that UA-to-UA communications may serve a useful purpose, we agree with commenters such as AURA and ALPA who argue that additional technical and cost-benefit analyses need to be conducted before considering use of this band for such communications and that it is premature to incorporate UA-to-UA operations into the 5030-5091 MHz band.[100] To the extent it becomes possible to introduce non-CNPC uses without detrimentally affecting spectrum access and use for CNPC, we will consider relaxing this CNPC-only restriction as we develop final rules for this band. At this juncture, however, we believe that ensuring access to protected flight safety spectrum for CNPC use is a benefit that outweighs the costs of not permitting non-safety of flight communications.

31. As we have indicated, the rules we are adopting in this Report and Order are specific to the NNA segment that we are making available for use pending the adoption of a permanent band plan and further development of service rules for the 5030-5091 MHz band.[101] It is possible that technical solutions and changes in standards will make it feasible to expand the permitted uses for the band. For example, RTCA notes that it has completed a study of UA-to-UA transmissions which recommends that UA-to-UA communications standards be developed.[102] RTCA states that future solutions could allow compatible UA-to-UA transmissions that would not require setting aside dedicated spectrum for UA-to-UA transmissions or UA broadcast messages.[103] Accordingly, it is feasible that in the future, we could permit communications such as UA-to-UA operations in this band.[104]

32. Until such time, however, we restrict operations to CNPC functions, and largely adopt the definition of CNPC proposed in the *UAS NPRM*. As discussed, the Commission proposed to define CNPC as "any UAS transmission that is sent to or from the UA component of the UAS and that supports the safety or regularity of the UA's flight."[105] In seeking comment on the appropriate definition, the Commission asked whether permissible communications should be restricted to communications between the control station and the UA, thereby excluding transmissions such as UA-to-UA communications.[106] While several commenters support the proposed CNPC definition,[107] ASRI observes that the proposed definition may be read as also including UA-to-UA communications, DAA communications, radionavigation, and possibly radiocommunications of other types.[108] We agree that the wording of the

(Continued from previous page)
Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial), RTCA-DO-362A (2020) (RTCA DO-362A). *See also supra* Section III.A.6.

[100] *See* AURA Reply at 4; ALPA Comments at 6.

[101] We note that NTIA/FAA and AIA suggest that we take action to allow airborne DAA systems to operate in the 15.4-15.7 GHz band. *See* NTIA/FAA Comments at 6; AIA Reply at 3. This issue is beyond the scope of the instant proceeding.

[102] RTCA Comments at 10.

[103] RTCA Comments at 10.

[104] We note that other matters beyond technical issues, such as band allocation issues, would also need to be resolved before non-safety of flight communications would be permissible.

[105] *UAS NPRM*, 38 FCC Rcd at 495, para. 47.

[106] *UAS NPRM*, 38 FCC Rcd at 496, para. 49.

[107] NTIA/FAA Comments at 3; UTC Reply at 5.

[108] ASRI Reply at 6-7.

proposed definition is overly broad given our decision to not permit UA-to-UA and payload communications at this time. Accordingly, we define a CNPC communication as any transmission that is sent between the UA component and the UAS ground station of the UAS and that supports the safety or regularity of the UA's flight. We find that this revised definition is narrow enough to advance the flight safety focus of the band's allocation yet is sufficiently broad to permit the evolution of permissible communications as UAS and supporting technologies continue to develop. We find this definition is more appropriate than alternative definitions discussed in the *UAS NPRM*. There, the Commission asked whether it should apply an alternate definition of CNPC as "any communications to or from a UA other than payload communications, and to define payload as information sent to achieve mission objectives,"[109] or, alternatively, whether it should specify certain categories of communications that would be covered.[110] We agree with uAvionix's assessment that defining CNPC merely as something "other than payload communications," runs the risk of failing to be appropriately narrow,[111] while defining permissible uses "by reference to 'certain categories of communications that are covered' also runs the risk of imprecision or oversight"[112] and thus decline to follow either approach. We do, however, find merit in adopting a definition of payload suggested in the *UAS NPRM*, i.e. information sent to achieve mission objectives. Certain of the comments, in distinguishing CNPC from payload functions, likewise describe payload communications as those that are used to accomplish mission objectives,[113] and the RTCA DO-362A standard similarly describes payload as "[a]ll elements of the aircraft which are not necessary for flight but are carried for the purpose for fulfilling specific mission objectives."[114] We therefore define payload as information sent to or from a UA component to achieve mission objectives.

33. We note that the *UAS NPRM* observed that the same data from a UA may be both for the purpose of achieving flight mission objectives and for flight safety-related purposes.[115] The *UAS NPRM* stated that, as an example, video transmissions could be used for both flight guidance as well as for purposes such as the transmission of surveillance data, while UA telemetry could be used to provide non-flight safety-related information such as local weather conditions.[116] The Commission sought comment on whether a dual-purpose use should be permissible so long as one of the purposes falls within the permissible scope, or whether only communications that are exclusively for the purposes of flight safety or regularity should be permitted.[117] Commenters support permitting additional communications such as video transmissions where such communications support flight guidance and safety of flight.[118] ALPA argues that whether uses such as video or telemetry should be permitted should be dependent on whether such communications is necessary for actual command and control of the UA or is instead associated with

[109] *UAS NPRM*, 38 FCC Rcd at 495, para. 47.

[110] *UAS NPRM*, 38 FCC Rcd at 496, para. 49.

[111] uAvionix Comments at 10 (asserting that "defin[ing] CNPC in an exclusionary manner . . . runs serious risk of failing to be appropriately narrow, either through an inadequate or imprecise definition of 'payload communications' or through an inability to predict the ever-evolving list of new communication possibilities that would need to be excluded").

[112] uAvionix Comments at 10.

[113] *See, e.g.*, ALPA Comments at 5 (generally describing payload as communications associated with the commercial objective or mission); Lockheed Martin Comments at 9 (stating that "'payload' data is understood to be that which the UA may capture and transmit to fulfill its primary mission or service objective").

[114] *See* RTCA DO-362A, Appx. A at A.10.

[115] *UAS NPRM*, 38 FCC Rcd at 495, para. 48.

[116] *Id.*

[117] *Id.*

[118] *See* NTIA/FAA Comments at 3; Lockheed Martin Comments at 9; ALPA Comments at 5.

the payload or the commercial purpose of the data.[119] ALPA states that "if the UAS design requires the use of video for controlling of the UA, regardless of payload or mission, that would qualify as CNPC communications."[120] We agree that communications used for CNPC should be permitted even if the communications could be used for other purposes.

34. While our definition of CNPC aligns with the definition for the AM(R)S allocation, which specifies that the band is reserved for communications relating to safety and regularity of flight, we do not adopt the provision specifying that flights are "primarily along national or international civil air routes."[121] In the *UAS NPRM*, the Commission proposed not to restrict the scope of permissible CNPC services to such communications given that the allocation does not require that communications be exclusively for flights along such air routes.[122] We note that many UAS operations, particularly non-networked flights, will occur in rural areas or areas not along civil air routes. EEI, for instance, asserts that the electric industry use case for UAS operations is not limited to flights along such air routes because electric company UAS operations will often follow grid infrastructure and notes that electric company operations often occur in rural areas or areas without sufficient access to other communications options.[123] ALPA similarly notes that UAS activity is likely to be in localized areas, for example for aerial agricultural uses, or defined by routes not specific to aviation, such as those used for railroad inspection.[124] Given that UAS operations will not occur only along civil air routes, we will not define CNPC as primarily occurring along national or international civil air routes.

35. Further, a number of commenters seek reassurance that, in limiting the scope of operations to CNPC here, we do not plan to restrict all UAS CNPC capability to the 5030-5091 MHz band.[125] Regardless of the final scope of permitted operations that the Commission eventually sets for the 5030-5091 MHz band, we do not intend for CNPC operations to be limited to this band. As the Commission noted in the *UAS NPRM*, other licensed bands are being explored as platforms for UAS operations, including for CNPC, and it is not the Commission's intention to apply the same rules and requirements for UAS operations in this band to UAS operations in other bands.[126] As the *UAS NPRM* stated and as we have emphasized here, the 5030-5091 MHz band is a limited resource, and the demand for interference-protected CNPC may exceed capacity.[127] Given the expected growth of UAS, we believe that it would be beneficial for other bands to be available as platforms for CNPC communications.

36. *Mobile and fixed NNA operations.* In the *UAS NPRM*, the Commission proposed to permit the stations used by the operator on the ground to send and receive signals to the UA to be either fixed stations or mobile stations (such as hand-held controllers).[128] The Commission however asked whether to instead require all NNA ground stations in the band to be fixed stations, and on the costs and benefits of permitting the use of mobile ground stations.[129] To the extent that mobile ground stations are not permitted, the Commission inquired whether to differentiate "portable" stations, i.e., stations that can

[119] ALPA Comments at 5.

[120] *Id*.

[121] *See* 14 CFR § 2.1(c).

[122] *UAS NPRM*, 38 FCC Rcd at 496, para. 50.

[123] EEI Comments at 11.

[124] ALPA Comments at 10.

[125] *See, e.g.*, AUSVI Comments at 2-3; Verizon Comments at 2-3; Small UAV Coalition Reply at 2.

[126] *UAS NPRM*, 38 FCC Rcd at 480, para. 12.

[127] *Id.*

[128] *UAS NPRM*, 38 FCC Rcd at 499, para. 58.

[129] *UAS NPRM*, 38 FCC Rcd at 499, para. 58.

be moved but are not intended to be used while in motion.[130] Comments regarding this issue, while limited, support allowing both fixed and mobile stations for NNA operations as long as the stations are not in motion during operation. AIA opposes allowing stations to move while in operation, arguing that "[m]obility in this context will significantly complicate the DFMS analysis necessary to authorize new operations and protect existing operations."[131] Similarly, AURA states that all ground stations in the 5030-5091 MHz band should be fixed when operating to simplify frequency coordination efforts.[132] AURA expresses concerns about permitting the use of mobile stations, at least in the context of how mobile stations are defined in the proceeding.[133] AURA argues that "[p]redicting, measuring, and mitigating interference from a station in motion will be very difficult for any DFMS, and will change the interference environment for other already authorized flights."[134] However, both AIA and AURA support the Commission allowing the use of stations that are portable as described in the *UAS NPRM* (i.e. moveable from one location to another) when not in operation.[135] AURA suggests that such stations may include handheld devices so long as they are essentially fixed.[136] We agree that stations in motion would make it difficult for a DFMS to accurately and effectively coordinate and deconflict requests for frequency assignments if the DFMS cannot be certain of the operating parameters of a given operation. However, we believe that limiting operations only to fixed stations is unnecessarily prescriptive. Instead, we agree with AIA and AURA that the use of both fixed and mobile ground stations[137] for NNA operations is permissible so long as they are not in motion during operation and operations are limited to the location associated with the specific frequency assignment.

37. With respect to the use of fixed stations, while an NNA operator may deploy fixed ground stations, we reiterate that the intention of designating a specific NNA block is to ensure that non-networked, direct link operations have sufficient access to flight safety-related spectrum in the 5030-5091 MHz band. The NNA spectrum is not intended to promote the deployment of widescale networks for consumer or customer-oriented commercial wireless services. This notwithstanding, we will not set specific limits as to the use of multiple fixed stations to achieve a single NNA operation.[138] To be clear, multi-station operations, whether involving multiple connected or non-connected stations, are permitted by the NNA rules.[139] Thus, as the *UAS NPRM* contemplated, UAS operators might choose to access NNA spectrum "using limited infrastructure deployment, such as a string of ground stations deployed over a

[130] *Id.*

[131] AIA Comments at 14.

[132] AURA Comments at 16-17.

[133] AURA Comments at 16. As in the *UAS NPRM*, we identify "mobile station" as a station "intended to be used while in motion or during halts at unspecified points." *See UAS NPRM*, 38 FCC Rcd at 499 n.112 (citing similar definitions for "mobile station" in 47 CFR § 87.5 (mobile service) and 47 CFR § 2.1, as well as 47 U.S.C. § 153(34) ("The term 'mobile station' means a radio-communication station capable of being moved and which ordinarily does move.")).

[134] AURA Comments at 18.

[135] AIA Comments at 14; AURA Comments at 17.

[136] AURA Comments at 17.

[137] We concur with AIA that it is not necessary to formally designate such stations as "portable." *See* AIA Comments at 14.

[138] *See* UAS NPRM, 38 FCC Rcd at 505 n.147 (stating that "[w]hile we do not anticipate that wide-area networks will be deployed in reliance on NNA assignments because of the highly transient nature of the relevant spectrum rights, we do not propose to prohibit operators from using their temporary assignments with fixed network infrastructure.").

[139] *See* Katy Milner, Counsel for CDA, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 22-323, at 1 (filed May 20, 2024) (urging the Commission to ensure that UAS spectrum rules are "as flexible as possible").

particular and frequently used flight path."[140] For example, utilities may use multiple stations, such as from fixed sites that may already be in their use, in a single operation to enable a flight beyond the operator's visual or radio line-of-sight in order to inspect utility infrastructure over a long range.[141] We note, however, that single ground station operations will have priority for assignments by a DFMS at times and in areas of extended congestion as discussed in Section III.B.

3. Licensing Stations by Rule

38. In the *UAS NPRM*, the Commission proposed to adopt a licensing approach that would not require individual licensing, in order to reduce the administrative burdens on UAS operators and the Commission.[142] Specifically, the Commission proposed to implement a license-by-rule authorization for aircraft and ground stations in the NNA spectrum pursuant to its authority under section 307(e) of the Act, as amended.[143] Under the license-by-rule framework, parties using rule-compliant stations and operating in compliance with the rules would only need to obtain the requisite temporary frequency assignment from the DFMS in order to have Commission authorization to transmit in the band in the assigned location, frequency, and timeframe.

39. Section 307(e)(1) limits the Commission's authority to adopt a license-by-rule approach to certain specific categories of service, including the "citizens band radio service."[144] Section 307(e)(3) in turn provides that "citizens band radio service" shall have the meaning given to it by the Commission by rule.[145] As defined in the Commission's rules, the "citizens band radio service" encompasses "any radio service or other specific classification of radio stations used primarily for wireless telecommunications for which the FCC has determined that it serves the public interest, convenience, and necessity to authorize by rule the operation of radio stations in that service or class, without individual licenses, pursuant to 47 U.S.C. 307(e)(1)."[146] In the *UAS NPRM*, the Commission tentatively found that licensing by rule of NNA stations would serve the public interest, convenience, and necessity, and accordingly proposed to implement licensing by rule by including NNA stations within the scope of the citizens band radio service.[147]

40. Numerous commenters support licensing NNA stations by rule.[148] Commenters assert that by reducing barriers to short-term spectrum access, licensing by rule will foster a variety of UAS operations.[149] While most of these commenters do not address how to classify stations for purposes of licensing by rule under section 307(e), uAvionix supports the classification of NNA stations under the citizens band radio service category.[150]

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[140] *UAS* NPRM, 38 FCC Rcd at 505 n.147.

[141] *See* Letter from Ari Q. Fitzgerald, Counsel to Florida Power & Light Company, to Marlene H. Dortch, Secretary, FCC, at 1-2 (filed May 9, 2024) (Utilities May 9, 2024 *Ex Parte*).

[142] *See UAS NPRM*, 38 FCC Rcd at 499, para. 58.

[143] *See id.*

[144] *See* 47 U.S.C. § 307(e)(1).

[145] *See* 47 U.S.C. § 307(e)(3).

[146] *See* 47 CFR § 95.303.

[147] *See UAS NPRM*, 38 FCC Rcd at 500, para. 59.

[148] *See* AASHTO et al. Comments at 3; AURA Comments at 16, 19; Boeing/Wisk Comments at 4, 17; CNO Comments at 3; EEI Comments at 17; Qualcomm Comments at 13; uAvionix Comments at 17-18; AIA Reply at 9, 10.

[149] *See* AURA Reply at 7; uAvionix Reply at 9 (licensing by rule accommodates operations that need temporary access without imposing the additional requirements of an individual licensing process).

[150] uAvionix Comments at 17-18 n.33.

41. We now adopt licensing-by-rule for both NNA ground and aircraft stations, pursuant to section 307(e). Under the license-by-rule framework we adopt, to obtain Commission authorization to use the NNA spectrum, NNA users must use certified, Commission-approved NNA stations, and comply with the applicable NNA rules, but need not obtain individual spectrum licenses from the Commission.

42. We find that licensing NNA stations by rule will serve the public interest, convenience, and necessity. A license-by-rule approach will minimize administrative burdens on users and the Commission and facilitate use of NNA for short-term (but exclusive) assignments focused on specific needs and operations rather than longer term authorizations used only intermittently. This approach will therefore promote the efficient and robust use of the NNA spectrum. In addition, the uniform support in the record for this approach bolsters our confidence that this approach is in the public interest. Because a license-by-rule approach will serve the public interest, convenience, and necessity, we find that NNA stations are appropriately classified as part of the citizens band radio services, and that we therefore have authority under section 307(e)(1) to adopt licensing by rule for both NNA ground and aircraft stations. We emphasize that this classification reflects only our determination that the NNA service should be licensed by rule as the Commission has used that construct pursuant to its section 307(e)(1) authority, and not a determination that it should be more generally be regulated in similar fashion to other services that are classified under the citizens band radio services category, such as those in part 95 or part 96 of the Commission's rules.[151] NNA remains a service based on an AM(R)S allocation, and will be governed by appropriate rules in part 88 designed for such services.

4. Eligibility

43. In the *UAS NPRM*, the Commission sought comment on whether to provide that any entity is eligible to operate NNA stations using assignments from a DFMS other than those precluded by section 310 of the Act from holding station licenses.[152] Section 310(a) and (b) of the Act provide for Commission review of foreign investment in radio station licenses and impose specific restrictions on who may hold certain types of radio station licenses, including aeronautical en route and aeronautical fixed radio station licenses.[153] The Commission further sought comment on whether the Commission

[151] *See* 47 U.S.C. § 95.303 (definition of CBRS). To be clear, neither part 95 subpart D, the rules governing the "CB Radio Service," nor part 96, governing the Citizens Broadband Radio Service, apply in any way to part 88 services. *See* 47 CFR pt. 95, subpart D; 47 CFR pt. 96.

[152] *See UAS NPRM*, 38 FCC Rcd at 498, para. 54.

[153] 47 U.S.C. § 310(a)-(b). Section 310(a) prohibits foreign governments or their representatives from holding a radio station license. 47 U.S.C. § 310(a). Sections 310(b)(1) and (b)(2) prohibit foreign individuals or their representatives, and corporations organized under the laws of a foreign government from holding a broadcast, common carrier, or aeronautical en route or aeronautical fixed (hereinafter "aeronautical") radio station license. 47 U.S.C. § 310(b)(1)-(2). The prohibitions in section 310(a), (b)(1), and (b)(2) are absolute, and the Commission has no discretion to waive them. *Review of Foreign Ownership Policies for Common Carrier and Aeronautical Radio Licensees under Section 310(b)(4) of the Communications Act of 1934, as Amended*, IB Docket No. 11-133, Second Report and Order, 28 FCC Rcd 5741, 5748, 5749 nn.26, 29 (2013) (*2013 Foreign Ownership Second Report and Order*). Section 310(b)(3) of the Act prohibits foreign individuals, governments, and corporations from owning or voting more than 20 percent of the capital stock of a broadcast, common carrier, or aeronautical radio station licensee. 47 U.S.C. § 310(b)(3). Section 310(b)(4) establishes 25 percent benchmarks for investment by foreign individuals, governments, and corporations in a U.S.-organized entity that directly or indirectly controls a U.S. broadcast, common carrier, or aeronautical radio station licensee. 47 U.S.C. § 310(b)(4). Foreign individuals, governments, or entities may own, directly or indirectly, more than 25 percent (and up to 100 percent) of the stock of a U.S.-organized entity that holds a controlling interest in a broadcast, common carrier, or aeronautical radio station licensee, unless the Commission finds that the public interest will be served by refusing to permit such foreign ownership. *See 2013 Foreign Ownership Second Report and Order*, 28 FCC Rcd at 9837, para. 10; *Review of Foreign Ownership Policies for Broadcast, Common Carrier and Aeronautical Radio Licensees Under Section 310(b)(4) of the Communications Act, as Amended*, GN Docket No. 15-236, Report and Order, 31 FCC Rcd 11272, 11276, para. 5 (2016).

should subject the operators or parties receiving assignments from a DFMS to eligibility restrictions comparable to those imposed by section 310 on station licensees, in the event that section 310 restrictions on the ownership or control of stations licenses do not directly apply to such assignments.[154]

44. Few commenters address this issue. EEI supports a rule ensuring that any entity is eligible to operate NNA stations, subject to eligibility restrictions comparable to section 310 restrictions on station licensees.[155] NMC urges the Commission to ensure that any regulation does not require an entity that has already complied with Commission foreign ownership rules, such as by obtaining a ruling permitting it to exceed foreign ownership limits on another of its licenses, to comply with further foreign ownership rules in this context.[156]

45. Given the limited discussion of the issues raised by foreign ownership of stations in a license-by-rule service, we are guided by the approach that the Commission took in the 3.5 GHz Citizens Broadband Radio Service (CBRS) rules to eligibility for users of CBRS General Authorized Access (GAA) stations, which, like NNA stations, are licensed by rule.[157] In relevant part, section 96.5 of the Commission's rules establishes that any entity, other than those precluded by section 310, that otherwise meets the technical, financial, character, and citizenship qualifications that the Commission may require in accordance with such Act, is eligible to be a General Authorized Access (GAA) user. We find that it would serve the public interest to adopt a similar eligibility rule for NNA users. We anticipate that the adopted eligibility rule will be sufficient to address any concerns that may be associated with foreign ownership in the band. If, on future consideration of a more robust record, we determine that application of this rule needs to be adjusted to address issues arising from foreign ownership of NNA stations, we will revisit the terms of eligibility for NNA operations.[158]

5. Creation of a New Part 88

46. In the *UAS NPRM*, the Commission sought comment on the appropriate location of the new NNA services within the organization of the Commission's rules.[159] Noting that section 87.1(b) of the Commission's rules provides that part 87 "states the conditions under which radio stations may be licensed and used in the aviation services,"[160] the Commission inquired whether the new service should be located in part 87, and also observed that it may be appropriate to locate service rules for NNA and NSS services in the same rule part.[161] However, the *UAS NPRM* also noted that, while section 87.5 defines aviation services as "[r]adio-communication services for the operation of aircraft,"[162] existing part 87 rules were not adopted with UAS in mind and that many rules in part 87, even those generally applicable

[154] *See UAS NPRM*, 38 FCC Rcd at 498, para. 54. The Commission also sought comment on NTIA's proposal that, to be eligible for a license for 5030-5091 MHz UAS operations, an applicant be required to certify that it has the requisite FAA remote pilot certification or, in the case of an organization, to certify that it will only utilize individuals with this qualification for its UAS operations in the band. *See id.* at 498, para. 55. We address certifications regarding FAA remote pilot authorization in the discussion of the DFMS, Section III.B.1.

[155] *See* EEI Comments at 11-12.

[156] *See* NMC Comments at 6 n.9.

[157] *See* 47 CFR §§ 95.303, 96.5.

[158] We note that, if the Commission determines that the eligibility rule on NNA service must be amended, the eligibility restrictions as revised will apply almost immediately to all NNA assignments in the band, given that NNA assignments may be granted only for single flights and made no more than seven days in advance and can therefore only be obtained on a short-term basis.

[159] *UAS NPRM*, 38 FCC Rcd at 505, para. 70.

[160] 47 CFR § 87.1(b).

[161] *UAS NPRM*, 38 FCC Rcd at 505, para. 70.

[162] 47 CFR § 87.5.

to part 87 services, may be unnecessary or inappropriate to apply to UAS communications or to the 5030-5091 MHz band generally.[163] Accordingly, the Commission inquired whether rules specific to UAS should be located in a new rule part, stating that "[l]ocating the rules in a new rule part may therefore provide greater clarity and ease of reference in determining the rules applicable to the band."[164]

47. Upon review of the record, we conclude that it is in the public interest to create a new part 88 specifically for UAS services that would be applicable to both networked and non-networked services. Those commenting on this issue largely support locating UAS-specific regulations in a new rule part.[165] While Lockheed supports placing UAS-related rules in part 87,[166] many commenters note that UAS is a new type of aeronautical service that contemplates aspects of different spectrum management and policy approaches, and agree with the *UAS NPRM*'s observation that UAS does not fit neatly into part 87.[167] Commenters, such as AURA and FPL, caution that, if UAS rules are placed in part 87, any revision of part 87 would also require an analysis of the impact of such changes to UAS.[168]

48. AURA and Federated Wireless point out that adopting a new rule part to house UAS-specific rules is consistent with past Commission practice.[169] The Commission, in adopting rules for 3.5 GHz CBRS to permit different levels and types of operations, both individually licensed and licensed by rule, found it appropriate to create a new part 96 to house all rules of the new service in a single rule part to facilitate administrative efficiency.[170] The Commission similarly adopted a new part 30 for the Upper Microwave Flexible Use Service (UMFUS), indicating that a single, unified set of rules for various types of permitted operations would provide "more clarity to licensees and more accurately reflect the nature of these licenses."[171]

49. We conclude that it is similarly appropriate in this case to include UAS-related rules for the 5030-5091 MHz band in a single rule part and to place such rules in a new part 88, rather than placing the new rules in part 87 given that, as noted, the new services permitted for use in the 5030-5091 MHz band may not fit entirely within the traditional scope of "aviation services." In addition to NNA rules established in this Report and Order, we will over time adopt additional rules to enable full deployment of services in this band including NSS services, and we anticipate that the services deployed in the band, particularly network-based operations, will differ from and raise issues that are distinct from traditional aviation services. As noted in the *UAS NPRM*, we anticipate that NSS licenses will be used for the

[163] *UAS NPRM*, 38 FCC Rcd at 505, para. 70.

[164] *UAS NPRM*, 38 FCC Rcd at 506, para. 70.

[165] *See, e.g.*, AURA Comments at 6-7; CDA Comments at 4; ; uAvionix Comments at 19, n.39; Federated Wireless Reply at 9-10; FPL Reply at 9-10; uAvionix Reply at 6 n.15.

[166] Lockheed Comments at 12 (stating that because operations in the 5030-5091 MHz band "will be conducted consistent with aeronautical norms and safety-of-life processes, the rules that define and authorize these operations appropriately reside in Part 87").

[167] *See, e.g.*, AURA Comments at 6; Boeing/Wisk Comments at 18-19; CTIA Comments at 10. Additionally, both AIA and Boeing/Wisk agree that UAS technology presents unique spectrum use cases and state that a new rule part or a new section within Part 87 should be created to reflect the reality that this is a new type of service. AIA Comments at 6; Boeing/Wisk Comments at 18-19.

[168] *See, e.g.*, AURA Comments at 7; Federated Wireless Reply at 8; FPL Reply at 8.

[169] *See also* AURA Comments at 6-7; Federated Wireless Reply at 8-9.

[170] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 15594, 15615-16, paras. 62-63 (2012); *see also* AURA Comments at 6-7; Federated Wireless Reply at 8-9.

[171] *See Use of Spectrum Bands Above 24 GHz et al.*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8073-74, paras. 159-161 (2016); *see also* AURA Comments at 7; Federated Wireless Reply at 8-9.

provision of commercial services, raising issues more akin to those involved in the regulation of commercial network services than the regulation of traditional aviation services, including rules relating to the promotion of service competition, network build-out, as well as the establishment of an individual licensing mechanism.[172] Accordingly, we establish a new part 88 in order to promote "clarity and ease of reference" regarding the rules applicable to UAS operations in the 5030-5091 MHz band. As Federated Wireless notes, this approach "will recognize the unique requirements of UAS and improve administrative efficiency and flexibility by allowing the Commission to tailor the new rule parts to the particular needs of UAS operations rather than seeking to fit the service into a rule part that does not contemplate uncrewed operations."[173] It should be noted that creating a new part 88 for the purposes of administering UAS operations in the 5030-5091 MHz band would in no way affect the AM(R)S allocation of the band. Regardless of where the rules for the band are located, the 5030-5091 MHz band will remain protected aviation spectrum allocated for AM(R)S uses with rules designed to achieve the safety and reliability appropriate for communications "relating to the safety and regularity of flight."[174]

50. We also conclude that it is appropriate to make the new part 88 subject to rules under part 1, subpart F of the Commission's rules governing "Wireless Radio Service" applications and proceedings. The *UAS NPRM* explained that subpart F includes public and private part 87 aviation services, as well as license-by-rule services such as those under parts 95 and 96, under the definition "Wireless Radio Services," but noted that not all of these subpart F provisions apply to license-by-rule services, such as those requirements governing license applications.[175] The *UAS NPRM* therefore sought comment on whether NNA services, even if licensed by rule, should be included in and subject to the subpart F rules for Wireless Radio Services to the same extent as other license-by-rule services.[176]

51. There was limited comment on this issue. uAvionix states that part 1 provisions should not apply to these services and uses[177] but provides no rationale for its opposition. Part 1, subpart F was intended to broadly cover application procedures for radio services licensed and administered by WTB.[178] Subpart F broadly defines "Wireless Radio Service" as [a]ll radio services authorized in parts 13, 20, 22, 24, 26, 27, 30, 74, 80, 87, 90, 95, 96, 97 and 101 of this chapter, whether commercial or private in nature,"[179] including, as noted, part 87 aviation services and certain license-by-rule services found in parts 95 and 96. Given the inclusion of rule parts that administer both individually licensed and license-by-rule

[172] *UAS NPRM*, 38 FCC Rcd at 505, para. 70. We note that there may have been some confusion over the *UAS NPRM*'s use of "commercial wireless network services" ("[W]e expect that NSS licenses will be used for the provision of commercial wireless network services . . ."). The term was intended to describe potential commercial or consumer-oriented UAS services using networked architecture and was not a reference to conventional commercial wireless radio services. *Id*.

[173] Federated Wireless Reply at 8.

[174] *See* 47 CFR § 2.1 (definition of AM(R)S); *UAS NPRM*, 38 FCC Rcd at 505-06, para. 70 ("[L]ocating the rules for the 5030-5091 MHz band in a new rule part would not be inconsistent with its allocation for AM(R)S. Whether or not the rules are in part 87, the band will remain protected aviation spectrum allocated for AM(R)S and rules under this allocation can be adopted to achieve the safety and reliability appropriate for communications 'relating to the safety and regularity of flight,' regardless of where the rules are located."). Thus, we do not agree with Lockheed Martin that it is necessary for UAS operations that "will be conducted consistent with aeronautical norms and safety-of-life processes" to be governed by rules located in part 87. Lockheed Martin Comments at 12.

[175] *UAS NPRM*, 38 FCC Rcd at 507, para. 73.

[176] *Id*.

[177] uAvionix Comments at 19.

[178] *See generally Biennial Regulatory Review -- Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission's Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services*, WT Docket No. 98-20, Report and Order, 13 FCC Rcd 21027 (1998).

[179] 47 CFR §1.907 (definition of Wireless Radio Services).

services as well as the broad applicability of subpart F (i.e. services licensed by WTB), we will include part 88 in and subject to part 1, subpart F rules.

6. Technical Requirements

52. *The RTCA DO-362A Standard.* In the *UAS NPRM*, the Commission inquired as to the appropriate technical requirements for governing 5030-5091 MHz NNA equipment and operations.[180] The Commission noted that, under the current record, NTIA, AIA, and many other parties support adoption of the technical requirements in the RTCA DO-362A for that purpose.[181] The Commission stated that RTCA DO-362A contains Minimum Operational Performance Standards (MOPS) for terrestrial-based (i.e., non-satellite) CNPC point-to-point or point-to-multipoint links in the 5030-5091 MHz band, including power limits, emission limits, and frequency accuracy requirements, and that the FAA recently issued a Technical Standard Order (TSO) establishing minimum performance standards in the 5030-5091 MHz band based on requirements in RTCA DO-362A.[182]

53. Based upon these considerations, the Commission proposed to adopt the RTCA DO-362A standard, or technical requirements based on that standard, to govern NNA equipment and operations and sought comment on that proposal.[183] The Commission sought specific comment on whether to do so through adoption of a general requirement that, to be certified for use under or operated under the NNA rules, all radio equipment must comply with the requirements of RTCA DO-362A, rather than to separately incorporate the various technical requirements of RTCA DO-362A (e.g., power, frequency stability, Time Division Duplex (TDD), and emission limitations) into the service rules.[184] The Commission nonetheless proposed to separately codify requirements for power and emission bandwidth based on the RTCA DO-362A standard, to provide clarity and ease of reference in the rules, even if it were to adopt a general requirement that equipment needs to comply with RTCA DO-362A.[185] In addition, the Commission sought comment on which additional provisions or requirements from RTCA DO-362A should be adopted if general compliance with the entire standard was not mandated, including whether the Commission's technical framework requires compliance more broadly with section 2 of the standard, which addresses the Equipment Performance Requirements and Test Procedures applicable to the link system radios, or both sections 2 and 3, the latter of which includes performance standards for the link system when installed in a UA and ground location.[186] Further, the *UAS NPRM* sought comment on whether, alternatively, it would be sufficient, for purposes of establishing the baseline technical framework, to require compliance with the specific frequency capture range (which includes a frequency accuracy standard), power limits, and emission limits stipulated by the standard.[187] The Commission also

[180] *See UAS NPRM*, 38 FCC Rcd at 500, para. 61.

[181] *Id.*; *see also* NTIA *Refresh Public Notice* Comments at 2; AIA *Refresh Public Notice* Comments at 10-11; ASRI *Refresh Public Notice* Comments at 5-6; Boeing *Refresh Public Notice* Comments at 2, 6; NUAIR *Refresh Public Notice* Comments at 1; Wisk *Refresh Public Notice* Comments at 2. Note that RTCA DO362-A is the update to the RTCA's Special Committee 228 (SC-228) Command-and-Control Data Link MOPS for the 5030-5091 MHz band. The first version of these standards was published in September 2016 with the release of DO-362, Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial) (RTCA DO-362).

[182] *UAS NPRM*, 38 FCC Rcd at 500, para. 61.

[183] *Id.*

[184] *UAS NPRM*, 38 FCC Rcd at 502, para. 65.

[185] *Id.*

[186] *UAS NPRM*, 38 FCC Rcd at 502-03, para. 65.

[187] *UAS NPRM*, 38 FCC Rcd at 503, para. 65.

sought comment on the adequacy of the RTCA DO-362A standard's equipment and operational performance requirements, including both transmitter power and receiver input power.[188]

54. After review of the record, we find it in the public interest to incorporate by reference the RTCA DO-362A standard and adopt certain technical requirements in our new UAS rules based on this standard. As discussed below, RTCA DO-362A provides the standards for CNPC Link Systems, which as stated are limited to communications between a UA and a control station. The Commission today adopts rules to authorize NNA equipment and operations in a segment of the 5030-5091 MHz band, solely for CNPC consistent with the AM(R)S allocation. As this approach authorizes UAS communications related solely to safety and regularity of flight, we believe it is vital to adopt technical requirements that will ensure air safety consistent with the FAA's TSO-C213a.[189]

55. Commenters largely support adoption of the RTCA DO-362A standard for UAS operations in the 5030-5091 MHz band or, at a minimum, the adoption of particular technical requirements taken directly from the standard.[190] Further, many commenters reference the standard and recommend specific parameters to be included in the Commission's rules.[191] For example, RTCA asserts that the "mandatory compatibility requirements specified in RTCA DO-362A, which should be included in the FCC rules, are the TDD requirement specified in Section 2.2.1.3, the transmitter output power and emission mask specified in Section 2.2.1.6 and the out-of-band emission specified in 2.2.1.8.2."[192] RTCA

[188] *UAS NPRM*, 38 FCC Rcd at 500-01, para. 61.

[189] *See* Federal Aviation Administration, Aircraft Certification Service, Technical Standard Order C213, Unmanned Aircraft Systems Control and Non-Payload Communications Terrestrial Link System Radios (2018) (TSO-C213). TSO-C213 adopted the RTCA DO-362 standard as a minimum performance standard for new models of UAS CNPC Link System radios operating in the 5040-5050 MHz portion of the 5030-5091 MHz band. *See* TSO-C213 at 1. On December 20, 2022, the FAA issued a revision of TSO-C213, designated TSO-C213a. *See* Federal Aviation Administration, Aircraft Certification Service, Technical Standard Order C213a, Unmanned Aircraft Systems Control and Non-Payload Communications Terrestrial Link System (2022) (TSO-C213a), available at FAA, *Technical Standard Orders*, https://drs.faa.gov/browse/TSO/doctypeDetails (last visited Aug. 19, 2024). TSO-C213a replaces TSO-C213 going forward, adopting aspects of RTCA DO-362A as minimum performance standards for CNPC Link Systems designed for operations within any spectrum in the 5030-5091 MHz band. *See* TSO-C213a at 2; RTCA DO-362A.

[190] *See, e.g.*, AIA Comments at 14 ("AIA supports the Commission establishing rules based on RTCA DO-362 and subsequent version when finalized."); ASRI Comments at 11-12 (arguing that the Commission "must adhere to the standards being developed by RTCA and certified by the FAA, such as the Minimum Operational Performance Standards ('MOPS') for UAS contained in DO-362A and its subsequent updates"); Lockheed Martin Comments at 10 ("Lockheed Martin continues to support the adoption of the technical recommendations of the RTCA DO-362A (and successor) standard for the development and implementation of NNA service rules."); AUVSI Comments at 3 (stating that "[t]he Commission should endorse RTCA DO-362A and not wait for further revisions or further work on compatibility with satellite communications systems"); uAvionix Comments at ii, 6 (explaining that uAvionix currently adheres to RTCA's DO-362A standard and that RTCA DO-362A can "ensure compatible [Command-and-Control] use across the entire 5030-5091 MHz band and greatly minimize the chance of a lost link at critical phases during UAS operations"). In its Reply, uAvionix now agrees with NTIA/FAA's comments to the *UAS NPRM* that the Commission need not fully incorporate the standard into its rules. uAvionix Reply at 7 n.15. Instead, uAvionix states that "the new rules should refer to 'relevant FAA TSOs, as updated.'" *Id.*

[191] *See* RTCA Comments at 12-13; AIA Comments at 14; AURA Comments at 20.

[192] RTCA Comments at 12-13. RTCA also indicates that the mandatory CNPC link performance requirements that all NNA radio systems must comply with to get FAA airworthiness approval, regardless of the RF signal-in-space modulation/error correction employed, are the frequency tuning range specified in Section 2.2.1.2, the frequency capture range specified in Section 2.2.1.4, the channelization specified in Section 2.2.1.5, the radio receiver adjacent and non-adjacent channel interference rejection specified in Section 2.2.1.7, the out of-band interference rejection specified in Section 2.2.1.8.3, the radio receiver performance under fading channel conditions specified in Section 2.2.1.12, radio receiver recovery from long fades specified in Section 2.2.1.9, airborne radio system antenna requirements specified in Section 2.2.1.10 and ground radio system specified in Section 2.2.1.11. *Id.* at 13.

also recommends that the Commission include frequency capture range as a minimum requirement for compatible use of the 5030-5091 MHz spectrum.[193] AIA supports the Commission adopting rules based on RTCA DO-362 and subsequent versions when finalized, and states that such rules should "specifically reference TDD, channel sizes, power limits, [out-of-band emissions (OOBE) limits], frequency accuracy, and emission designations . . . ."[194] AURA similarly recommends that the Commission reference specific sections of the RTCA DO-362A standard that govern areas commonly adopted in its rules, such as TDD, channel sizes, power limits, OOBE limits, frequency accuracy, and emission designators.[195]

56. In the *UAS NPRM*, the Commission sought comment on a range of issues related to the RTCA DO-362A standard.[196] The FAA, supported by NTIA, recommends referencing relevant FAA TSOs instead of incorporating the entire standard through a single Commission rule as proposed in the *UAS NPRM* Appendix A, expressing concern about continued updates to the standards and noting that the FAA incorporates the RTCA standards through its TSOs.[197] Other commenters raise concerns with the RTCA DO-362A standard and express support for the Commission to adopt modern cellular technology standards, specifically 3GPP standards, to provide UAS operational flexibility, in lieu of RTCA DO-362A.[198] In particular, Qualcomm states that RTCA DO-362A is "not appropriate as a universal standard for all UAS that will be operating in the 5030 MHz band. . . ."[199] Qualcomm argues, *inter alia*, that "the RTCA standard targets high-altitude drones and is ill-suited for highly scaled low-altitude drones (e.g., below 500 feet), which represents the most compelling use for the 5030 MHz band," that the standard "is

[193] RTCA Comments at 21.

[194] AIA Comments at 14.

[195] AURA Comments at 20.

[196] *UAS NPRM*, 38 FCC Rcd at 500-01, paras. 61-62. The Commission sought specific comment on the standard in the following areas: (i) the adequacy of the RTCA DO-362A specified equipment and operational performance requirements with respect to both transmitter power and receiver input power, and required minimum coupling loss (separation distance) between ground and airborne CNPC radios and emissions from other licensed radio services; (ii) an appropriate measure of CNPC link reliability to assess RTCA DO-362A and other standards, the specific anticipated level of CNPC link reliability through radios compliant with the RTCA DO-362A standard, and any available data that confirms that reliability; and (iii) information on current or past operation of equipment compliant with RTCA DO-362 or RTCA DO-362A, the results of any such operations, and on the extent to which they support or raise issues or concerns about incorporation of the standard as the governing technical framework for the 5030-5091 MHz band. *Id.* In requesting comment on any results of UAS deployments, the Commission noted that some parties have already constructed 5030-5091 MHz UAS radios compliant with RTCA DO-362 and some have also obtained experimental license authorization from the Commission for their operation in the 5030-5091 MHz band. *Id*. at 501, para. 62.

[197] NTIA/FAA Comments at 6. We note that FAA TSO-C213a specifies that "[n]ew models of UAS CNPC Link Systems identified and manufactured on or after the effective date of this TSO must meet the applicable requirements in Section 2 of RTCA Document RTCA/DO-362A, Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial), dated December 17, 2020 with the additional requirements listed in appendix A of this TSO." TSO-C213a at 2. We note that concerns about Commission responsiveness to standards updates are addressed below. *See infra* para. 68.

[198] *See* ATIS Comments at 1, 3 (arguing that the RTCA DO-362A standard focuses on high-altitude, large drones and is inappropriate for the NNA band, and therefore recommends use of the specifications under development by 3GPP for NNA operations); CTIA Comments at 7, 15 (supporting an expansive and flexible approach to the 5030-5091 MHz band, but not requiring rigid use of the RTCA standards, and placing a high priority on interoperability with commercial wireless technical standards, while also noting that 3GPP has developed standards and specifications to ensure commercial wireless technologies are reliable and secure for UAS operations); Dimetor Comments at 2 (recommending the adoption of the 3GPP standard instead of the RTCA DO-362A standard for NNA operations and equipment); ModalAI Comments at 2 (recommending the adoption of the 3GPP standard for NNA equipment instead of the RTCA DO-362A standard).

[199] *See* Qualcomm Comments at 9.

not scalable to support the expected increased demand for UAS communications," and that it "is not comparable to modern cellular technology standards [3GPP] geared for efficiency, guaranteed [quality of service], interference management, and much more."[200] WInnForum commented in this proceeding, generally indicating that it "looks forward to working with all stakeholders to develop technical standards that support spectrum rules and policies for the operation of Unmanned Aircraft Systems in the 5030-5091 MHz band."[201] WInnForum expressed difficulty, however, in responding to many of the *UAS NPRM's* questions, as they "refer to documents that are accessible only behind a paywall that limits access to our collective membership."[202]

57. In adopting certain technical requirements from the RTCA DO-362A standard through incorporation by reference, we recognize that, as RTCA acknowledges, the standard is not specifically intended for aircraft operated under the FAA's Part 107 rules for small UAS operations, but is envisioned to apply to uncrewed aircraft operated under the FAA's Part 91 rules applicable to "General Operating and Flight Rules."[203] Based on the overall record, however, we find that taking this approach is appropriate at this time, particularly given today's incremental steps toward facilitating UAS operations, which provides a path in the 5030-5091 MHz band for authorization of NNA equipment and operations through shared use, while deferring for further consideration and study potential approaches to exclusive licensing for NSS operations.

58. We find the technical requirements of the RTCA DO-362A standard to be the superior option for the types of safety-of-flight UAS operations in the 5030 MHz band we authorize today, as these requirements are consistent with the AM(R)S allocation for the band, the limitations associated with CNPC only operations, and current FAA standards. Moreover, relying on the RTCA DO-362A standard at this time does not act as an in perpetuity rejection of other standards (e.g., 3GPP) commenters argue may be more appropriate for the vast range of potential UAS operations that may be authorized for operation in the 5030-5091 MHz band in future stages of our proceeding. Rather, much like the evolution over the past several decades of technical standards governing wireless communications generally, we anticipate that future revisions of the technical standards for UAS could expand to cover and facilitate additional types of UAS operations and use cases that go beyond the current standard's AM(R)S allocation for the band and the CNPC limitation as applied in today's Report and Order (e.g., UA-to-UA for Detect and Avoid (DAA), Broadcast Remote ID, aircraft-to-everything (A2X)). The Commission will continue to monitor technology and standards development in these areas, and anticipates that subsequent phases of this proceeding will address broader use of the band and opportunity for input from a variety of interested stakeholders. Further, with respect to WInnForum's participation in this proceeding, we do not believe it has adequately demonstrated specific difficulties in accessing the standards upon which the Commission sought comment, or what options were explored to obtain such access, including for its members.[204] We note that the Commission previously has adopted a number of rules that incorporate by reference standards developed by standards groups that charge a fee to access the materials.[205]

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[200] *Id*. at 9-10.

[201] WInnForum Comments at 2.

[202] *Id*.

[203] *See* RTCA DO-362A Executive Summary.

[204] *See, e.g., American Society for Testing and Materials v. Public.Resource.Org, Inc*., 84 F.4th 1262 (D.C. Cir. 2023) (affirming the finding that a public interest group's placement on its website of certain standards incorporated by reference into agency's rules was fair use and not a violation of copyright law).

[205] *See, e.g.,* 47 CFR § 80.1101 (requiring a wide range of maritime equipment to conform to the specifications of a number of organizations' standards for which a fee is charged, including, for example, those of the International Electrotechnical Commission (IEC)); 47 CFR § 87.199 (requiring Emergency Locator Transmitters in part 87 aviation services to comply with RTCA/DO-204's Minimum Operational Performance Standards for which a fee is charged for access).

59. After review of the overall record, we do not find it necessary to incorporate by reference the entire RTCA DO-362A standard into our rules governing NNA equipment and operation in the 5030-5091 MHz band. Rather, we find it in the public interest to incorporate by reference into our technical rules the specific sections of the RTCA DO-362A standard applicable to transmitter output power, emissions bandwidth, out-of-band emission limits, emission mask and, as discussed immediately below, time division duplexing.[206]

60. *Time Division Duplexing*. As recommended by RTCA, we also adopt the requirement of the RTCA DO-362A standard relating to TDD for NNA equipment and operations in the band. RTCA states that DO-362A is a "compatibility standard for efficient use of the band without needing guards between different types of service such as terrestrial NNA, terrestrial NSS and satellite based service."[207] In response to the *UAS NPRM*'s question on which provisions or requirements from RTCA DO-362A should be imposed,[208] RTCA suggests, on the specific issue of requiring TDD, that emission limit requirements should also require compliance with the 50 ms Time Division Duplex (TDD) requirements specified under section 2.2.1.3 of the standard.[209] RTCA asserts that use of non-TDD systems or TDD systems with different time length frames operating in the 5030-5091 MHz band within the same radio horizon as RTCA DO-362A compliant equipment will cause unacceptable levels of interference.[210] Commenters supporting reliance on the RTCA DO-362A standard recognize that a part of the current standard includes the 50 ms TDD requirement pursuant to section 2.2.1.3.[211] To minimize the risk of interference and to achieve consistency with the FAA TSO based on the RTCA DO-362A standard, we find it appropriate at this time to incorporate into our rules the 50 ms TDD frame structure requirement for NNA equipment and operations for CNPC purposes in the 5030-5091 MHz band.

61. Some commenters argue that, absent the establishment of guard bands, adopting the RTCA DO-362A TDD standard for part of the band would ultimately necessitate adopting that approach throughout the remainder of the band to avoid harmful interference.[212] We recognize that requiring compliance with the RTCA DO-362A standard's 50 ms TDD frame rate for the segment of the band dedicated to NNA equipment and operations implicates issues relevant to any future determination as to the appropriate use of the remainder of the 5030-5091 MHz band, particularly NSS use. Such issues include, for example, how to ensure efficient UAS use in the band overall and whether a future guard band or other measures (e.g., filter designs) are necessary to avoid harmful interference between NNA operations and any future NSS use of the band.

62. As stated, today's action is intended to facilitate near-term NNA use in a limited part of the band. The record reflects that significant study is underway on a revised standard (RTCA DO-362B)

[206] *See* Appx. A (Final Rules). After review of the record, we find it unnecessary to adopt a specific transmitter requirement regarding frequency capture range. We note that the RTCA DO-362A standard requires the frequency capture range of every CNPC Link System radio receiver to meet a receiver sensitivity specification. *See* RTCA DO-362A § 2.2.1.4. Today's Report and Order adopts an emission mask requirement that applies to transmitters operating in the 5030-5091 MHz band and therefore collaterally addresses frequency stability issues (e.g., transmitter oscillation).

[207] RTCA Comments at 12.

[208] *UAS NPRM*, 38 FCC Rcd at 502, para. 65.

[209] RTCA Comments at 23; *see also* RTCA *Refresh Public Notice* Comments at 6.

[210] RTCA Comments at 23.

[211] *See supra* para. 56; *see also* AIA *Refresh Public Notice* Comments at 11 (supporting a requirement that transmitters comply with the 50 ms TDD requirements of RTCA DO-362A § 2.2.1.3).

[212] *See* RTCA Comments at 8 ("To enable shared use of the band by satellite-based NSS services and terrestrial NNA and NSS systems without guard bands, the TDD Frame Duration would need to be compatible with Geostationary Global Satcom-based NSS services.").

that could result in a revised TDD frame rate.[213] We note that a potential revision to the RTCA standard is particularly relevant to international issues raised in the record. Specifically, the Commission sought comment in the *UAS NPRM* on certain concerns raised in the record by Canada regarding potential technical incompatibilities that have been identified between RTCA DO-362A and a proposed standard by the European Organization for Civil Aviation Equipment (EUROCAE) for satellite-based CNPC in the same band, designated draft ED-265.[214] Canada asserts that adoption of the RTCA DO-362A standard without addressing the incompatibilities may create difficulties in managing the operation of CNPC links in support of international UAS operations.[215] The *UAS NPRM* sought comment on whether any coordination or other requirements are necessary to ensure adequate protection of foreign satellite-based CNPC services in the band, particularly insofar as they may operate near United States jurisdictional boundaries.[216]

63. As discussed, the RTCA DO-362A TDD frame rate is 50 ms. According to RTCA, ". . . EUROCAE has determined that the optimum periodic TDD frame rate duration for geostationary satellite service . . . is 260 ms."[217] To address the potential interference issue, RTCA indicates that RTCA SC-228 and EUROCAE WG-105 have "agreed to develop revised standards that utilize a compromise common TDD frame duration for both terrestrial and geostationary satellite C2 Link systems,"[218] and that the proposed revision to a Common TDD Frame Rate Duration . . . is being discussed for inclusion in RTCA DO-362B."[219] After review of the record, we find it unnecessary to delay implementation of rules that will facilitate near-term NNA equipment and operations in the band. We also find that, because of our measured approach to UAS implementation that defers a number of issues for potential future consideration by the Commission, as well as the anticipated near-term resolution of currently different technical standards for TDD, we need not impose at this time additional coordination requirements to ensure adequate protection of foreign satellite-based CNPC services in the band.

64. *Application of Part 87 Subpart D Technical Requirements and Emission Designators*. In the *UAS NPRM*, in addition to seeking comment on any costs or disadvantages in imposing the RTCA DO-362A standard, the Commission sought comment on whether any of the general technical requirements of part 87 subpart D should apply to NNA equipment, for example the emission limits set forth in rule section 87.139(c), and whether the Commission should specify authorized emission

[213] *See* RTCA Comments at 17.

[214] *UAS NPRM*, 38 FCC Rcd at 501-02, para. 64.

[215] *UAS NPRM*, 38 FCC Rcd at 501-02, para. 64 (citing Canada *Refresh Public Notice* Comments at 1).

[216] *UAS NPRM*, 38 FCC Rcd at 502, para. 64. The Commission noted in the *UAS NPRM* that footnote 5.443C of the Table of Frequency Allocations limits the use of the 5030-5091 MHz band to "internationally standardized aeronautical systems," and sought comment on whether this provision requires adoption of a standard that is compatible with the EUROCAE standard, and whether RTCA DO-362A would meet our obligations under footnote 5.443C. *Id*. In its Comments, RTCA stated that, to address this issue, RTCA SC-228 is proposing modifications to DO-362A MOPS to make terrestrial and satellite based C2 compatible by adopting a Common TDD Frame Duration with timing synchronized to UTC. RTCA Comments at 16-17.

[217] RTCA Comments at 15.

[218] RTCA Comments at 16.

[219] RTCA Comments at 17. In the *UAS NPRM*, the Commission also sought comment on whether, if revisions to RTCA DO-362A are necessary or appropriate to address these issues, the next version of the standard is anticipated to be backwardly compatible with RTCA DO-362A, and if not, whether adoption of final rules should be deferred until these issues are resolved in a new version of the standard. *UAS NPRM*, 38 FCC Rcd at 502, para. 64. In response, RTCA states that if a common TDD Frame Rate is adopted, "RTCA DO-362B will not be backwards compatible with RTCA DO-362A," but notes that "CNPC radios currently deployed or deployed in the near future based on DO-362A could be modified by software/firmware to become compatible with RTCA DO-362B standards . . . ." RTCA Comments at 17.

designators and classes for this service.[220] RTCA argues that the current requirements of rule section 87.139(c) are less stringent than those in RTCA DO-362A, and that the Commission should only require compliance with the latter.[221] RTCA also argues that "none of the current emission classes and designators defined in section 87.139(c) of the rules agree with the range of authorized bandwidths and occupied bandwidths permitted by RTCA DO-362A or planned updates in the DO-362B MOPS."[222] L3H asserts that it is not clear whether rule section 87.139 is applicable, as it applies only to communications using certain specific Emissions Designators and the RTCA DO-362A mandatory modulation makes no reference to these designators.[223] The Commission also sought comment on the appropriate classes and designators, and whether to use one of the types of assignable emissions already defined in, for example, section 87.137 of the Commission's rules.[224] The Commission then proposed certain emission designators for data and video and sought comment on their appropriateness for operations subject to RTCA DO-362A.[225]

65. After review of the record, we find that applying the current rule section 87.139(c)[226] emission limits to NNA equipment and operations in the 5030-5091 MHz band is not warranted. We agree with RTCA that the requirements of rule section 87.139(c) are less stringent than those set forth in the RTCA standard under section 2.2.1.8.2 incorporated by reference into our technical rules governing NNA equipment and operations. We note, however, that the RTCA DO-362A section 2.2.1.8.2 Table 2-5 Out-of-Band Emission Limits does not specify emission limits into frequency bands above 5150 MHz for which protection is required. We received no comment regarding this potential disadvantage to adopting the RTCA-DO 362A standard's emission limits with respect to limiting possible spurious emissions. To provide certainty to manufacturers and facilitate equipment authorization testing, we find it appropriate to adopt our standard limit of -13 dBm/MHz above 5150 MHz. Further, as stated, the FAA's TSO-C213a requires compliance with minimum performance standards for UAS terrestrial CNPC Link System designed for operation in the 5030-5091 MHz band. The FAA specifically requires new models of UAS CNPC Link Systems identified and manufactured on or after the December 22, 2022 TSO effective date to meet the applicable requirements in section 2 of the RTCA DO-362A standard in order to be approved and to be identified with the applicable TSO marking.[227] As stated, we seek to provide clarity to equipment manufacturers and licensees, and also to maintain a harmonized approach with the FAA to avoid imposing potentially inconsistent OOBE requirements. We therefore decline to apply the section 87.139(c) requirement to NNA equipment and operations in the 5030-5091 MHz band. Further, we received limited comment on the issue of specifying emission designators in new part 88 of the Commission's rules.[228] To provide stakeholders increased flexibility, and in lieu of mandating use of

[220] *UAS NPRM*, 38 FCC Rcd at 501, 503-04, paras. 63, 67; *see also* 47 CFR § 87.131 (specifying emission designators in aviation services).

[221] *See* RTCA *Refresh Public Notice* Comments at 6.

[222] RTCA Comments at 25.

[223] *See* L3H *Refresh Public Notice* Comments at 9.

[224] *UAS NPRM*, 38 FCC Rcd at 504, para. 67; *see also* 47 CFR § 87.137 (providing the assignable emissions for part 87 services and corresponding emission designators and authorized bandwidths).

[225] *See* 47 CFR § 2.201; *see also* Appx. A (adding 47 CFR § 88.105).

[226] 47 CFR § 87.137(c).

[227] TSO C213a at 2-3.

[228] *See UAS NPRM*, 38 FCC Rcd Appx. A (Proposed Rules). Lockheed Martin supports the Commission adding proposed emission designators G8D for data and G8F for video. Lockheed Martin Comments at 12. RTCA indicates that "the current emission classes and designators defined in section 87.137 of the rules are not compatible with the authorized and occupied bandwidths allowed by RTCA DO-362A and future updates in DO-362B MOPS." RTCA Comments at 25.

specific emission designators, we will permit an applicant seeking equipment certification to specify the emission designator appropriate to its equipment design and proposed operation, provided it meets the technical requirements we adopt governing NNA equipment and operations.

66. *RTCA DO-377A.* In the *UAS NPRM*, the Commission noted that RTCA has also adopted another standard applicable to CNPC in the 5030-5091 MHz band, designated RTCA DO-377A, Minimum Aviation System Performance Standards for C2 Link Systems Supporting Operations of Unmanned Aircraft Systems in U.S. Airspace (RTCA DO-377A).[229] As stated, RTCA DO-377A can be applied to systems relying on a direct connection or systems relying on network functionality for the connection, and focuses on system requirements, including system performance, safety, and security requirements. The *UAS NPRM* sought comment on whether the Commission should adopt rules requiring compliance with the standard, to the extent that RTCA DO-377A applies to NNA operations.[230] Alternatively, the Commission sought comment on whether, as AIA recommends, requirements should be limited to technical requirements based on RTCA DO-362A, and system performance, safety, and security requirements, such as those in RTCA DO-377A, should be left to be considered by a multistakeholder group or addressed by the FAA.[231] Commenters addressing the requirements of DO-377A continue to describe that standard in the context of network-based CNPC and exclusive use licensing,[232] and some argue that the Commission should limit its requirements to the technical requirements in RTCA DO-362A and leave system performance, safety, and security requirements to a multi-stakeholder group or the FAA.[233] As discussed above,[234] we find that our incorporation of technical requirements through reference to RTCA DO-362A strikes the appropriate balance at this time in facilitating near-term NNA equipment development and operations in the 5030-5091 MHz band and reducing the potential for harmful interference. We agree with commenters and find it appropriate to defer consideration of issues relating to system performance, safety, and security requirements for NSS operation in the 5030-5091 MHz band and associated compliance with the RTCA DO-377A standard or updates to that standard.[235]

[229] *UAS NPRM*, 38 FCC Rcd at 504, para. 69. The Commission noted that RTCA DO-362A describes "minimum performance standards for the ground and airborne radios used for a direct link, focusing on certain design characteristics of these radios such as power and emissions limits." *Id*. In contrast, RTCA DO-377A describes the "minimum performance of an overall 'C2 Link System,' defined as a system used to send information exchanges between a control station and an unmanned aircraft and to manage the connection between them, and which can be comprised of one or many Air/Ground links and Ground/Ground links." *Id*.

[230] *UAS NPRM*, 38 FCC Rcd at 504-05, para. 69.

[231] *Id*. at 505, para. 69.

[232] *See* RTCA Comments at 29 (noting that RTCA DO-377A provides standards for coverage availability, latency and security to support FCC/FAA approval of NSS licensees); AURA Comments at 17-18 (recommending that "exclusive use licensees should use frequency management techniques in their licensed areas for safe UAS flight, as compliance with RTCA DO-377A requires the use of such techniques."); *see also* AIA *Refresh Public Notice* Comments at 6 (asserting that network providers of CNPC must "meet[] aviation performance levels and the safety requirements (in DO-377A) that govern a proposed network of [ground stations] and services"); id. at 8 (stating that RTCA DO-377A "guides the implementation of ground networks"); uAvionix *Refresh Public Notice* Comments at 1; Wisk *Refresh Public Notice* Comments at 2 n.5 ("DO-377A provides a basis for the safety, performance, and security standards that a CNPC network should meet . . . .").

[233] Lockheed Martin Comments at 12.

[234] *See supra* paras. 53-64.

[235] We note that, in December of 2023, RTCA issued an update to RTCA DO-377A. *See* RTCA, Minimum Aviation System Performance Standards (MASPS) for C2 Link Systems Supporting Operations of Uncrewed Aircraft Systems in U.S. Airspace, RTCA-DO-377B (2023).

67. *Delegation of Authority for Streamlined Procedures to Update Incorporated Standards*. In the *UAS NPRM*, the Commission anticipated that any technical standard developed by a standards organization that ultimately is incorporated by reference into the Commission's rules would be subject to ongoing revisions as parties gain more experience and as the UAS industry continues to rapidly evolve.[236] The Commission noted that RTCA DO-362A is a 2020 revision of the RTCA DO-362 standard issued by RTCA in 2016, and that RTCA Special Committee 228 (SC-228) is currently working on a second revision, which we reference herein as RTCA DO-362B.[237] The Commission anticipated that the rules would need to be "revisited in the future to reflect important and beneficial standard updates,"[238] and therefore invited comment on whether to adopt a delegation of rulemaking authority to one or more Bureaus in this proceeding, comparable to actions the Commission has previously taken in similar circumstances.[239] The Commission sought comment specifically on whether to delegate joint rulemaking authority to WTB and Office of Engineering and Technology (OET) to incorporate into the Commission's rules, after consultation with the FAA and NTIA, and notice and an opportunity for public comment, any updated version of a previously incorporated technical standard applicable to UAS operations in the 5030-5091 MHz band.[240] Lastly, the Commission sought comment on whether to limit any delegated authority to the incorporation of standards updates that do not raise major compliance issues, similar to limitations the Commission has placed in some earlier delegations of rulemaking authority to update standards.[241]

68. We received no comments directly responding to the issue of delegation of authority to incorporate standards updates. Boeing/Wisk, however, support incorporation of FAA standards in lieu of adopting the RTCA standard, but recommend that the FCC ensure "any existing FAA regulations incorporated directly into its regulatory regime for the 5030-5091 MHz Band allow for future iterations of those FAA rules."[242] They argue that the Commission should not produce rules or requirements that are tied to a specific version of an FAA regulation but incorporate "the latest amendment or TSO revision level."[243] Further, Boeing/Wisk states that "[i]f the Commission disagrees and incorporates RTCA standards directly into its regulations, they should follow the same approach when incorporating standards."[244] To facilitate expedited updates to our technical rules based on evolving technical standards, we find it in the public interest to delegate joint rulemaking authority to WTB and OET to incorporate into the Commission's rules, after notice and an opportunity for public comment if necessary or appropriate, any updated version of a previously incorporated technical standard applicable to UAS

[236] *UAS NPRM*, 38 FCC Rcd at 507, para. 74.

[237] *Id.*

[238] *Id.*

[239] *Id*. (citing *Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones*, WT Docket 01-309, Report and Order, 18 FCC Rcd 16753, 16779, para. 63 (2003); *Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets*, WT Docket No. 07-250, First Report and Order, 23 FCC Rcd 3406, 3441, para. 87 (2008); *Access to Telecommunication Equipment and Services by Persons with Disabilities; Amendment of the Commission's Rules Governing Hearing Aid-Compatible Handsets*, CG Docket No. 13-46, WT Docket Nos. 07-250, 10-254, Report and Order and Order on Reconsideration, 32 FCC Rcd 9063, 9092, Appx. B (2017) (expanding rulemaking delegation codified at section 20.19(k)); *see also Structure and Practices of the Video Relay Service Program, Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, GC Docket Nos. 10-51, 03-123, Report and Order and Further Notice of Proposed Rulemaking, 28 FCC Rcd 8618, 8643, para. 49 (2013)).

[240] *Id.* at 507-08, para. 74.

[241] *Id*. at 508, para. 74.

[242] Boeing Comments at 13.

[243] *Id*.

[244] *Id*.

operations in the 5030-5091 MHz band. We seek to expedite necessary future changes to accommodate updates in standards relevant to previously adopted technical requirements. We find that this delegation will help ensure that key technical updates relevant to requirements for authorization of UAS equipment and operations can be incorporated without unnecessary administrative delay.

7. Equipment Authorization

69. In the *UAS NPRM*, the Commission proposed to impose equipment authorization requirements similar to those under sections 87.145 and 87.147 of the Commission's rules to all equipment intended for use in the 5030-5091 MHz band and sought comment on that proposed approach.[245] The Commission's stated goal is to ensure that such equipment "has the level of reliability and safety required of aviation equipment."[246] Section 87.145 requires that each transmitter must be certificated for use in the relevant service, and section 87.147 establishes a specific equipment authorization process for part 87 equipment, which, for the frequencies in the 5030-5091 MHz band among others, requires coordination with the FAA.[247] The Commission noted that 5030-5091 MHz UAS radio equipment must independently satisfy any applicable FAA requirements,[248] and anticipated that this coordination process would ensure that the 5030-5091 MHz equipment authorizations by the Commission and the FAA are consistent and that all equipment approved for use in the band will meet both agencies' requirements.

70. Commenters addressing the equipment authorization issue support the Commission's proposal.[249] Boeing/Wisk support the proposed equipment authorization requirements "for UAS operations in the 5030-5091 MHz band that would require each transmitter type be certified for use in the relevant service."[250] Boeing/Wisk agree with the *UAS NPRM* that this approach "would ensure that equipment in the new band has the same level of safety and reliability as aviation equipment."[251] They also support the participation of the FAA in the equipment authorization process to ensure interagency coordination.[252] uAvionix supports the Commission's proposal to require that the FAA be notified by applicants when they file for FCC equipment authorization for devices that will operate in the 5030-5091 MHz band.[253] uAvionix also supports the Commission's proposal requiring the FCC equipment

[245] *UAS NPRM*, 38 FCC Rcd at 518, para. 99.

[246] *Id*.

[247] *See* 47 CFR §§ 87.145(a), 87.147(d). Among other things, the applicant for certification of equipment intended for transmission "must notify the FAA of the filing of the equipment certification, and must describe the equipment, give the manufacturer's identification, antenna characteristics, rated output power, emission type and characteristics, the frequency or frequencies of operation, and essential receive characteristics if protection is required." 47 CFR § 87.147(d).

[248] *See, e.g.*, TSO-C213a.

[249] *See, e.g.*, Boeing/Wisk Comments at 3 ("The Commission should also adopt appropriate licensing, technical, and service rules for each category of operations, appropriate protections for adjacent operators, and equipment authorization requirements."); uAvionix Comments at 26-27 ("uAvionix supports this new rule because it gives the FAA the opportunity to review equipment designed to operate in the 5030-5091 MHz band before the FCC authorizes it.").

[250] Boeing/Wisk Comments at 21.

[251] *Id*. (citing *UAS NPRM*, 38 FCC Rcd at 518, para. 99).

[252] Boeing/Wisk Comments at 21.

[253] uAvionix Comments at 26.

authorization application to include a copy of the FAA submission and specifying that the authorization can only be granted once the FAA has made a determination.[254]

71. Based on the record, to promote reliability and safety, we find it in the public interest to adopt our proposal and will require transmitters to be certified for use in this new part 88 service through compliance with OET procedures for equipment authorization under part 2, subpart J of the Commission's rules. In addition to the technical requirements, those part 2 rules now also prohibit authorization of particular equipment produced by entities identified on the Commission's Covered List.[255] We also require that the applicant, when filing the requisite application for equipment certification, notify the FAA of the identity of the equipment manufacturer. We agree with commenters that this approach will ensure that necessary coordination occurs with the FAA, given its responsibility for ensuring aviation safety in the NAS, and will prevent harmful interference through NNA equipment compliance with the relevant technical requirements.

B. Dynamic Frequency Management System

72. In the *UAS NPRM*, the Commission proposed that NNA operations be managed by one or more DFMSs.[256] It described a DFMS as a frequency coordination system that, in response to requests from a UAS operator for a frequency assignment in NNA spectrum, would determine and assign to the requesting operator, through an automated (non-manual) process, temporary use of certain frequencies for a particular geographic area and time period tailored to the operator's submitted UAS flight plan.[257] It further contemplated that for the duration of the assignment, the operator would have exclusive and protected use of the assigned frequencies within the assigned area and timeframe, after which the frequencies would be available in that area for assignment to another operator.[258] The Commission proposed that a DFMS would be administered by a private third party, referred to as a DFMS administrator, and that more than one DFMS would be permitted to operate in the band, with each system capable of frequency coordination-related activities on a nationwide basis and across the entire 5030-5091 MHz band.[259] The Commission further proposed certain high level requirements for the DFMS and DFMS administrator and related requirements for users of a DFMS.[260]

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[254] *Id*. uAvionix finds this approach important to "ensure that devices operating in spectrum used for aviation do not cause harmful interference" and because it confirms that all equipment approved for use in the band will meet both FCC and FAA requirements. *Id*.

[255] We note that, since February 2023, the Commission's part 2 rules for equipment authorization prohibit authorization of equipment identified on the Commission's Covered List, which has been determined to pose "an unacceptable risk to the national security of the United States or the security and safety of United States persons." *See Protecting Against National Security Threats to the Communications Supply Chain through the Equipment Authorization Program; Protecting Against National Security Threats to the Communications Supply Chain through the Equipment Authorization Program*, ET Docket No. 21-232 and EA Docket 21-233, Report and Order and Further Notice of Proposed Rulemaking, 37 FCC Rcd 13493, 13494-95, para. 1 (2022) (prohibiting authorization, going forward, of equipment identified on the Covered List produced by particular entities); 47 CFR §§ 2.903 (prohibiting authorization of equipment identified on the Covered List issued pursuant to 47 CFR § 1.50002), 2.911(d)(5) (requiring that applicants for equipment certification provide a written and signed certification that the subject equipment is not equipment on the Covered List as of the date of the filing of the application). We further note that because we are creating new service rules under part 88, only UAS equipment authorized under these new rules is permitted in the 5030-5091 MHz band and no previously authorized UAS equipment would satisfy this requirement.

[256] *See UAS NPRM*, 38 FCC Rcd at 486, para. 26.

[257] *See id.*

[258] *See id.*

[259] *See id.* at 486, 487, paras. 26, 28.

[260] *See id.* at 487-91, paras. 29-37; *id.* at Appx. A (proposing 47 CFR §§ 88.31, 88.135, 88.137, 88.139).

73. After review of the record, we adopt the DFMS approach, as detailed below, to coordinate NNA operations in the 5030-5091 MHz band. We define a DFMS as "a frequency coordination system operating in the 5030-5091 MHz band that (1) is highly automated and capable of providing rapid responses to frequency assignment requests from registered NNA operators, and (2) in response to such requests, is capable of assigning to the requesting operator temporary protected use of certain frequencies for a particular geographic area and time period tailored to the operator's submitted operation, to the extent such frequencies are available." As proposed, we will require parties seeking to use or using the NNA spectrum to be registered with a DFMS and to transmit in the 5030-5091 MHz band only pursuant to and consistent with the terms of a frequency assignment from a Commission-approved DFMS.[261]

74. We find that the record overwhelmingly supports this approach to managing shared spectrum in the band and gives us confidence that the DFMS will achieve substantial benefits for UAS operators and the public.[262] In particular, we find that this approach will be an effective way to coordinate short-term dynamic access to interference-protected, highly-reliable CNPC in a timely, efficient, and cost-effective manner, and will facilitate the efficient and intensive use of a shared spectrum resource.[263] In addition, the management of the NNA operations by the DFMSs will help to ensure the protection of other authorized services inside the band and in adjacent spectrum.[264] In reaching these conclusions, we rely in part on our past experience with automated frequency management systems. As the *UAS NPRM* noted, the Commission authorized Spectrum Access Systems (SASs) to coordinate shared spectrum access to the 3.55-3.7 GHz band (3.5 GHz band) on an automated basis, which allowed incumbent radar systems, licensed services, and license-by-rule services, including stations in the Citizens Broadband Radio Service (CBRS), to successfully coexist in the band.[265] The record confirms that a DFMS approach can be feasibly implemented drawing on these tested technologies and methods.[266]

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[261] *See id.* at Appx. A (proposing § 88.27(c), (d)).

[262] *See* AIA Comments at 10 ("[F]or shared segments, the Commission should require the use of a DFMS to coordinate access to channels."); ALPA Comments at 9; AURA Comments at 9; Boeing/Wisk Comments at 3; CDA Comments at 5; DSA Comments at 2-3 (finding the DFMS approach "will ensure efficient utilization of spectrum and foster innovation"); EEI Comments at 12-14; Federated Wireless Comments at 2 ("[T]he use of a DFMS is likely the only feasible means to ensure coexistence between and among the various uses and users of spectrum in the rapidly evolving advanced aviation space, and certainly for such coexistence to be feasible at scale."); Lockheed Martin Comments at 6; NAB Comments at 3; NAM/MRFAC Comments at 3; NMC Comments at 4; uAvionix Comments at 14, 17 ("[A] DFMS framework is essential to maximize safe, efficient, and productive use of the 5030-5091 MHz band."); WInnForum Comments at 3; Xcel Reply at 5, 7.

[263] *See UAS NPRM*, 38 FCC Rcd at 486, para. 26; AIA Comments at 10; DSA Comments at 2; Federated Wireless Comments at 2-3; WInnForum Comments at 3 (arguing spectrum access databases "enable increased sharing and thereby increase the dynamic nature of spectrum management"); Boeing/Wisk Reply at 8-9 ("[T]he DFMS model has a proven ability to assign spectrum efficiently across large numbers of operators and protect such operators from harmful interference . . . .").

[264] *See UAS NPRM*, 38 FCC Rcd at 487, para. 26; *see also, e.g.*, DSA Comments at 2; Federated Wireless Comments at 11 ("The demonstrated success of dynamic spectrum management . . . can be built upon to not only protect users in the 5030-5091 MHz band, but also users in adjacent bands.").

[265] *See UAS NPRM*, 38 FCC Rcd at 487, para. 27; 47 CFR pt. 96, subpt. F; *see also Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015) (*3.5 GHz R&O*). Since adopting the rules governing SASs, the Commission has authorized multiple SASs for commercial operations in the band. *Wireless Telecommunications Bureau and Office of Engineering and Technology Approve Four Spectrum Access System Administrators for Full Scale Commercial Deployment in the 3.5 GHz Band and Emphasize Licensee Compliance Obligations in the 3650-3700 MHz Band Under Part 96*, GN Docket No. 15-319, Public Notice, 35 FCC Rcd 117, 117, para. 1 (WTB/OET 2020) (certifying CommScope, Federated Wireless, Inc., Google, and Sony, Inc. as SAS Administrators); *Wireless Telecommunications Bureau and Office of Engineering and Technology*

(continued….)

75. Some commenters argue for alternatives to a DFMS, but we are not persuaded that there are better alternatives at this time for providing access to shared NNA spectrum for protected, highly-reliable CNPC. For example, Qualcomm asserts that 3GPP standards can already enable reliable use of 5030-5091 MHz spectrum without the coordination of a DFMS or a network, but does not provide any specifics regarding its proposal or discuss any examples of a previous use of 3GPP standards to implement such an approach for protected access.[267] NTIA argues that we should explore the use of a cognitive radio solution, which it states "hold[s] the promise of securing non-networked spectrum without the need of a centralized [DFMS]."[268] NTIA argues that cognitive radio technologies could increase spectrum efficiency permitting more UAS operations in comparison with a DFMS.[269] Other commenters raise concerns, however, that cognitive radio solutions may not provide the necessary reliability for safety-critical CNPC.[270] Commenters also argue that cognitive radio solutions require significantly more study and development before they can be used for this purpose.[271] In light of the current record, while

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Approve Spectrum Access System Administrator Amdocs for Full Scale Commercial Deployment in the 3.5 GHz Band, GN Docket No. 15-319, Public Notice, 35 FCC Rcd 3687, 3687, para. 1 (2020 WTB/OET); *Wireless Telecommunications Bureau and Office of Engineering and Technology Approve Spectrum Access System Administrator Key Bridge Wireless for Full Scale Commercial Deployment in the 3.5 GHz Band*, GN Docket No. 15-319, Public Notice, 36 FCC Rcd 4880, 4880, para. 1 (WTB/OET 2021); *Wireless Telecommunications Bureau and Office of Engineering and Technology Approve Spectrum Access System Administrator Red Technologies For Full Scale Commercial Deployment in the 3.5 GHz Band, to Support Spectrum Manager Leasing, and to Use Key Bridge Wireless LLC's Environmental Sensing Capability*, GN Docket No. 15-319, DA 23-893 (WTB/OET rel. Sept. 22, 2023). Under SAS coordination, there has been steady growth in the number of CBRS devices deployed. *See* NTIA, An Analysis of Aggregate CBRS SAS Data from April 2021 to January 2023, NTIA Report 23-567, at 10, 53 (2023), https://its.ntia.gov/umbraco/surface/download/publication?reportNumber=TR-23-567.pdf (2023 CBRS Usage Report).

[266] *See* DSA Comments at 2-3 (agreeing that a DFMS approach is "feasible and practical"); AIA Reply at 11 (arguing that database technologies like the DFMS "are a tested solution to dynamically assigning shared spectrum, and there are several solutions that already exist in the marketplace."); AURA Reply at 16 ("[T]he UAS industry is already developing the standards and processes that DFMS could use to coordinate shared use spectrum access effectively and dynamically for the safe flight of UA."); Xcel Reply at 7 (agreeing that CBRS is a "useful starting point" for the development of a DFMS).

[267] *See* Qualcomm Comments at 13 (asserting that "3GPP standards would streamline the process for operationalizing the NNA band for UASs, requiring no DFMS(s) or less complex systems"). As we discuss elsewhere, we are adopting technical requirements for NNA stations consistent with the RTCA DO-362A standard. *See supra* paras. 53-64. We note that even Qualcomm concedes that, if RTCA DO-362A (rather than 3GPP standards) is the basis of the technical requirements, "[t]he need of a DFMS is especially apparent[.]" Qualcomm Comments at 13 n.32.

[268] NTIA Comments at 2. It describes cognitive radio as "a form of wireless communication in which a transceiver can intelligently detect which communication channels are in use and which are not, and instantly move into vacant channels while avoiding occupied ones," which "optimizes the use of available spectrum while minimizing interference to other users." *Id.* at 2 n.4.

[269] *Id.* at 2.

[270] *See, e.g.*, Lockheed Martin Comments at 9 (asserting that cognitive radio "would not provide the assurances required to conduct the complex missions that Lockheed Martin undertakes with high-value UA"); AIA Reply at 11 (arguing for DFMS approach rather than cognitive radio "given the safety of life aspects of operating in this band and the reality that spectrum management systems are effectively required to comply with the relevant minimum performance standards"); AURA Reply at 18-19 ("[C]ognitive radios are not closed loop nor are they deterministic, both of which are important (and may be required) to support safety-of-life UAS CNPC operations."); Federated Wireless Reply at 7.

[271] *See, e.g.*, AERPAW Comments at 3 ("Use of cognitive radio based approaches can help improve the spectrum utilization in this band. However, cognitive radio remains at this time an academic concept, and there is a need for development and testing before it can be used in real-world scenarios."); AURA Reply at 18-19 (use of cognitive (continued….)

we acknowledge that cognitive radio is an interesting tool that could play a role in the band in the future, we find that it would be premature to mandate that NNA be deployed with a cognitive radio solution at this time, and that such an approach could delay use of the band for an indefinite number of years to accomplish the necessary standards work, technology development, and multi-agency testing and review. In contrast, deployment of one or more DFMSs provides a shorter and more certain path to making shared NNA spectrum available, as it can rely on established technologies applying technical standards already approved for UAS CNPC in the band by the FAA. The DFMS approach should therefore yield more immediate benefits than a cognitive radio approach.[272]

76. Moreover, adopting and implementing the DFMS approach at this time will not delay or prevent later use of cognitive radio in the band if that solution is ultimately desired and developed. The deployment of DFMSs to manage NNA operations does not preclude the future deployment of a cognitive radio solution in NNA spectrum in the event that appropriate technologies are standardized, developed, and tested. For example, such technologies could be deployed in the NNA spectrum as an overlay solution providing access when NNA spectrum is not otherwise in use. The deployment of DFMSs may even facilitate investment in cognitive radio technologies for CNPC in the 5030-5091 MHz band, as it will give public and private stakeholders experience regarding the extent and distribution of demand for the NNA spectrum and methods of avoiding or mitigating interference that might inform development of the necessary contention-based protocols. For all of these reasons, we conclude that assigning management of the NNA spectrum to one or more DFMSs in the near term will better serve the public interest than deferring access until the development of a cognitive radio solution.

77. Skydio asserts that using a DFMS to allocate frequencies would be slow and that having to connect to a DFMS may preclude operation in areas without a network connection.[273] Skydio proposes that we instead "utilize self-coordination methods[.]"[274] As Skydio does not elaborate on its proposal, it is unclear what methods it is referencing. To the extent Skydio is supporting a cognitive radio solution, we decline to adopt this approach for the reasons discussed above. Further, contrary to Skydio's assertions, we anticipate that turnaround on requests will be rapid given that the DFMS will implement automated rather than manual processing, and we have specifically required above that a DFMS be capable of rapid response to frequency requests. We do anticipate that communications with a DFMS will require access to an Internet connection. These communications, however, can occur over any available form of coverage.[275] We also note that under the 3.5 GHz CBRS rules, which require more extensive communications with the SAS than we require with a DFMS, deployments have been robust nationwide.[276] Accordingly, we expect that instances in which lack of coverage would preclude use of the

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radio would "require extensive analysis and testing . . . . [I]ndustry stakeholders would need to create and validate a standard, and the FAA would need to accept that standard and regularize its use.").

[272] *See, e.g.*, uAvionix Comments at 16 ("Given the rapid development of new UAS capabilities, it is important that DFMS be in place as soon as possible.").

[273] Skydio Comments at 7.

[274] *Id.*

[275] We recently adopted a Report and Order establishing a regulatory framework to enable collaborations between satellite operators and terrestrial wireless service providers to offer customers supplemental coverage from space (SCS), which will enable consumers in areas not covered by terrestrial networks to be connected using their existing devices via satellite-based communications. *See Single Network Future: Supplemental Coverage from Space*, GN Docket No. 23-65, Report and Order and Further Notice of Proposed Rulemaking, FCC 24-28 (rel. Mar. 15, 2024). We expect SCS will help with connectivity, especially in rural and remote areas. *See id.* at 8, para. 16.

[276] *See, e.g.*, 2023 CBRS Usage Report, at xi, 6, 29 (finding that the number of active CBRS devices (CBSDs) more than doubled between April 1, 2021 to January 1, 2023, to 287,033, with one or more CBSD in 78.1% of counties and more than 70% of all active CBSDs deployed in rural census blocks); *see also* 47 CFR §§ 96.39, 96.41.

system will be rare, and this small potential impact does not alter our conclusion that the DFMS approach will better serve the public interest than other alternatives raised in the record.

78. We are also unpersuaded by FPVFC's proposal that the DFMS should be implemented as an extension to existing Low Altitude Authorization and Notification Capability (LAANC) systems rather than as an independent system.[277] Under the LAANC program established by the FAA, UAS operators can apply to LAANC service providers to receive a near real-time FAA airspace authorization for operations under 400 feet in controlled airspace around airports.[278] We find that requiring integration of the DFMS into LAANC would present numerous problems. First, LAANC only provides authorization for those UAS flights at low altitude in controlled airspace and accordingly would not be applicable for the full scope of operations we permit in the 5030-5091 MHz band. Further, the scope of LAANC is determined by the FAA rather than the Commission, and the FAA has not chosen to integrate spectrum assignment functions into LAANC functions.[279] Accordingly, any action to add the DFMS function to LAANC would first require an FAA determination to amend and expand their program. In addition, LAANC systems have already been deployed by third-party service providers, and as these systems do not include spectrum assignment functions, any such integration would involve significant changes in their deployed technology and responsibilities, which could be disruptive to the highly successful LAANC program. Requiring such integration would also complicate the implementation of the DFMS itself, potentially adding significant delays and cost. Accordingly, we will not require the implementation of the DFMS function as an extension of LAANC.

79. As proposed in the *UAS NPRM*, we will approve any DFMS that can meet our requirements, including approving multiple DFMSs if each of them meets the requirements. Each approved DFMS will be required to provide access to frequencies nationwide, and to communicate and coordinate with the other approved DFMSs as necessary to ensure that their assignments are consistent. As in the 3.5 GHz band, where the Commission permitted multiple SASs to operate, we anticipate that this approach will foster a diverse, competitive marketplace of DFMS providers, promote technological innovation, and encourage the development of market-based solutions to the challenges involved with effective spectrum management in the band.[280] Multiple providers will also make the provision of DFMS service more robust overall, ensuring redundancy in the event a DFMS is temporarily disabled or ceases operations. We further find substantial support in the record for permitting multiple DFMSs subject to appropriate requirements to coordinate their assignments.[281]

80. ENTELEC/API argue that the Commission should instead choose a single provider to maximize simplicity and minimize the risk of inconsistent assignments.[282] We find, however, that the benefits of multiple DFMSs greatly outweigh the challenges that would need to be addressed in implementing that framework. We acknowledge that permitting multiple DFMSs will introduce

[277] *See* FPVFC Comments at 2.

[278] *See* FAA, *UAS Data Exchange (LAANC)*, https://www.faa.gov/uas/programs_partnerships/data_exchange/ (last visited Aug. 19, 2024).

[279] *See id.*

[280] *See 3.5 GHz R&O*, 30 FCC Rcd at 4063, para. 354.

[281] *See* AIA Comments at 10 (supporting multiple DFMS operators "so long as there is a robust data exchange between them"); AURA Comments at 18 ("The Commission should authorize as many DFMS operators as meet its requirements, but it should impose an interoperability requirement that would ensure that each DFMS is sufficiently able to authorize only those channels that are available in a given area[.]"); DSA Comments at 3 (permitting more than one DFMS will "spur competition, promote innovation, and encourage differentiated services in response to changing market demands"); EEI Comments at 14; Federated Wireless Comments at 6 ("There is tremendous value in authorizing more than one coordination database administrator to operate in any spectrum band, and this is already occurring in the CBRS and the 6 GHz bands."); NAM/MRFAC Comments at 3-4; uAvionix Reply at 10.

[282] *See* ENTELEC/API Comments at 8.

additional complications to the implementation of these systems.[283] It will be important for DFMS administrators to agree on and implement appropriate DFMS-to-DFMS lines of communication, as well as protocols for coordination and common interference models, that ensure that inconsistencies or conflicts in assignments are avoided, which may require coordination of requests in real time.[284] We agree with Federated Wireless, however, that these challenges should be surmountable with appropriate stakeholder coordination to develop effective inter-DFMS protocols, and restricting selection to a single DFMS would chill the innovation and other benefits that competition can bring and increase the risk to the continuity of NNA operations from the possibility that a DFMS is temporarily disabled or ceases operations.[285]

81. Below, we establish requirements to govern the DFMS and DFMS administrator and the process by which DFMSs and DFMS administrators will be approved, as well as certain rules governing the request and assignment process. We emphasize that the requirements we establish are high-level rules that describe minimum requirements. We expect that stakeholders will work collaboratively to develop specific policies, standards, procedures, and technologies necessary to show compliance with, implement, and enforce the rules during the DFMS approval process and thereafter. While EEI raises concerns that this approach may prove unsuccessful if parties are unable to agree, such collaborative efforts enabled stakeholders in the 3.5 GHz band to address numerous issues of SAS deployment in a flexible and innovative manner.[286] Accordingly, we believe it can be successful in this context. We further anticipate that a flexible approach will better enable the DFMSs to address the rapidly evolving UAS industry needs and technologies.[287] However, if solutions are not reached on issues through industry consensus, the Commission may further address these issues in the future.

1. DFMS Requirements

82. In the *UAS NPRM*, the Commission sought comment on the appropriate requirements and responsibilities of the DFMS.[288] The Commission sought comment generally on whether the Commission could draw on the rules governing the SAS and SAS administrators in the 3.5 GHz band and the general policy reflected in those rules of establishing only the minimum high-level requirements necessary to ensure the effective development and operation of the DFMSs.[289] The Commission also proposed certain high level requirements to be codified in proposed section 88.135 of the Commission's rules.[290] Among these requirements, the Commission proposed that:

- A DFMS must provide a process for NNA users to register with the system for the purpose of submitting frequency assignment requests and obtaining frequency assignments.
- A DFMS must be capable of responding to frequency assignment requests nationwide and across the entire 5030-5091 MHz band. However, a DFMS may only make assignments for spectrum within those frequencies in which NNA operations are permitted.

[283] *See* ENTELEC/API Comments at 7.

[284] *See* Federated Wireless Comments at 14 ("[T]he dynamic nature of aviation requires that the synchronization process for DFMS must happen in near-real-time on an ongoing basis" and noting that "[a] possible scenario that must be accounted for is multiple UAS operators simultaneously contacting their respective DFMSs to request in-flight revisions of their spectrum assignments, possibly in reaction to the same event").

[285] *See* Federated Wireless Comments at 14; Federated Wireless Reply at 5.

[286] *See* EEI Comments at 14-15.

[287] *See, e.g.*, uAvionix Comments at 15 (finding that "high level of oversight for DFMS . . . best provides the flexibility needed for the nascent UAS industry").

[288] *See UAS NPRM*, 38 FCC Rcd at 487-88, para. 29.

[289] *See id.* at 488, para. 29.

[290] *See id.*; *id.* at Appx. A (proposing 47 CFR § 88.135).

- In response to frequency assignment requests from a registered NNA user, a DFMS shall determine and provide, through an automated (non-manual) process, a frequency assignment for a particular geographic area and time period tailored to the NNA user's submitted flight plan, to the extent that frequencies are available to meet the request and the assignment is otherwise consistent with this part. Assignments must provide protected access to frequencies over a duration and geographic area sufficient to cover the entire submitted flight plan.
- Assignments must account for the need to protect other authorized operations.

83. Commenters generally support the adoption of high-level requirements.[291] On the proposed section 88.135, however, commenters provide little comment. Some commenters object to one aspect of the rules in the proposed section 88.135 – the requirement that NNA users submit a specific flight plan and receive assignments tailored to such a flight plan. Boeing asserts that the Commission should not require submission of flight plans because these plans are regulated by the FAA and include information that may be irrelevant to a DFMS assignment.[292] Boeing proposes that, instead, the Commission should require submission of appropriate flight-related information to assist the DFMS in coordinating authorizations.[293] The HAPS Alliance asserts that operators of high altitude platform stations may seek separate NNA assignments to control the ascent and descent of such stations, rather than seeking an assignment covering an entire flight plan.[294] AIA also suggests that requests should not necessarily be limited to a single flight, but that a DFMS should have flexibility to make a frequency assignment for a longer time period initially "and evolve over time as spectrum demands grow."[295]

84. In response, we modify the proposed requirements to clarify that we do not mandate that NNA users submit a "flight plan" in connection with their requests. "Flight plan" is a term of art in the aviation industry, with specified format and content.[296] While a DFMS will require sufficient information regarding the time, relevant geographic area and, potentially, altitude of a UAS operation to model potential interference impacts, we do not intend to specify the particular content or format of that information, but to give stakeholders flexibility to develop standards to implement this requirement. In addition, requiring specification of precise flight plans may raise security concerns, and may not accommodate numerous UAS operations that do not involve a flight plan. We still require, however, that requests be for spectrum to support a single UAS flight, which should help to ensure that parties reserve spectrum only for those times that they actually need the assignment, and to maximize the usage of the NNA spectrum and the resulting benefits. To reflect these determinations, we modify the proposed requirements to use the term "UAS flight" instead of "flight plan" (e.g., requiring that a DFMS provide a frequency assignment for a particular geographic area and time period tailored to the NNA user's submitted UAS flight).

85. We find no other objections to the requirements in the proposed section 88.135. We therefore adopt these requirements essentially as proposed, with the specified modification. After review of the record, we also adopt certain additional requirements, as discussed below.

86. *Interference modeling.* We add a high level requirement regarding the process of interference calculations. In the *UAS NPRM*, the Commission observed that ensuring that UAS operators operating with assigned spectrum are protected from harmful interference and do not cause such

[291] *See, e.g.*, AIA Comments at 9; NTIA/FAA Comments at 4; uAvionix Comments at 15; AURA Reply at 16.

[292] *See* Boeing/Wisk Comments at 10.

[293] *See id.*

[294] *See* HAPS Alliance Comments at 4-5.

[295] *See* AIA Comments at 12.

[296] *See, e.g.*, FAA, *Form FAA 7233-1 – Flight Plan*, (Aug. 1, 1982), https://www.faa.gov/forms/index.cfm/go/document.information/documentID/186159.

interference to other protected operations would be one the DFMS's most important responsibilities, and sought comment on appropriate high-level requirements in connection with this function.[297] AIA asserts that, among the minimum requirements, a DFMS should have to accurately model the RF environment in each geography, including potential interference, and assign channels only after determining, based on a set standard, that the channels can operate free of interference and without causing interference.[298] Federated Wireless asserts that analysis and modeling should be effective with respect to planned UAS operations, and that it will further be essential for each DFMS to abide by detailed technical standards to ensure consistency in the numerical results of any calculations.[299] It recommends, however, that any detailed standards for coverage and interference modeling should be produced by a multi-stakeholder group rather than the Commission.[300] Consistent with these recommendations, we do not adopt any detailed requirements regarding the methodology or modeling for interference calculations. We further agree that models and methodologies for interference determinations should be both effective in avoiding harmful interference and consistent between different DFMSs. Accordingly, we adopt these high level requirements. As with other high level requirements, we envision that stakeholders will establish detailed standards for specific models and methods that meet the Commission's requirements. We emphasize, however, that whatever standards stakeholders develop to implement the DFMS requirements must be in compliance with the rules, and the Commission will remain ultimately responsible for ensuring that any such standards satisfy the requirements of the rules and are otherwise consistent with them.

87. *FAA authorizations.* We include a requirement to help ensure that parties requesting frequency assignments have the necessary FAA pilot and flight authorizations. In the *UAS NPRM*, the Commission found that compliance by 5030-5091 MHz operators with applicable FAA remote pilot regulations will be critical to the safe operation of UAS in the 5030-5091 MHz band, and sought comment on the best approach to achieve this goal.[301] The Commission also noted that in addition to spectrum access from the Commission, UAS operators need authorization from the FAA to conduct flights in the airspace of the United States, and sought comment on whether and how frequency assignments should be coordinated with airspace authorizations.[302] It further sought comment on whether to rely on the DFMS to ensure that parties had the necessary FAA approvals for piloting and flight authorization.[303] In its comments, the FAA indicates support for this requirement.[304] In addition, Boeing/Wisk agree that FAA flight authority should be a prerequisite before the DFMS makes a frequency assignment, but argue that a DFMS should merely ascertain that a party requesting a frequency assignment has the requisite qualifications or authority, without interfering with these existing FAA

[297] *See UAS NPRM*, 38 FCC Rcd at 488, para. 30.

[298] *See* AIA Comments at 9.

[299] *See* Federated Wireless Comments at 11; Federated Wireless Reply at 9. *See also* Federated Wireless Comments at 12-13 ("A detailed standard for coverage and interference modeling, including acceptable thresholds, should be produced by the multi-stakeholder group. The standard must additionally account for the complications of the physical modeling of radio signals in aviation scenarios.").

[300] *See* Federated Wireless Reply at 9. *See also* AURA Comments at 18 (supporting authorization of as many DFMS operators as meet the Commission's requirements, contingent on an interoperability requirement that ensures each DFMS is able to authorize only channels available in an area "based upon the coordination contours that the Commission (or a third-party industry group) establishes.").

[301] *See UAS NPRM*, 38 FCC Rcd at 498, para. 55.

[302] *See UAS NPRM*, 38 FCC Rcd at 492, paras. 40-41.

[303] *See UAS NPRM*, 38 FCC Rcd at 492, 499, paras. 41, 57.

[304] *See* NTIA/FAA Comments at 5.

regimes.[305] Other commenters oppose requirements that make FAA remote pilot authorization a pre-requisite for a frequency assignment.[306]

88. After consideration of these comments, we will require a DFMS to confirm through certifications in the frequency assignment request process that the requesting party has flight authorization from the FAA to cover the flight associated with the assignment request, and that the flight will only be piloted by parties that have the necessary FAA remote pilot authorization.[307] NMC argues that requiring a DFMS to confirm an operator's compliance with FAA regulations would be time-consuming and redundant without any added benefit to the use of the band, but we disagree.[308] While a DFMS may implement additional measures to obtain confirmation, we only require it to implement certifications, and therefore do not expect the requirement to be time-consuming. Further, it will provide additional assurance that the NNA spectrum is used for authorized purposes.[309] EEI warns that FAA requirements may change over time, but our requirement will accommodate such changes.[310] We conclude that the benefit outweighs the limited cost of the requirement.[311]

89. While the Commission will have primary responsibility for the enforcement of this Commission requirement, we anticipate that the Commission will coordinate with the FAA as necessary to ensure that oversight and enforcement is effective. In particular, we find that compliance questions regarding the underlying FAA requirements should generally be determined with FAA input.[312] Therefore, we will require anyone challenging a DFMS action with regard to this requirement or otherwise seeking a Commission determination regarding a party's FAA authorization in this context to submit, with its filing to the Commission, a determination from the FAA regarding whether the party in question has the relevant authorization under FAA rules and requirements.

90. We decline to require that DFMSs "tie into" LAANC systems to confirm air authorizations, as proposed by ENTELEC/API.[313] Such a requirement could impose significant additional

[305] *See* Boeing/Wisk Comments at 10; *see also* AIA Comments at 11 (supporting that operators must be required to submit FAA authorization to operate); Lockheed Martin Comments at 10 (agreeing that it is necessary to require an operator to possess an FAA remote pilot license); uAvionix Reply at 8-9 ("[The Commission] should[] require any spectrum licensee or assignee to comply with all of the FAA eligibility requirements.").

[306] *See* CTIA Comments at 11 (arguing that operator licensing or permitting requirements "are unnecessary and inappropriate in light of FAA regulation of UAS remote pilot qualifications"); EEI Comments at 12 (acknowledging that compliance with FAA remote pilot regulations will be critical, but arguing that it is "not germane to the Commission's mission related to the allocation of spectrum"); NMC Comments at 7.

[307] We note that this requirement does not preclude NNA users from receiving assignments for the support of autonomous flights that may not involve an active remote pilot. For example, flights may involve remote parties that intervene only in the event of problems. We merely require a DFMS to confirm that all remote operators that will be involved in the operation, including those that may potentially take over otherwise autonomous flights, have any necessary FAA remote pilot authorization.

[308] *See* NMC Comments at 7.

[309] During the period governed by the Interim Access Mechanism (before a DFMS is operational), as discussed elsewhere in this Report and Order, there will be a general certification that an operator has received authorization from the FAA to ensure deconfliction, but that obligation will go away once a DFMS is operational.

[310] *See* EEI Comments at 12.

[311] We note that a license certification to address this issue, as proposed by NTIA, is impractical given that NNA will be a license-by-rule service and operators will not be required to have individual licenses.

[312] *See* AURA Comments at 7-8 (arguing the Commission should rely on the FAA to ensure compliance with FAA requirements).

[313] *See* ENTELEC/API Comments at 7; *see also* AURA Comments at 18 (recommending that the DFMS should be able to interact with "the FAA-provided or authorized airspace awareness services").

costs and complexity, and might require modification of the relevant LAANC systems. In addition, the benefits are unclear, as LAANC authorization only applies to a limited subset of UAS operations, that may not include many or even most of the operations occurring in the 5030-5091 MHz band. Further, it is not clear on the record that, even for operations approved under LAANC, a direct-interaction requirement is necessary to provide reasonable assurances that NNA operators have the necessary FAA authorizations. We also do not adopt ENTELEC/API's proposal that all operations must be conducted by a remote pilot with an FAA part 107 remote pilot certification.[314] Our adopted requirement will address the importance of pilot authorizations in a flexible manner that applies regardless of the specific pilot authorization requirements applicable to the operation.[315] We further do not adopt ENTELEC/API's proposal that Remote ID transmission be a requirement for any UAS to access NNA spectrum.[316] While we anticipate that most NNA operations will rely on UAS that have Remote ID capability, the Remote ID obligations for UAS operations are determined by the FAA's Remote ID rules, and accordingly, the extent of their application to NNA operations will be determined by those rules.[317]

91. *In-flight revisions.* We further add a requirement that a DFMS be capable of responding to in-flight revision requests. In the *UAS NPRM*, the Commission observed that operators may need to revise the assignments after a flight has commenced and sought comment on rules to enable or facilitate the filing and timely processing of such requests.[318] The limited record on this issue generally confirms that a DFMS should be capable of supporting such revisions.[319] The capacity to revise an assignment during a flight will help to address circumstances in which the planned area or duration of operations must be altered during the flight, including NPSTC's concern that, responding to an emergency, public safety operators will have difficulty predicting up front the duration of their need for the assignment.[320]

92. *Communications between DFMS and NNA stations.* We also add certain requirements for communications between a DFMS and NNA stations to better ensure compliance with DFMS assignments. In the *UAS NPRM*, the Commission noted that, in the 3.5 GHz band, SASs may reassign fixed stations to new frequencies, reduce the permitted transmitting power level, or cease operations, as necessary, to avoid or eliminate harmful interference and implement spectrum access priorities.[321] It sought comment on whether to adopt requirements to enable or implement similar active management processes by the DFMS.[322] Further, in addition to any machine-to-machine communications, the

[314] *See* ENTELEC/API Comments at 6-7.

[315] We note that the benefits of a flexible requirement apply to flight authorizations as well. As Boeing/Wisk note, the specific authorizations required under FAA rules will depend on the operation and may evolve as operations are further integrated into the NAS. *See* Boeing/Wisk Comments at 10 ("In the UAS context, [flight authorization] currently may involve blanket authorization in Class G airspace pursuant to Part 107 for appropriately certificated pilots, special authorization through a COA, or authorization to fly in non-Class-G airspace through the FAA's Low-Altitude Authorization Notification Capability ('LAANC'). As the UAS industry continues to advance, flight authorization procedures likely could more closely resemble those used for traditional aircraft.").

[316] *See* ENTELEC/API Comments at 8.

[317] *See* 14 CFR part 89.

[318] *See UAS NPRM*, 38 FCC Rcd at 490, para. 36.

[319] *See*, *e.g.*, Federated Wireless Comments at 14 ("The DFMS also must support the need to revise assignments after a flight has commenced, where it is possible and practicable to do so.").

[320] *See* NPSTC Comments at 7.

[321] *See UAS NPRM*, 38 FCC Rcd at 490, para. 37 (citing 47 CFR § 96.39(c)(2)).

[322] *See id.* at 490-91, para. 37. *See also id.* at 504, para. 68 (seeking comment on requirements on NNA equipment to facilitate a DFMS's ability to communicate with or otherwise control such equipment in the execution of the DFMS's responsibilities, including whether equipment should be required to enable the DFMS to make direct (machine-to-machine) frequency assignments to the UAS equipment in order to ensure that assignments are accurately programmed).

Commission proposed that an NNA user operating under a DFMS assignment must provide indication to the DFMS, within 5 minutes of the event, when a flight has commenced and when it has terminated.[323]

93. Commenters responding to this issue argue against active controls of the UAS by the DFMS. The FAA argues that airworthiness safety, and operational safety are compelling reasons why a DFMS should not have any direct control on an aircraft system.[324] Lockheed Martin argues in particular against any mechanism that would involve immediate cessation of a CNPC link during a flight.[325] Federated Wireless asserts that the DFMS should not control – or be understood to control – the behavior of UAS ground control stations or aircraft.[326] It does propose that ground stations should "exchange a sequence of messages with a DFMS administrator in order to move a frequency assignment through a series of states," and that the DFMS administrator be responsible for "recording the status of each flight and frequency assignment throughout the lifecycle of the flight, including during planning, pre-flight, inflight, and post-flight phases."[327]

94. We agree with commenters that a DFMS should not be in control of the operation of a UAS, and that an assignment should not be terminated while a flight is ongoing or modified during this time unless pursuant to a revision request. We are concerned, however, that an approach in which a DFMS merely reviews requests and transmits approved assignments to operators, without any further mechanism or requirement to promote user compliance, will lead to a higher probability of communications occurring outside of authorized parameters, either by intention or accident, and will not achieve the high level of safety and reliability that we intend for this band. Accordingly, we require that a DFMS be able to communicate directly with a ground station operating in the NNA spectrum, or proxy software acting on its behalf, to achieve the following: (1) ensure that all NNA stations used in the operation, including any ground or airborne stations, are programmed to limit communications in the 5030-5091 MHz band, during the period of the frequency assignment, to the specific frequencies assigned by the DFMS and in accordance with the other terms of the assignment; and (2) receive updates on flight status when a UA has launched and when it has landed. We will similarly require NNA ground stations to be capable of communicating with a DFMS as necessary to achieve these functions.

95. We find that these requirements will help to prevent operation over unauthorized frequencies and will bolster the ability of the DFMS to accurately identify available frequencies and, in emergency cases (such as cases of use outside the authorized time), to notify and potentially reassign affected authorized operators and to communicate with the operator of the unauthorized flight as necessary to bring the operation to an end. Further, we find the requirements are practical, as they are analogous to communications that have been implemented between the SASs and the devices that they coordinate.[328] While these requirements will impose some cost on the development of NNA stations, the

[323] *See id.*, Appx. A, § 88.31(d).

[324] *See* NTIA/FAA Comments at 6 ("Airworthiness safety, and operational safety are more compelling reasons not to have an external system (DFMS in this case) have any direct control on aircraft system.").

[325] Lockheed Martin Comments at 8 (arguing that "immediate cessation of a CNPC link during a flight would make use of this band for these operations untenable" and "[a]t most, operations could be required to end a mission as soon as is safely possible"); *see also* EEI Comments at 16 ("[A]ssignments should not be revoked during flights."); *UAS NPRM*, 38 FCC Rcd at 490 n.77 (noting prior record opposition to mechanisms that would automatically revoke an assignment after the duration of the assignment has expired, on grounds that termination of an assignment during an ongoing flight would create safety concerns).

[326] *See* Federated Wireless Comments at 10.

[327] *See id.* at 9-10.

[328] *See* 47 CFR § 96.53(b); Federated Wireless Comments at 9 (proposing that, "[s]imilar to [Citizens Broadband Radio Service Device] communication with the SAS, the UAS ground control station, or proxy software acting on its behalf, will exchange a sequence of messages with a DFMS administrator in order to move a frequency assignment through a series of states").

use of proxy software provides one option to reduce this cost, and we find that the benefits discussed above justify the imposition.[329] Further, because we require direct flight status updates from the NNA ground stations or proxy software, we will not also adopt a separate requirement proposed in the *UAS NPRM* that UAS operators must provide this information to the DFMS manually.[330]

96. *Limits on requests.* We add certain requirements to address concerns that a party may hoard or monopolize the limited spectrum available for NNA operations. In the *UAS NPRM*, the Commission sought comment on whether a DFMS should make a frequency assignment for the duration and other parameters requested if spectrum is available, or alternatively if limits or restrictions should be placed on what assignments can be made, such as a limit on maximum duration to prevent monopolization of the spectrum by one or a few parties with flights of long or indefinite duration.[331] Some parties suggest that the DFMS should generally approve the requested terms of an assignment if the spectrum is available.[332] uAvionix recommends that, given "rapidly advancing UAS technology," the Commission should not set "rigid up-front limits" but should allow the DFMS "to limit UAS operators seeking spectrum access to whatever spectrum use the administrator determines is a reasonable amount of time and coverage area."[333] Other commenters support limits on the permissible duration of an assignment, however. NAB, for example, recommends that the Commission consider time limits for authorization of frequency use, as long term use "could effectively foreclose access to the band for other users."[334] EEI proposes that, while a DFMS should generally make a frequency assignment for the duration requested if spectrum is available, the Commission should provide guidance regarding limits or restrictions on what can be assigned to prevent monopolization of the spectrum by parties with flights of long or infinite duration.[335] NMC similarly proposes that the rules "should guard against the ability of any particular operator(s) to monopolize the licensed spectrum by requesting long-term use of a frequency."[336]

97. The Commission further sought comment on whether an operator should be required to submit requests no more than a certain specified time period in advance of a flight.[337] Commenters on the *UAS NPRM* do not address this issue. In its original petition for rulemaking, however, AIA contemplated

[329] FPVFC, representing recreational users, raises concerns that requirements that require "frequency hopping" to avoid interference are not viable for UAS flying today. *See* FPVFC Comments at 1. We do not require such capability, and in any case, we disagree that the minimal requirements we adopt will render impacted UAS generally unviable. To the extent that FPVFC objects to the Commission imposing any new requirements that cannot already be implemented by existing equipment, such a restriction would make use of the NNA spectrum practically impossible, as most if not all currently deployed UAS are unequipped with the radios that will be necessary to operate over the NNA spectrum in the 5030-5091 MHz band.

[330] *See UAS NPRM*, 38 FCC Rcd Appx. A (proposing 47 CFR § 88.31(d)).

[331] *See UAS NPRM*, 38 FCC Rcd at 490, para. 35.

[332] *See, e.g.*, AURA Comments at 17 ("[U]sers in the shared portion of the band should receive authorizations after a DFMS determines that the requested channel is available.").

[333] *See* uAvionix Comments at 16.

[334] *See* NAB Comments at 4.

[335] *See* EEI Comments at 15-16.

[336] NMC Comments at 5 n.7.

[337] *See UAS NPRM*, 38 FCC Rcd at 490, para. 34.

that requests would be required to be filed within 20 minutes of a flight.[338] Other parties suggested that requests should be permitted days in advance or longer.[339]

98. We generally provide flexibility to DFMSs to determine the parameters of the frequency assignment necessary to support the UAS flight, including specific frequencies, bandwidth, maximum transmit power, amount of time, and coverage area. As discussed above, we require DFMS assignments to provide protected access over a duration and geographic area sufficient to cover the entire submitted UAS flight, but we do not mandate that a DFMS frequency assignment have the specific terms requested. We expect that, in a typical case, a DFMS will provide a frequency assignment with the requested terms if sufficient spectrum is available, particularly given that review and decision on such requests will be an automated process rather than a manual assessment. We do not wish, however, to preclude administrators from developing common policies, standards, or approaches regarding the assessment of requests and assignment of frequencies to better meet the industry's collective need for this limited spectrum resource. A DFMS might, for example, need to assign different frequencies where requested frequencies are unavailable or adopt policies that meet the needs of users with more efficient or better tailored assignments.[340]

99. We also find that two specific restrictions on permissible requests are warranted to prevent monopolization and facilitate broader access to NNA spectrum. First, we provide that requests may only be approved for an operation lasting no more than 24 hours. We find this restriction is consistent with our intention that assignments provide support for only a single flight. We are aware that, as UAS technology evolves, manufacturers are developing systems capable of continuous flight for much longer durations than 24 hours.[341] We expect, however, that 24 hours will provide sufficient duration for the overwhelming majority of flights.[342] Further, we agree with NAB and NMC that permitting indefinite use of frequencies could enable parties to effectively monopolize frequencies.[343] Accordingly, we believe that 24 hours strikes an appropriate balance between providing the industry with flexibility in the operations that can use the spectrum and preventing long-term monopolization of a limited spectrum resource.

100. Second, we also provide that requests may not be approved for periods commencing more than seven calendar days after the submission of the request, except to the extent that lack of frequency availability in that time frame justifies a later assignment.[344] We find that seven calendar days strikes an appropriate balance between preventing parties from engaging in long term reservation of the

[338] *See* AIA Petition at 14.

[339] *See* RTCA *Refresh Public Notice* Comments at 4; Wisk *Refresh Public Notice* Comments at 4 (recommending that spectrum be reservable "anytime a flight plan is ready," including "days or weeks in advance").

[340] *See also* AURA Comments at 12 (arguing that the DFMS should be allowed to authorize the appropriate amount of bandwidth requested for each use case); FPL Comments at 13 (a DFMS should "assign no more spectrum than is necessary for the safe operation of a given flight").

[341] *See, e.g.*, Airforce Technology, *The 10 Longest Range Unmanned Aerial Vehicles (UAVs)* (June 19, 2019), https://www.airforce-technology.com/features/featurethe-top-10-longest-range-unmanned-aerial-vehicles-uavs/?cf-view (describing a UA that can fly for months continuously).

[342] *See, e.g.*, BusinessWire, *Skyfront Drone Sets Endurance and Distance Record of 13 hours, 4 minutes* (Mar. 18, 2021), https://www.businesswire.com/news/home/20210318005319/en/Skyfront-Drone-Sets-Endurance-and-Distance-Record-of-13-hours-4-minutes.

[343] *See* NAB Comments at 4; NMC Comments at 5 n.7.

[344] As discussed below, we also provide an exception to this limit for assignments subject to coordination requirements in connection with the National Radio Quiet Zone. *See supra* Section III.C.6.

spectrum and permitting reservations in advance to provide greater certainty to parties planning their operations.[345]

101. NPSTC raises concerns about any requirement that requests be limited by duration, arguing that public safety UAS operations are normally not limited to a pre-defined time period.[346] A system that assigns spectrum indefinitely, however, would likely result in a dramatic reduction in the efficiency of spectrum usage in the band, and make it much more difficult for parties to schedule assignments in advance. Further, we emphasize that assignments are intended to cover single flights, and we find that the duration of a single UAS flight should be amenable to estimation. Indeed, parties currently submit such estimates as part of the process of obtaining air authorization under LAANC.[347] Further, as discussed above, NNA users will be able to submit in-flight revision requests if necessary. We note, however, that the two limitations adopted above are based on our predictive judgments regarding the extent and nature of uses of the spectrum and the Commission may modify the specific values as we develop more experience. A DFMS should be capable of implementing such changes to the rules.

102. *Coordination requirements.* We add a coordination requirement to ensure the proper functioning of the DFMSs. As discussed above, it will be critical, in the event there are multiple DFMSs, that they actively coordinate their assignments to avoid conflicts.[348] Accordingly, we adopt a requirement that a DFMS communicate and coordinate with other DFMSs as necessary to ensure consistent data and assignments, the safe and robust operation of authorized services, and compliance with the rules. Some commenters recommend that we also require a DFMS to coordinate with non-NNA operations in the band.[349] We defer determination of whether to adopt coordination or other rules for DFMSs or DFMS administrators in connection with non-NNA services or spectrum designated for non-NNA services pending a determination of the final band plan and the service rules for non-NNA UAS services in the band.

103. *Information submitted with registration and requests.* The *UAS NPRM* sought comment on the requirements we should impose regarding the format and content of information submitted with registration or with frequency requests.[350] Some commenters propose various requirements regarding submissions. AIA, for example, recommends requiring information about each "link" sufficient to determine the quality and potential for interference.[351] The PRC proposes that request details should contain, at least, the actual transmit power configured by the ground control station during operation, not

[345] We anticipate that, in addition to these restrictions, the authorization we provide the DFMS administrator to charge reasonable fees, including usage-based fees, will help deter parties from hoarding or monopolization.

[346] *See* NPSTC Comments at 7.

[347] *See* Aloft, *Submitting Your First LAANC Request*, https://www.aloft.ai/help/submitting-your-first-laanc-request/ (last visited Aug. 19, 2024).

[348] *See supra* paras. 80-81.

[349] *See, e.g.*, AIA Comments at 9, 11 (recommending that the DFMSs should communicate with systems employed by exclusively licensed operators as well as with each other, and that network operators in exclusively licensed spectrum should be required to make an application programming interference (API) available for DFMS operators and to share a minimum set of information necessary for a DFMS to protect authorized UAS operations in exclusively licensed spectrum and shared spectrum); AURA Reply at 18 (recommending that licensees of non-NNA spectrum "interoperate and share certain information with a DFMS through the use of an API.").

[350] *See UAS NPRM*, 38 FCC Rcd at 489-90, para. 34.

[351] *See* AIA Comments at 9; *see also* AIA Comments at 11 (operators in the band must be required to provide technical and operational information "includ[ing] site locations, channels requested, altitude of the transmitters and aircraft, expected flight path, EIRP, antenna patterns, UA model, information about the occurrence of a takeoff and landing, FAA authorization to operate, [and] certification that the aircraft is certified.").

the nominal maximum transmit power of the ground control station (assuming that the transmit power value of the ground station is configurable within a reasonable interval), arguing that this information will facilitate the DFMS administrator's ability to manage the spectrum efficiently.[352] Federated Wireless, however, recommends that we not adopt such specifications, but preserve flexibility in the rules and defer to the industry to develop the details of the registration and request format and content in appropriate standards.[353]

104. We seek only to adopt the minimum high level requirements for the DFMS, and to otherwise preserve flexibility to enable DFMSs to respond to the rapidly evolving needs of the UAS industry. Accordingly, beyond requiring that registration information include the registrant's legal name and contact information, and that requests must address and be limited to the frequencies, duration, and geographic coverage necessary to support a single submitted UAS flight, we do not define the specific information that a party must submit with a frequency assignment request or with registration.[354] We delegate authority to WTB, however, to impose additional specific requirements, after notice and an opportunity for public comment if it deems necessary or appropriate, regarding information that a DFMS must collect regarding registrants or frequency requests, such as the manufacturer, producer, make, or model of the equipment used, that WTB determines will promote the robust and safe use of the band or otherwise address security concerns regarding the use of the band, and we require the DFMS to have the capability to collect such additional information if required by WTB or the Commission. Further, to facilitate inter-DFMS coordination, we will mandate that each DFMSs require the same registration and request information, and, as with information provided to the SAS, we will require that information submitted to the DFMS be accurate, complete, and made in good faith.[355] In addition, consistent with our determinations above, we modify the language in proposed section 88.31(a) to clarify that we do not mandate that assignment requests necessarily must include specific flight plans. We will further require operators to keep any registration information up to date and keep any request information up to date through the scheduled end of the assignment.[356] Further, consistent with the rules governing the SAS, we will require that a DFMS maintain all records for at least 60 months.[357]

105. *Security.* We adopt a requirement to ensure data security in DFMS communications with NNA operators. In the *UAS NPRM*, the Commission sought comment on what requirements it should adopt to ensure such security, including the security of end-to-end communications between operators and a DFMS and the security of information stored by a DFMS.[358] uAvionix asserts that the FAA is best positioned to determine such requirements.[359] Federated Wireless, however, suggests that SAS

[352] *See* PRC Comments at 3.

[353] *See* Federated Wireless Comments at 9 ("Requirements regarding the specific information to be provided to the DFMS administrator for purposes of registering and requesting spectrum grants for UAS ground control stations and uncrewed aircraft should be developed by the multi-stakeholder group."); Federated Wireless Reply at 9 (arguing that a multi-stakeholder group "should establish minimum flight path and operational information that must be provided to enable the DFMS to perform effective analysis and modeling with respect to planned UAS operations").

[354] We note that parties will be required by our rules to comply with instructions from a DFMS, including instructions on what registration and request information to provide and in what format.

[355] *See* 47 CFR § 96.39(c).

[356] *See* AIA Comments at 11.

[357] *See* 47 CFR § 96.55(b).

[358] *See UAS NPRM*, 38 FCC Rcd at 489, para. 31.

[359] *See* uAvionix Comments at 16.

requirements on security codified at sections 96.53 and 96.61 of the Commission's rules may be helpful as a model.[360]

106. We find that certain security requirements should be adopted at this time as part of the Commission's requirements for a DFMS to ensure the confidentiality, integrity, and availability of data maintained by the DFMS, including communications with NNA users and NNA stations.[361] First, because the data involved in DFMS frequency coordination will involve safety-critical aeronautical operations such as flights in controlled airspace and may also involve proprietary or public-safety sensitive information, data security ensuring that system data is not improperly accessed, taken offline, or modified will be important both to public safety and the success of the DFMS coordination approach. In addition, it will be essential to the reliability of assignments that only devices compliant with the technical requirements are provided frequency access. Given the limited record on specific security requirements, however, and consistent with Federated Wireless's suggestion, we adopt a minimum set of high level requirements to address these concerns, similar to SAS requirements under section 96.61: (1) a DFMS must employ protocols and procedures to ensure that all communications between the DFMS and users or NNA stations in connection with a DFMS's NNA functions are secure and that unauthorized parties cannot access, shut down, or alter the DFMS or its stored information; (2) communications between users and a DFMS, and between different DFMSs, must be secure to prevent corruption or unauthorized interception of data, and a DFMS must be protected from unauthorized data input or alteration of stored data; and (3) a DFMS must verify that the NNA stations to be used in operations are part 88 FCC-certified devices and must not provide assignments to any other device.[362] In addition, similar to a measure we adopted in connection with an Internet-of-Things cybersecurity labeling program, we delegate authority to WTB in coordination with, at a minimum, the Office of the Managing Director (OMD) (specifically the Office of the Chief Information Officer) and, to the extent necessary, the Office of General Counsel (OGC) (specifically the Senior Agency Official for Privacy) to identify and impose on the DFMS any applicable security or privacy requirements arising from Federal law or Federal guidance.[363]

107. *Protection of other services.* We also include additional requirements regarding the protection of non-UAS services. We discuss these requirements further below in section III.C. In addition, we adopt a general requirement, based on a similar rule applicable to SASs, that a DFMS be capable of receiving reports of interference and requests for additional protection from Microwave

[360] *See* Federated Wireless Comments at 10; 47 CFR §§ 96.53, 96.61. Otherwise, the Commission received limited comment on the issue. *See* AIA Comments at 9 (recommending the DFMS should be "secure and highly available"); ALPA Comments at 9 (DFMS should be required to protect data archives of CNPC messages and any user data).

[361] We note that the regulation of data and communications security has been an increasingly important part of the Commission's mission in regulating communications networks and other communications systems. *See, e.g.*, News Release, FCC, Chairwoman Rosenworcel Launches New 'Privacy and Data Protection Task Force' (June 14, 2023), https://docs.fcc.gov/public/attachments/DOC-394384A1.pdf (announcing establishment of task force to coordinate across the agency on the rulemaking, enforcement, and public awareness needs in the privacy and data protection sectors, including data breaches such as those involving telecommunications providers and related to cyber intrusions); *see also* The White House, Presidential Policy Directive 21: Critical Infrastructure Security and Resilience (PPD-21) (Feb. 12, 2013) (tasking the Commission with "identifying communications sector vulnerabilities and working with industry and other stakeholders to address those vulnerabilities . . . [and] to increase the security and resilience of critical infrastructure within the communications sector").

[362] *See* 47 CFR § 96.61.

[363] *See Cybersecurity Labeling for Internet of Things*, PS Docket No. 23-239, Report and Order, FCC 24-26, 62, para. 121 (rel. Mar. 15, 2024).

Landing System (MLS) users in the 5030-5091 MHz band or authorized users in adjacent bands and promptly address interference issues.[364]

108. *Non-discrimination.* As noted previously, in the *UAS NPRM*, the Commission sought comment on whether the rules for the DFMS and DFMS administrator could draw on the requirements and responsibilities governing the SAS and SAS administrators in the 3.5 GHz band.[365] Among other requirements imposed on SAS administrators, the Commission required SAS administrators to discharge their frequency assignment functions in a non-discriminatory manner.[366] The Commission further provided that, in determining whether to approve parties to serve as SAS Administrators, it would require a demonstration of their intent and ability to comply with all of the rules, including the nondiscrimination requirement as well as the requirement that they cooperate with other SAS Administrators in coordinating and exchanging required information.[367] Similar to the SAS model, we adopt a requirement that frequency assignment functions be performed in a non-discriminatory manner.[368] We specifically require that assignment requests generally be granted in a first-come-first-served manner subject only to the priorities specified in the rules.[369]

109. *Prioritization.* In the *UAS NPRM*, the Commission sought comment on whether to establish priorities among different categories of CNPC or leave the rules flexible on this matter, with prioritization potentially to be considered and developed through appropriate standards development.[370] Several commenters argue that CNPC for public safety entities (such as firefighters and law enforcement) and the critical infrastructure industry (CII) should be given priority over other uses, at least in emergencies.[371] Some commenters also propose other categories of prioritization or propose that the rules permit other kinds of prioritization to be developed through appropriate standards by multi-stakeholder groups.[372] Boeing/Wisk recommend that the Commission reject such proposals, however, arguing that the DFMS can meet the needs of specialized operators requiring timely access without priority

[364] *See* 47 CFR § 96.53(o).

[365] *See UAS NPRM*, 38 FCC Rcd at 488, para. 29.

[366] *See* 47 CFR § 96.59(a); *3.5 GHz R&O*, 30 FCC Rcd at 4065-66, paras. 364-66.

[367] *See 3.5 GHz R&O*, 30 FCC Rcd at 4065, para. 365.

[368] *See* EEI Comments at 13 (DFMS should assign spectrum in a fair and equitable manner that does not prioritize any commercial use cases over others); FPL Comments at 13 (same). *See also* Federated Wireless Comments at 10 (asserting that, in determining requirements for the DFMS, the frequency assignment requirements of section 96.59 may be relevant).

[369] *See* Boeing Comments, RM-11798, at 12 (filed May 29, 2018) (supporting authorization of access to CNPC frequencies on a first-come, first-served basis). *See also* AIA Petition at 14.

[370] *See UAS NPRM*, 38 FCC Rcd at 496, para. 49.

[371] *See* EEI Comments at 13 (arguing for priority of public safety and CII "[w]hen a given geographic area is experiencing natural disasters"); NTIA/FAA Comments at 5 (arguing for standards to "ensure that priority operations (EMS, firefighting, law enforcement) are granted access over lower priority operations"); FPL Comments at 13 (arguing that when a given area experiences an imminent threat to safety, the DFMS should prioritize public safety and CII UAS operations for a subset of the NNA spectrum in the affected area); AURA Reply at 17 (supporting priority access for public safety and CII); Xcel Reply at 7 (agreeing that DFMS should prioritize access for public safety and CII "during emergency situations such as storm events or other disasters"). *See also* Letter from Ari Q. Fitzgerald, Counsel to Florida Power & Light Company, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 22-323, at 2 (filed Apr. 24, 2024) (FPL, PG&E, Xcel Energy, and EEI Apr. 24, 2024 *Ex Parte*) (arguing for "the importance of prioritizing utilities' access to shared-use spectrum for UAS").

[372] *See* ALPA Comments at 4 (recommending prioritization of operations in controlled airspace in contact with Air Traffic Control); EEI Comments at 10.

mechanisms.[373] While supporting priority for CII, EEI argues that a DFMS should not otherwise prioritize any commercial uses over others.[374]

110. After considering the record, we adopt two high-level requirements regarding the prioritization of requests. Boeing's argument against such mechanisms appears to imply that congestion will never happen in the NNA spectrum. This is not a realistic assumption, given the limited amount of spectrum available for NNA operations and the extent of potential demand for that resource. While, as discussed above, we will generally require the DFMS to process requests in a non-discriminatory, first-come-first-served manner, we find that two priorities in the event of congestion are in the public interest.

111. First, we provide that, in the event of emergencies, a DFMS should, to the extent feasible and consistent with the interests of aviation safety, prioritize requests from public safety entities. We find ample support in the record for prioritizing these entities in periods of congestion, as discussed above, but no discussion as to any of the details regarding the circumstances for or mechanisms of priority or how to define the entitled recipients. We acknowledge that, depending on how priority is implemented, it could be impractical or unsafe in certain circumstances. Accordingly, given the limited record, we impose this requirement at a high-level, and we expect that, as with other high-level requirements, stakeholders will develop common standards regarding who qualifies as public safety entities, what constitutes a triggering emergency, how priority is implemented, and over what period or area such priority rights apply. We limit the requirement to prioritization that is feasible and consistent with the interests of aviation safety, to address the concern that prioritization might itself increase safety risks, for example, if a particular implementation of prioritization would increase the risk of conflicting uses. In particular, we do not permit prioritization in a way that would terminate or modify an NNA user's assignment while the assignments are in use during a UAS flight. We find that, as between the many other important private sector uses and critical infrastructure, the non-discrimination principle should apply and therefore decline to adopt prioritization for the critical infrastructure industry.

112. Second, we adopt a requirement that, in extended periods of congestion, the DFMS prioritize requests involving flights relying on a single ground station over requests that rely on multiple stations, to the extent feasible and consistent with the interests of aviation safety.[375] While we permit operators the flexibility to use NNA spectrum for multi-station operations, NNA spectrum is primarily intended for non-networked operations, flights "that can rely on direct wireless links between the UAS operator's controller and the UA and therefore do not require any supporting network infrastructure."[376] Accordingly, we adopt this prioritization to ensure access by the intended focus of the spectrum.[377] As with the public safety priority, we establish this requirement at a high level. For both of these requirements, we expect that stakeholders will work collaboratively to develop appropriate standards and practices to implement them. If necessary, we may revisit them with more specificity.

[373] *See* Boeing/Wisk Reply at 8-9.

[374] *See* EEI Comments at 13. *See also* FPL Comments at 13.

[375] To the extent that both priorities come into play, we provide that the public safety priority should take precedence.

[376] *See UAS NPRM*, 38 FCC Rcd at 481, para. 13.

[377] We note support in the record for permitting operations with multiple stations in the NNA spectrum. *See, e.g.*, AIA Comments at 13 ("[F]lexibility in the shared portion of the band by operators that may need to use multiple sites but that may not be able to or want to acquire exclusive use licenses should be allowed assuming such use can be appropriately coordinated by the DFMS(s)."). Our requirements will permit such operations, while ensuring that the spectrum serves its intended purpose.

2. DFMS Administrator Requirements

113. In the *UAS NPRM*, the Commission also proposed requirements for DFMS administrators largely modeled on analogous requirements of the SAS administrators. Specifically, it proposed to require that administrators:

- Operate a DFMS consistent with the rules.
- Establish and follow protocols and procedures to ensure compliance with the rules.
- Provide service for a ten-year term. This term may be renewed at the Commission's discretion.
- Securely transfer all the information in the DFMS to another approved entity in the event it does not continue as the DFMS Administrator at the end of its term. It may charge a reasonable price for such conveyance.
- Develop a standardized process with other DFMS Administrators for coordinating operations with other approved DFMSs, avoiding any conflicting assignments, and maximizing shared use of available frequencies.
- Coordinate with other DFMS Administrators including, to the extent possible, sharing assignment and other information, facilitating non-interference to and from operations relying on assignments from other DFMSs, and other functions necessary to ensure that use of available spectrum is safe and efficient and consistent with this part.
- Ensure that the DFMS shall be available at all times to immediately respond to requests from authorized Commission personnel for any and all information stored or retained by the DFMS.
- Establish and follow protocols to comply with enforcement instructions from the Commission.[378]

114. No commenters objected to the proposed administrator requirements. Given the critical importance of inter-DFMS coordination to the safety and reliability of the system, we modify the coordination requirement to reflect that the specified coordination is mandatory rather than a "best efforts" requirement. Further, in addition to the limits we adopt above on requests to prevent monopolization of the NNA spectrum, we also expressly authorize DFMS administrators to adopt additional reasonable limits as necessary to address similar concerns. Specifically, we provide that the DFMS administrator may implement such reasonable limits on requests as are necessary to prevent the hoarding, warehousing, monopolization, or otherwise excessive reservation of NNA spectrum by a particular party. These limits may include, for example, limits on the amount of spectrum that may be reserved in a particular area and at a particular time by a single party or related parties and on the geographic area that may be reserved at a particular time by a single party or related parties.

115. As an additional mechanism to assist the Commission in its enforcement responsibilities, we will also add a requirement, drawn from SAS administrator requirements, that DFMS administrators establish and follow protocols to comply with enforcement instructions from the Commission. We expect detailed enforcement mechanisms and procedures employed by DFMSs to be developed during the approval process described below, including mechanisms and procedures to address unauthorized use of the spectrum, and we anticipate that most issues will be addressed through these mechanisms and procedures. However, the Commission retains the ultimate responsibility for and authority over NNA operations in the band. In the event that the DFMS is unable to resolve disputes or identify and address

[378] *See UAS NPRM*, 38 FCC Rcd, Appx., § 88.137.

the sources of harmful interference or unauthorized or otherwise unlawful operations in the band, these issues may be addressed by the Commission.

116. Above, we require a DFMS to immediately respond to requests from authorized Commission personnel for any and all information stored or retained by the DFMS. We also anticipate that other federal agencies may have important interests in obtaining DFMS information, particularly related to the coordination and protection of federal UAS operations in the band. Accordingly, we delegate authority to WTB, in consultation with NTIA, to establish a process, as needed, for direct access by federal agencies to information stored or retained by the DFMS, including the scope and terms of such access, through regulation, guidance, or agreement, as appropriate.

117. We note that, in some past instances of frequency coordination, the Commission has required a frequency coordination petitioner to make specific demonstrations of how it would avoid conflicts of interest or otherwise imposed specific restrictions regarding the coordinator's use or holding of the spectrum.[379] We find that various other measures we adopt will provide the equivalent benefits in ensuring neutrality of administration. As discussed above, we require DFMS assignment functions to be performed on a non-discriminatory, first-come-first-served basis. Further, in determining whether to approve parties to serve as DFMS administrators, we will require a demonstration of their intent and ability to comply with all of our rules, including this non-discrimination requirement and the requirement that DFMS administrators cooperate with each other in coordinating and exchanging required information. We find that these measures, together with the short term nature of the assignments and the highly automated nature of the frequency assignment process, should be sufficient to address concerns regarding conflicts of interest. We also expect that establishment of a competitive market for DFMS services will further help ensure against discriminatory conduct based on potential conflicts of interest.[380] We note that, for the SASs, the Commission relied on similar measures, including a non-discrimination requirement, to address conflict-of-interest concerns, and we are aware of no conflict-of-interest problems that have resulted in the administration of the SASs. Further, no commenter in this proceeding proposes restrictions or prohibitions regarding conflicts of interest by DFMS administrators. Accordingly, we find the measures adopted should be adequate to ensure the fair, equitable, and non-discriminatory management of NNA spectrum. We will monitor the behavior of DFMS administrators, however, and will not hesitate to take enforcement action if necessary to ensure that they comply with all applicable rules.

118. *Fees.* In the *UAS NPRM*, the Commission proposed to authorize the administrator of a DFMS to charge reasonable fees for its provision of services, including registration and channel assignment services, and to permit parties to petition the Commission to review fees and require changes if fees are found to be unreasonable.[381] We adopt this proposal and authorize administrators to charge

[379] *Wireless Telecommunications Bureau Opens Filing Window for Requests to be the Frequency Coordinator for Medical Body Area Networks*, Public Notice, 29 FCC Rcd 13750 (WTB 2014) (requiring that party seeking to be frequency coordinator demonstrate "how it will prevent any conflict of interest"); *Wireless Telecommunications Bureau Opens Filing Window for Requests to Be a Frequency Coordinator in the Wireless Medical Telemetry Service*, Public Notice, 15 FCC Rcd 19038 (WTB 2000) (same); *Wireless Telecommunications Bureau Opens Filing Window for Proposals to Develop and Manage Independent Database of Site Registrations by Licensees in the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, Public Notice, 19 FCC Rcd 4597 (2004) (providing that database manager applicants must show how they would prevent conflict of interests or alternatively certify that neither they nor any affiliate would be a licensee); *Wireless Telecommunications Bureau Certifies Additional Frequency Coordinator for 800/900 MHz Business/Industrial/Land Transportation Pool, Public Notice*, 29 FCC Rcd 9599 (WTB 2014) (certifying Association of American Railroads as a frequency coordinator but precluding it as a license holder from coordinating submissions on its own behalf).

[380] *See 3.5 GHz R&O*, 30 FCC Rcd at 4066, para. 366; *see also* EEI Comments at 14 (authorizing multiple DFMSs will "help prevent discriminatory conduct based on potential conflicts of interest, and place competitive pressure on fees and quality of service.").

[381] *See UAS NPRM*, 38 FCC Rcd at 491, para. 38.

reasonable fees for registration, assignments, and other services, including reasonable usage-based fees. DFMS fees will not only be necessary to fund the development and operation of a DFMS, but can provide UAS operators with important incentives to use the limited NNA spectrum efficiently and discourage monopolization, warehousing, or hoarding.[382] FPVFC, representing recreational users of UAS, objects that any fee is too high, but we find that the purposes above justify the imposition of reasonable fees, even if it renders access to the shared 5030-5091 MHz spectrum unaffordable by some parties.[383] We also note that we are not requiring use of the 5030-5091 MHz band for all CNPC communications, and that unlicensed spectrum, which has been commonly used for recreational and other low-risk UAS operations, will continue to be freely available for such uses among others.

119. FPVFC raises concerns that DFMS administrators will exploit leverage to charge high fees, but the adopted rule will address that concern, providing that parties may petition the Commission for review of fees alleged to be unreasonable.[384] We decline NMC's request that we elaborate at this time on what would constitute a "reasonable" fee.[385] Given the Commission's successful experience in the 3.5 GHz band, in which the Commission provided SAS administrators with similar fee authority and discretion and has not subsequently had to review the reasonableness of any such fees, and given our decision here to permit more than one DFMS to operate in the band in competition, we anticipate that DFMS administrators will charge reasonable fees without the need for elaborating guidance on what constitutes reasonable fees.[386] We further find that further determinations regarding reasonableness are better made on a specific record.

3. DFMS and DFMS Administrator Approval Process

120. In the *UAS NPRM*, the Commission sought comment on adopting a process for approval of one or more DFMS and DFMS administrators similar to the process that it used to approve the SASs

[382] We also note support for such fees from several commenters. *See* ENTELEC/API Comments at 7 ("[O]perational costs could be funded through a combination of Federal UAS registration fees and/or reasonable access fees."); CDA Comments at 5; Federated Wireless Comments at 10; *see also* Boeing Comments, RM-11798, at 12 (filed May 29, 2018) (asserting that frequency manager would "likely be able to collect fees" for assignment of frequencies and maintenance of the database). ENTELEC/API propose that a DFMS should be engineered with funding provided by auction proceeds. *See* ENTELEC/API Comments at 7. There will be no auction of NNA spectrum, however. In addition, our auctions authority in the past has not provided us authority for that use of auctions revenue, and we do not anticipate that future auctions authority will. *See* 47 U.S.C. § 309(j)(8) (governing treatment of auction revenues). We further note that the Commission currently lacks general spectrum auction authority, as its authority to auction spectrum lapsed on March 9, 2023. *See* Consolidated Appropriations Act, 2023, Pub. L. No. 117-328, 136 Stat. 4459 (December 29, 2022) (extending spectrum auction authority through March 9, 2023). Legislation was introduced on March 14, 2024, that would reinstate the Commission's auction authority through September 30, 2027. *See* Spectrum Pipeline Act of 2024, S.3909, 118th Cong. (2024).

[383] *See* FPVFC Comments at 2; *see also* NMC Comments at 8 ("[O]perators[] should not be precluded from operating in licensed airspace merely because the associated fees are 'reasonable' to some entities."). FPVFC also asserts that "[t]his is an example of the Commission facilitating a system to charge the public to use spectrum where there is no fee today." FPVFC Comments at 2. We disagree with this assertion. FPVFC confuses the free access that recreational UAS operators have had (and will continue to have) to unlicensed spectrum with licensed access to the 5030-5091 MHz band, which UAS operators have not had in the past and which we now enable through this Report and Order. Accordingly, it is not accurate to say that the public has previously had free licensed access to the 5030-5091 MHz band, or indeed, any licensed access to the band. Further, because licensed and protected access in the 5030-5091 MHz band will involve coordination by a DFMS, whereas access to unlicensed spectrum does not, the comparison between them is not apt.

[384] *See* FPVFC Comments at 2.

[385] *See* NMC Comments at 7-8.

[386] *See* EEI Comments at 14 (arguing that having multiple DFMSs will "place competitive pressure on fees and quality of service").

and SAS Administrators in the 3.5 GHz band.[387] Under this approach, the Commission delegated authority to WTB and OET to administer the process in close consultation with other stakeholder agencies, and provided that the Bureaus would issue a Public Notice requesting petitions from entities desiring to administer a SAS. Based on these petitions, WTB and OET would determine whether to conditionally approve any of the petitioners, and any petitioners that received conditional approval would then be required to demonstrate that their SASs meet all the requirements in the rules and any other conditions the Bureaus deemed necessary, and at a minimum, to allow their systems to be tested and analyzed by Commission staff.[388] Commenters take various positions on this issue. Several commenters support the SAS approval approach.[389] uAvionix recommends that the FAA should develop eligibility qualifications for DFMS administrators and then select candidates for recommendation to the Commission.[390] ENTELEC/API propose that selection should be accomplished by competitive bidding based on a Request for Proposal co-authored by the Commission and the FAA.

121. After review of the record, we adopt an approach for review and approval of DFMS and DFMS administrators similar to the Commission's process for selection of SASs and SAS administrators in the 3.5 GHz band, and we delegate authority jointly to WTB and OET to administer this process in close consultation at all stages of the process with the FAA and NTIA, as well as other administrative authority over the DFMS comparable to the delegation granted to WTB and OET to administer the SASs.[391] We further delegate authority jointly to WTB and the Office of the Managing Director (OMD) to determine fees, if any, in connection with the filing of a petition to be a DFMS administrator. We also direct WTB to obtain Office of Management and Budget review of all information collections associated with this process as required under the Paperwork Reduction Act.[392]

122. As mentioned earlier, the Commission adopted a similar approach in the 3.5 GHz band that proved highly successful, addressing the requirements of the various stakeholders, including multiple federal agencies, and resulting in the establishment of multiple SASs that have supported robust spectrum usage and innovation in the band. Aviation commenters in the instant proceeding endorse a process of Commission-led review with close FAA and NTIA coordination, and commenters with experience in the SAS model specifically support its applicability here.[393] We conclude that this proven model for successfully reviewing and approving one or more automated frequency managers is the appropriate process for the instant context. We find it is preferable to the RFP option proposed by ENTELEC/API and the review process suggested by uAvionix. Unlike these options, the approach we take is a tested and proven model for the designation of multiple automated frequency managers. We also find the careful review and testing involved in our approach will provide better assurance that the systems will perform as intended than the competitive bidding process contemplated by ENTELEC/API. Further, while uAvionix contemplates a sequential agency review, with an FAA review leading to recommendations to the Commission for a second review and final approval, the adopted approach will facilitate either a single integrated and coordinated review and testing by the stakeholder agencies. We therefore anticipate that

[387] *See UAS NPRM*, 38 FCC Rcd at 491-92, para. 39.

[388] *See id.* at 491, para. 39.

[389] *See* Federated Wireless Comments at 7; WInnForum Comments at 4. AIA and AURA appear to endorse this approach as well. *See* AIA Comments at 12 (recommending that the DFMS should be selected by the Commission in coordination with NTIA and the FAA); AURA Comments at 18 (same). AIA and AURA recommend that, as part of this approach, the Commission and the FAA should establish that a DFMS meets FAA requirements for CNPC in the band. AIA Comments at 12; AURA Comments at 18.

[390] *See* uAvionix Reply at 11.

[391] *See* 47 CFR §§ 0.241(j), 0.331(f).

[392] 44 U.S.C. § 3501 et seq.

[393] *See* AIA Comments at 12; AURA Comments at 18; Federated Wireless Comments at 7.

the adopted approach will enable a more rapid approval overall. We agree with uAvionix, AIA, and AURA that the DFMS will need to meet FAA regulatory requirements as well as the Commission's requirements, and we believe that, through close consultation between the agencies at all stages of the process, the concerns and regulatory requirements of the stakeholder agencies can be addressed without requiring sequential review.

123. WTB and OET will commence the process for DFMS and DFMS administrator review and approval by issuing a Public Notice requesting petitions from entities desiring to administer a DFMS. Petitioners will be required to, at a minimum, demonstrate how they plan to meet the Commission's rules governing DFMS operations, demonstrate their technical and other qualifications to operate a DFMS, and provide any additional information requested by WTB and OET, which could include information to demonstrate how they will meet relevant FAA requirements or standards. Based on these petitions, WTB and OET, in close consultation with the FAA and NTIA, will determine whether to conditionally approve any of the petitioners.

124. Any petitioner that receives conditional approval must then demonstrate, to the satisfaction of WTB and OET, again in close consultation with the FAA and NTIA, that their DFMS meets all the requirements in the rules and any other conditions the Bureaus deem necessary. WTB and OET will provide detailed instructions to petitioners throughout the process. At a minimum, petitioners will be required to allow their systems to be tested and analyzed by Commission staff prior to making their systems available for a period of public testing in order to gain final approval from the Commission. Petitioners may also be required to attend workshops and meetings as directed by the offices. The FAA and NTIA will provide input and guidance as needed. Based on the results of this review, WTB and OET will determine whether to grant final approval for operations, which may be conditioned on appropriate post-approval reporting to confirm that operations are successful and consistent with parties' representations and the rules. WTB and OET will then issue a public notice establishing the date on which parties seeking access to NNA spectrum must request a frequency assignment from the DFMS.

4. Obtaining an Assignment from a DFMS

125. In the *UAS NPRM*, the Commission proposed rules governing the process by which parties would obtain an NNA frequency assignment from a DFMS.[394] Among these, it proposed that NNA users registered with a DFMS may submit a request for temporary frequency assignment for CNPC limited to the duration and geographic coverage necessary to support a single submitted UAS flight plan.[395] It further proposed that requests may be made either prior to an operation or submitted during the relevant operation to modify the assignment, and that modification requests must be made to the same DFMS responsible for the original assignment.[396] In addition, it proposed that, if frequencies meeting the request are available, the DFMS would assign them on an exclusive but temporary basis, with the scope of the assignment tailored in both duration and geographic coverage to ensure interference-free communications for the entire submitted UAS flight plan.[397] It also proposed that, when using the services of a DFMS, an NNA user shall comply with all instructions of the DFMS Administrator, including those regarding registration, requests and other submissions to the DFMS, and operational use of NNA assignments.[398]

[394] *See UAS NPRM*, 38 FCC Rcd Appx. A (proposing 47 CFR § 88.31(a)-(c)).

[395] *See id.* (proposing 47 CFR § 88.31(a)).

[396] *See id.*

[397] *See id.* (proposing 47 CFR § 88.31(b)).

[398] *See id.* (proposing 47 CFR § 88.31(c)).

126. For the reasons discussed above, instead of requiring submission of a "flight plan," we establish a more flexible requirement to submit a "UAS flight." Otherwise, we find no objections to these specific provisions, and adopt them substantially as proposed.

5. Multi-stakeholder Group

127. In the *UAS NPRM*, the Commission sought comment on a possible role for a multi-stakeholder group to help develop the requirements and processes applicable to the DFMS, as well as to study standards and interference issues associated with UAS operations in the band.[399] Specifically, the Commission suggested that it would be beneficial for stakeholders (such as members of the aviation industry, the UAS standards-making community, frequency managers, and network operators) to assist in the development of requirements and processes because their aviation-specific knowledge could uniquely inform how spectrum access should be managed.[400]

128. The Commission has utilized multi-stakeholder groups successfully in other proceedings, such as for the development of the Spectrum Access System (SAS) in the 3.5 GHz band for the Citizens Broadband Radio Service (CBRS),[401] and the implementation of Automated Frequency Coordination (AFC) systems in the 6 GHz band,[402] both of which resulted in rapid deployment in their respective services. The record generally supports reliance on a multi-stakeholder group to further develop technical requirements and processes for the DFMS and to analyze and address standards and interference issues related to UAS operations in the 5030-5091 MHz band.[403]

129. We believe a multi-stakeholder group could provide a wealth of valuable insights and useful information, and be instrumental in addressing implementation issues in the 5030-5091 MHz band, as well as the complex administrative and technical issues regarding the DFMS. We agree with commenters that allowing the multi-stakeholder group to fill in the technical requirements will provide

[399] *See UAS NPRM*, 38 FCC Rcd at 493, para. 45.

[400] *See id*. at 493-94, para. 45.

[401] *See 3.5 GHz R&O*, 30 FCC Rcd at 4081, paras. 416, 417 (finding that a multi-stakeholder group could be instrumental in developing answers to some of the novel technical questions raised by the CBRS rules, declining to formally designate a group or adopt a specific process for reviewing and responding to their recommendations, but encouraging any such group to work to share their findings with the Commission and to incorporate their work, to the extent feasible, into the development of the 3.5 GHz band SAS and citizens band radio service devices). To serve as a multi-stakeholder group for this purpose, the Wireless Innovation Forum created the Spectrum Sharing Committee, which, *inter alia*, collaborated with relevant government agencies to develop 10 standards for the 3.5 GHz band addressing a range of CBRS and SAS technical and operational issues. *See, e.g.*, WInnForum *Refresh Public Notice* Comments at 1-2.

[402] *See 6 GHz R&O*, 35 FCC Rcd at 3918-19, paras. 174-80 (encouraging the formation of a multi-stakeholder group to provide a forum for the industry to study technical and operational issues raised by 6 GHz band unlicensed access and work cooperatively towards solutions); *see also Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, GN Docket No. 18-122, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343, 2467, para. 333 (2020).

[403] *See* WInnForum Comments at 5 (supporting the use of multi-stakeholder groups to develop standards, recommendations, and guidelines for the development of the DFMS); FPL Comments at 12 (agreeing that the Commission rightfully proposes establishing a multi-stakeholder group to develop DFMS requirements and processes); ALPA Comments at 9 (supporting the establishment of multi-stakeholder groups to develop requirements and processes for "Dynamic Frequency Management Services" and address standards and interference issues related to UAS operations in the 5030-5091 MHz band); CDA Comments at 5 (stating a multi-stakeholder group with significant industry participation will provide valuable insights and help ensure that recommendations account for real-world UAS uses and need); DSA Comments at 3 (suggesting all but minimum requirements to be addressed by multi-stakeholder groups); EEI Comments at 13 (urging the Commission to form and actively participate in a multi-stakeholder group with diverse UAS operators to develop the DFMS requirements and processes).

maximum flexibility as UAS continues to evolve.[404] While we support the participation of a diverse group of stakeholders with all relevant experts, we do not take a position on the exact scope, makeup, or organizational structure of the multi-stakeholder group. Given the successful formation of such groups in other areas, such as CBRS, we find it unnecessary to formally designate or specify a framework for a multi-stakeholder group.[405]

130. We encourage a multi-stakeholder group addressing issues in the band to work collaboratively towards innovative solutions that would encourage the rapid development of the DFMS, while protecting in-band and adjacent band operations through proper mitigation of harmful interference, and benefiting all potential stakeholders in the 5030-5091 MHz band. We hope that any such group would develop technical specifications and standards for DFMS operation in 5030-5091 MHz band, as well as system performance, safety, security requirements, and any other specific system standards necessary to ensure secure and reliable communications.

131. We envision the multi-stakeholder group could establish detailed protocols and specific methods for meeting the DFMS rule requirements, while simultaneously allowing nimble and evolving technical solutions consistent with the set of core obligations today's Report and Order establishes for NNA operations. In addition, recommendations for information requirements, registration processes and spectrum assignment formats within the DFMS would be highly beneficial and aid in successful DFMS deployment and operation. Finally, we believe that the insights provided by any such working group could be informative during the DFMS Administrator approval process.

132. While this informal multi-stakeholder group would be organized outside of the Commission's direct involvement, we encourage the multi-stakeholder group to provide the Commission with frequent updates on its work, such as through an annual report to apprise the Commission of its progress. Timely updates to the Commission will afford the Commission an opportunity to better understand the various technical issues and recommendations and allow the Commission to move more expeditiously on such recommendations when finalized. While we decline to adopt a specific process for reviewing and responding to recommendations made by such a forum at this time, we anticipate cooperative collaboration and communication to advance the goal of rapid deployment in the 5030-5091 MHz band. While some commenters are concerned about the need for clear direction to ensure that the needs of all stakeholders (such as public safety) are fully considered throughout the process,[406] we believe the benefit of an industry-led approach will provide the appropriate flexibility needed for the evolving demands of UAS operations in the 5030-5091 MHz band.

6. Interim Access Mechanism

133. While we adopt rules today for the establishment and operation of a DFMS, we expect there will be a significant period of time before a DFMS is operational, and we therefore establish an interim access mechanism (IAM) to provide access to the 5030-5091 MHz band during this provisional period. The establishment of the IAM will allow for immediate access to dedicated UAS spectrum as adopted in this proceeding, promoting the goal of meeting the current UAS needs. We find the IAM approach preferable to the Commission's existing special temporary authority (STA) process, as STAs do not inherently provide interference protection, a critical issue in the current unlicensed UAS environment that reduces reliability of UAS operations. In addition, the IAM will provide consistency with the

[404] *See* Federated Wireless Comments at 17.

[405] BusinessWire, Multi-Stakeholder Collaboration Highlighted in Report to the FCC by the Wireless Innovation Forum (Sept. 20, 2018), https://www.businesswire.com/news/home/20180920005828/en/Multi-Stakeholder-Collaboration-Highlighted-in-Report-to-the-FCC-by-the-Wireless-Innovation-Forum (specifying participation in the multi-stakeholder process included some 63 organizations and 336 participants).

[406] NPSTC Comments at 8.

license-by-rule approach adopted today for NNA and will ease administrative burdens by reducing the time required to gain access to the 5030-5091 MHz band.

134. Specifically, the IAM will be available to all eligible NNA operators licensed by rule, and will allow limited, short-term access to 20 megahertz of spectrum in the 5040-5060 MHz band of frequencies.[407] The initial access will only be suitable for NNA operations, which are typically single flights or events. The temporary nature of NNA operations corresponds appropriately to the license-by-rule framework, which does not require an individual FCC license,[408] but does require compliance with all applicable operating requirements, procedures, and technical specifications found within the UAS rules adopted herein. In order for NNA operators to gain access and begin transmission in the 5040-5060 MHz block, they must complete a two-step process, including FAA coordination and FCC registration.

135. *FAA Coordination.* NNA operators seeking to transmit in the band under the IAM are first required to submit a request to the FAA for deconfliction and approval.[409] The specific technical details of the requested location, frequency, and timeframe will be conveyed in this request process, pursuant to FAA directives. The FAA process will support the sharing of information that promotes situational awareness and strategic deconfliction, which is one of the key capabilities that NNA operators will use to maintain separation from one another and from obstacles and airspace constraints during this interim period. NNA operators must first receive FAA authorization/concurrence before any operation in the band is commenced, and must ensure that any such operations comply with the scope of approval, terms, conditions, and/or restrictions of the FAA authorization/concurrence. The FAA process will also include any required inter-agency coordination to ensure compatibility and deconfliction between federal and non-federal operations,[410] with the exception of the separate registration and certification process with the Commission detailed herein.

136. *FCC Registration Process*. For IAM access, NNA operators holding an FAA authorization must complete an on-line NNA registration form with the Commission providing various basic information and certifications, including a company or individual name, email address, and the following certification statements: (1) they have complied with the FAA authorization process; (2) they have/will comply with the Commission's NNA rules and technical requirements; (3) all equipment utilized in NNA operations meets the equipment certification requirements; and (4) their authorization to use the IAM assignment terminates immediately in the event a DFMS becomes operational prior to the end of the IAM assignment.[411] We delegate authority to WTB to set up the registration process consistent with the determinations in this Report and Order, and to require any further information and certifications found to be helpful to the administration or successful operation of the IAM. This registration process

[407] *See supra* Section III.A.1. As noted, while we are allotting 10 megahertz of spectrum for use by NNA operations, we are making available 20 megahertz of the 5030-5091 MHz during the IAM period to aid the deconfliction of NNA use.

[408] *See supra* Section III.A.3.

[409] *See* FAA, Spectrum Engineering AJW-19, https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/safety_ops_support/spec_management (last visited Aug. 19, 2024).

[410] *See* FAA, Spectrum Engineering AJW-19, https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/safety_ops_support/spec_management (last visited Aug. 19, 2024) (FAA Spectrum Engineering & Policy Office ensures "radio spectrum compatibility and deconfliction between federal and non-federal radio systems").

[411] We note that, during the IAM period, parties may continue to seek access to the 5030-5091 MHz band through experimental authorization applications under the Commission's part 5 rules for the purposes authorized under those rules such as the testing of equipment in connection with production or regulatory approval of such equipment. *See* 47 CFR § 5.3.

will not require a fee, or any subsequent review process.[412] Once the registration form is completed and submitted, a confirmation number of their registration will be provided and NNA operations can commence immediately. WTB will issue a public notice providing further information regarding the registration process, including the date on which registration may begin. During the IAM, the FCC will work with the FAA to resolve disputes or identify and address the sources of harmful interference or unauthorized operations in the 5030-5091 MHz band.

137. *Transition to DFMS Management of NNA Spectrum.* When a DFMS is first granted final approval, as discussed above, WTB will issue a public notice establishing the date on which the DFMS may begin operations, after which parties seeking access to NNA spectrum must request a frequency assignment from the DFMS. For the DFMS assignment process to reliably determine interference impacts, it is critical that all UAS operations have gone through a DFMS. Accordingly, after the date on which a DFMS first begins operation, parties may not seek or use assignments from the IAM. We note that, after such date, the spectrum available for NNA operations will be restricted to 10 megahertz, as discussed above. If WTB finds it appropriate to help ensure a smooth transition, it may establish and announce by public notice a date prior to final approval of a DFMS after which requests will no longer be processed through IAM, but no earlier than the date of the first DFMS conditional approval. Further, we authorize WTB to take any other necessary steps to ensure a smooth transition to the DFMS management of the NNA spectrum, including setting the date for a DFMS to begin operations a sufficient period after the date of final approval to permit all or most of the outstanding IAM approvals to expire.

C. Compatibility with Other Services

1. Microwave Landing Systems

138. The Microwave Landing System (MLS) is a radio guidance system that was intended to be installed at airports to aid aircraft in landing in circumstances such as when an airport is visually obscured by bad weather, and that provided certain technical improvements over the original Instrument Landing System.[413] Footnote US444 of the Table of Allocations provides that in the band 5030-5150 MHz, the requirements of MLS have priority over other uses of this frequency band.[414]

139. The MLS technology has been rendered obsolete by more recent instrument-landing solutions, and no current licensed non-federal MLS systems are in the 5030-5150 MHz band. Further, the FAA does not anticipate any future use of these systems at airports.[415] NTIA's most recent summary of the federal use of the 5030-5250 MHz band indicates, however, that the Air Force uses the 5030-5091 MHz band for MLS at military bases and "will continue to use MLS into the foreseeable future in order to provide landing guidance to military aircraft."[416] Given the lack of non-federal MLS and the

[412] We find that fees are not warranted here because the registration is a process intended to collect basic identification and certification information during this interim period that may be used, if necessary, in circumstances where interference issues or questions of rule compliance arise. As discussed in Section III.A.3, NNA operators are licensed by rule, are not required to apply for an individual license, and are not obtaining any additional operating rights solely as a result of this registration requirement. Thus, we would not consider it an application subject to section 8 of the Act. See 47 U.S.C. § 158 (requiring the Commission to adopt application fees).

[413] *See* WTB & OET, Report on Section 374 of the FAA Reauthorization Act of 2018, GN Docket No. 19-356, 5 (2020), https://docs.fcc.gov/public/attachments/DOC-366460A1.pdf.

[414] *See* 47 CFR § 2.106(c)(444) (footnote US444); *see also id.* § 87.173(b) (authorizing MLS over the frequencies 5030-5150 MHz). The rules also permit deployment of "radionavigation land test" stations at 5031 MHz but only for the testing of MLS airborne receiving equipment. *See* 47 CFR § 87.475(c)(2).

[415] *See* NTIA, NTIA Spectrum Compendium, 5030-5250 MHz, at 11 (Feb. 2021), https://www.ntia.doc.gov/files/ntia/publications/compendium/5030.00-5250.00-02092021.pdf (NTIA Spectrum Compendium (5030-5025 MHz)).

[416] *Id.* at 1, 11.

obsolescence of the systems, the *UAS NPRM* proposed to amend the rules to provide that no future non-federal MLS licenses (including MLS radionavigation land test licenses at 5031 MHz) would be granted in the 5030-5091 MHz band, but sought comment on the measures the Commission should adopt to protect federal MLS services.[417]

140. The limited comment on non-federal MLS use in response to the *UAS NPRM* provides further support for the conclusion that MLS is an obsolete technology, and that it is highly unlikely that any non-federal party will seek to deploy MLS in the band.[418] No party indicates that there is any interest in or need for the deployment of such systems, and as noted, the FAA does not anticipate any future use of these systems at airports.[419] Given that there are no non-federal MLS stations in the band, and that we do not anticipate licensing any future MLS systems, we adopt no measures to protect such operations. We will coordinate with the FAA the specific actions necessary to remove the availability of the 5030-5091 MHz band for non-federal MLS use as part of our ongoing efforts to establish final rules for this band.

141. Because we anticipate continued use of federal MLS by the Air Force, we adopt measures to ensure the priority of federal MLS over NNA operations. As suggested in the *UAS NPRM*, we will establish exclusion zones to protect such systems.[420] Further, drawing on analogous requirements of the SAS, we will require the DFMS to retain information on, and enforce, the zones sufficient to protect any federal MLS stations in the 5030-5091 MHz band.[421] The Commission will coordinate with NTIA to identify both the current locations of federal MLS and the appropriate exclusion zones, after which the exclusion zones will be identified by Public Notice. To the extent that these locations change, such changes can be addressed through a similar process. We delegate authority to WTB to issue the public notice identifying any initial MLS exclusion zones as well and any subsequent public notices necessary to identify changes.

142. Comments in response to the *UAS NPRM* that address this issue generally support exclusion zones to protect MLS.[422] While AIA, in its rulemaking petition, suggested a coordination mechanism for this purpose,[423] we expect that exclusion zones will be easier to implement than a coordination mechanism that would require either deployment of a sensing mechanism or an ongoing interactive process between the relevant federal agencies and DFMSs. In addition, while coordination could enable greater use of the NNA spectrum, we do not anticipate that the additional benefit would be significant, as the protection of MLS at a few specific Air Force bases should not require extensive zones, and non-federal UAS operations in the vicinity of these bases are likely in any case to be prohibited or

[417] *See UAS NPRM*, 38 FCC Rcd at 518-19, paras. 102-03.

[418] *See* ALPA Comments at 11 (agreeing that MLS "has largely been rendered obsolete by other technologies," that "it is unlikely that new non-Federal MLS systems will ever be deployed," that therefore no protection of non-federal MLS are necessary, and further supporting elimination of future MLS licensing in 5030-5091 MHz).

[419] *See* NTIA, NTIA Spectrum Compendium, 5030-5250 MHz, at 11 (Feb. 2021), https://www.ntia.doc.gov/files/ntia/publications/compendium/5030.00-5250.00-02092021.pdf (NTIA Spectrum Compendium (5030-5250 MHz)). We note that any application for MLS stations would need to be coordinated with the FAA. *See* 47 CFR § 87.475(a). We do not anticipate FAA endorsement of such applications for the reasons discussed.

[420] *See UAS NPRM*, 38 FCC Rcd at 518-19, para. 102; *see also* Appx. A (adding 47 CFR § 88.135(m)).

[421] *See* 47 CFR § 96.53(e).

[422] *See* ENTELEC/API Comments at 8 (supporting exclusion zones); Qualcomm Comments at 13 (same).

[423] *See* AIA Petition at 18; *see also* Lockheed Martin *Refresh Public Notice* Comments at 5; Boeing *Refresh Public Notice* Comments at 11.

severely restricted.[424] We also decline to modify footnote US444 in the Table of Allocations to identify the specific locations to be protected, as has been suggested by some parties.[425] Because the DFMS will know the MLS exclusion zones and enforce them automatically, enforcement does not depend on operators knowing the locations.[426] Further, there are other convenient ways for operators to obtain such information, such as from the relevant Public Notice. In addition, because federal MLS locations may be eliminated or newly established in the future, identification of such locations through a public notice process, rather than codifying the locations in the Commission's rules, will allow the Commission and the DFMS to be more nimble in appropriately protecting federal MLS locations in the future.

2. Radionavigation-satellite Service

143. The 5010-5030 MHz band includes an allocation for the radionavigation-satellite service (RNSS) (space-to-Earth) for potential future use.[427] Footnote 5.443C of the Table of Frequency Allocations addresses requirements in the 5030-5091 MHz band for the protection of RNSS downlinks.[428] Specifically, it provides that "[u]nwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5010-5030 MHz band" and that "[u]ntil such time that an appropriate value is established in a relevant International Telecommunication Union Radiocommunication Sector (ITU-R) Recommendation, the equivalent isotropic radiated power (EIRP) density limit of -75 dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station unwanted emission should be used."[429] Footnote 5.443C further limits AM(R)S use of the 5030-5091 MHz band to "internationally standardized aeronautical systems." As NNA operations services would be part of the AM(R)S allocation, the requirements of footnote 5.443C would apply to such operations in the 5030-5091 MHz band. In the *UAS NPRM*, the Commission sought comment on requiring UAS operations in the 5030-5091 MHz band to comply with footnote 5.443C, and on whether it should adopt any other measures to protect RNSS downlinks.[430]

144. We conclude that the technical requirements applicable to NNA combined with the frequency separation between the NNA spectrum and the 5010-5030 MHz band will be sufficient to provide compatibility between NNA operations and RNSS in the 5010-5030 MHz band. The FAA indicates that the protection of RNSS systems was taken into consideration in the drafting of the RTCA standard, and that RNSS can safely be protected as long as RTCA standards are followed.[431] We also note that the OOBE limits in RTCA DO-362A incorporate the limits established in footnote 5.443C that were specifically adopted to protect RNSS from AM(R)S in the 5030-5091 MHz band.[432] As discussed above, we are adopting NNA technical requirements through incorporation by reference to provisions of RTCA

[424] *See* FAA, *Security Sensitive Airspace Restrictions*, https://www.faa.gov/uas/getting_started/where_can_i_fly/airspace_restrictions/security_sensitive (last updated Aug. 19, 2024) (stating that "[d]rones are prohibited from flying over designated national security sensitive facilities," including "[m]ilitary bases designated as Department of Defense facilities").

[425] *See, e.g.*, Lockheed Martin *Refresh Public Notice* Comments at 4-5.

[426] As discussed above, until a DFMS is operational in the band, NNA access will be governed by a two-step interim access mechanism, including FAA coordination and Commission registration. *See supra* Section III.B.6.

[427] *See* 47 CFR § 2.106. ALPA anticipates that future United States or international Global Navigation Satellite Systems may use this band for network control. ALPA Comments at 12.

[428] *See* 47 CFR § 2.106(b)(443)(iii) (footnote 5.443C).

[429] *See id.*

[430] *See UAS NPRM*, 38 FCC Rcd at 521, para. 108.

[431] *See* NTIA/FAA Comments at 5.

[432] *See* RTCA DO-362A, § 2.2.1.8.2.2. We note that footnote 5.443C will also continue to apply to NNA equipment and services of its own force.

DO-362A, including its power and OOBE limits. We therefore anticipate that these limits will be sufficient to protect RNSS.

145. Some commenters argue that we should adopt 4.5 megahertz guard bands at the edges of the 5030-5091 MHz band to protect RNSS, and that such a guard band is necessary to meet the requirements of footnote 5.443C.[433] There is no need at this time, however, to determine whether such a guard band is necessary, as the interim spectrum we designate for NNA in this Report and Order will provide more than twice that frequency separation between NNA operations and the 5030-5091 MHz band edges.[434]

3. AeroMACS

146. AeroMACS is a wireless broadband aeronautical mobile (route) service system that will enable communications for surface operations at airports between aircraft and other vehicles and between other critical fixed assets.[435] The Commission allocated both the 5000-5030 MHz and 5091-5150 MHz bands for such use but has not yet established service rules in either band.[436] The AeroMACS allocation for 5010-5030 MHz further provides that in making assignments for this band, attempts shall first be made to satisfy requirements in the bands 5000-5010 MHz and 5091-5150 MHz.[437] In the *UAS NPRM*, the Commission sought comment on whether any special measures beyond the generally applicable technical requirements were necessary to ensure compatibility between UAS operations in the 5030-5091 MHz band and AeroMACS.[438]

147. As with RNSS, we similarly conclude that the adopted technical requirements, combined with the frequency separation, will be adequate regulatory measures to provide compatibility between NNA operations and AeroMACS in the upper and lower band.[439] Parties assert that protection of AeroMACS will require a 4.5 megahertz guard band at the 5030-5091 MHz band edges.[440] We reiterate that we need not decide at this time whether to adopt such a guard band, given the location of NNA spectrum, for now, at the core of the band.

148. NTIA/FAA assert that, in addition to compliance with the technical requirements in RTCA DO-362A, protection of AeroMACS will also require "careful planning . . . when installing UAS C2 Link Ground Stations at airports where AeroMACS Base Stations are installed to ensure that the C2

[433] *See* NTIA/FAA Comments at 1; RTCA Comments at 3, 40; AIA Reply at 9; uAvionix Reply at 4; *see also* RTCA DO-362A, Appx. T.2.

[434] We will reconsider the option of guard bands when the final band plan for the 5030-5091 MHz band is determined.

[435] *See Amendment of the Commission's Rules to Promote Aviation Safety et al.*, WT Docket No. 19-140 et al., Notice of Proposed Rulemaking, 34 FCC Rcd 4984, 4997, para. 34 (2019) (*Aviation NPRM*).

[436] *See id.* at 4997, para. 35.

[437] *See* 47 CFR § 2.106(c)(115)(b) (footnote US115(b)).

[438] *See UAS NPRM*, 38 FCC Rcd at 520, para. 107.

[439] *See, e.g.*, NTIA/FAA Comments at 5; RTCA Comments at 39 ("RTCA SC-228 confirms that the out-of-band emissions specification in RTCA DO-362A for UA and terrestrial NNA . . . ground systems protect AeroMACS services in the 5000-5030 MHz and 5091-5150 MHz bands."). RTCA also confirms that RTCA's revised technical standard for AeroMACS will protect UAS services in the 5030-5091 MHz band from harmful interference from AeroMACS systems. *See* RTCA Comments at 40. NTIA/FAA and RTCA also suggest that certain siting requirements will be necessary to protect AeroMACS in addition to compliance with these technical requirements, however. *See* NTIA/FAA Comments at 5; RTCA Comments at 40, 41. We discuss these assertions below.

[440] *See, e.g.*, RTCA Comments at 40.

Link Ground Station antenna main beam is not pointing towards an AeroMACS Base Antenna."[441] This concern is reflected in a provision of RTCA DO-362A, section 2.1.20.5, entitled "[Ground radio station] Antenna Siting in Airport with AeroMACS Service," which provides that the main beam of the ground station "shall point outside the main beam of AeroMACS Base Station antenna and AeroMACS Fixed Station antennas such that at least 12.5 dB of sidelobe rejection is provided."[442] We find, however, that it is unnecessary to regulate siting at an airport to protect the airport's AeroMACS when the airport operators will be fully able to determine and enforce restrictions for siting at their airports. Accordingly, we decline to adopt siting requirements at airports to protect AeroMACS.

4. Aeronautical Mobile Telemetry

149. The 5091-5150 MHz band is also allocated for federal and non-federal aeronautical mobile telemetry (AMT) communications from aircraft stations, subject to the technical parameters in ITU Resolution 418 (WRC-12) intended to ensure compatibility with other services.[443] According to NTIA, federal agencies currently use this allocation in the 5091-5150 MHz band to support flight testing.[444] The band is similarly used for non-federal flight testing operations.[445] As specified in footnote US111 of the Table of Allocations, flight testing in the band 5091-5150 MHz is conducted at seventeen locations, and additional locations may be authorized on a case-by-case basis.[446]

150. In the *UAS NPRM*, the Commission sought comment on whether measures beyond generally applicable out-of-band emissions limits are necessary to ensure that 5030-5091 MHz operations are compatible with AMT communications in the 5091-5150 MHz band.[447] AFTRCC notes that the rules for Wireless Communications Service (WCS) operations in the 2345-2360 MHz band immediately adjacent to AMT spectrum (2360-2395 MHz) provide for protection of AMT receiver stations through coordination consistent with the criteria in ITU Recommendation ITU-R M.1459, as adjusted using generally accepted engineering practices and standards to take into account the local conditions and operating characteristics of the applicable AMT and WCS facilities.[448] AFTRCC argues that, because UAS operations will be opportunistic and dynamic, a similar coordination scheme may not be practical,

[441] *See* NTIA/FAA Comments at 5; *see also* RTCA Comments at 41 (asserting that UAS ground station "antenna beams cannot be pointed towards the AeroMACS Base Station antennas").

[442] *See* RTCA DO-362A, § 2.1.20.5.

[443] 47 CFR § 2.106(c)(444)(ii) (footnote US444B). Resolution 418 limits applications to flight testing transmissions from aircraft stations, and establishes criteria for coordination with MLS, fixed-satellite service, mobile service in the band 5150-5250 MHz, and AM(R)S in the band 5091-5150 MHz. *See* ITU Resolution 418 (rev. WRC-19), "Use of the frequency band 5091-5250 MHz by the aeronautical mobile service for telemetry applications." (Resolution 418).

[444] *See* NTIA Spectrum Compendium (5030-5025 MHz) at 1, 9.

[445] *See* AFTRCC Comments at 10.

[446] *See* 47 CFR 2.106(c)(111) (footnote US111).

[447] *See UAS NPRM*, 38 FCC Rcd at 521, para. 109.

[448] *See* AFTRCC Comments at 10; 47 CFR § 27.73(a) (requiring WCS licensees operating stations in the 2345-2360 MHz band, prior to operation of such stations, to achieve a mutually satisfactory coordination agreement with AMT entities for any AMT receiver facility within 45 kilometers or radio line of sight of the intended WCS station; further requiring that such agreements provide protection to existing AMT receiver stations consistent with ITU-R M.1459, as adjusted using generally accepted engineering practices and standards to take into account the local conditions and operating characteristics of the applicable AMT and WCS facilities); *see also* International Telecommunication Union (ITU) Recommendation ITU–R M.1459, "Protection criteria for telemetry systems in the aeronautical mobile service and mitigation techniques to facilitate sharing with geostationary broadcasting-satellite and mobile-satellite services in the frequency bands 1452–1525 MHz and 2310–2360 MHz," adopted May 2000 (ITU-R M.1459).

and that, to protect AMT, the Commission should simply impose across-the-board power and OOBE limits on UAS operations consistent with the criteria of ITU-R M.1459.[449]

151. We find that the limits we adopt above, incorporated by reference to provisions of RTCA DO-362A, are sufficient to protect AMT because the low emission limits into the 5091-5150 MHz band are comparable to the WCS limits in our part 27 rules. We decline to require NNA operations to also comply with the criteria of ITU-R M.1459. ITU-R M.1459 was adopted to establish AMT protection criteria for sharing with satellite services.[450] The criteria of RTCA DO-362A have been developed specifically for terrestrial CNPC in the 5030-5091 MHz band with low emission limits sufficient to protect adjacent AMT operations. AFTRCC does not assert that the RTCA DO-362A criteria are insufficient to protect AMT or offer any explanation or analysis supporting that conclusion or otherwise demonstrating that ITU-R M.1459 is more appropriate, and we find that reliance on ITU-R M.1459 may be excessively restrictive. In referencing the ITU-R M.1459 criteria for coordination between WCS in the 2360-2395 MHz band and neighboring AMT, the Commission emphasized that ITU-R M.1459 "sets forth extremely conservative baseline protection" and that it would in many cases "provide more protection than required, unnecessarily restricting areas where WCS licensees may provide service."[451] We note that Boeing, which uses the 5091-5150 MHz band for aircraft certification and testing, does not request ITU-R M.1459 criteria be applied.[452] We also note that, while the Commission required WCS licensees in 2345-2360 MHz to coordinate with AMT, it did not require similar coordination, under ITU-R M.1459 or any other standard, from WCS licensees in the 2305-2320 MHz band, who are separated by 40 megahertz from AMT in 2360-2395 MHz.[453] As the NNA spectrum we designate in this Report and Order will be comparably separated by 41 megahertz from AMT, we find that the WCS rules further support our conclusion that compliance with ITU-R M.1459 is unnecessary to adequately protect AMT from NNA operations at this time.[454]

5. Mobile Satellite Service Feeder Links

152. As specified in footnote US444A of the Table of Allocations, the 5091-5250 MHz band is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis for non-Federal use, limited to feeder links of non-geostationary satellite systems in the Mobile Satellite Service (MSS).[455] After January 1, 2016, the 5091-5150 MHz portion of this allocation permitted no new assignments.[456] Globalstar operates gateway earth stations in the 5091-5250 MHz band under this allocation as part of its

[449] *See* AFTRCC Comments at 11-12. We note that, while federal flight testing also occurs in the band, neither NTIA nor any federal agency has similarly requested application of the ITU-R M.1459 criteria.

[450] *See* ITU-R M.1459.

[451] *See Amendment of Part 27 of the Commission's rules to Govern the Operation of Wireless Communications Service in the 2.3 GHz Band*, WT Docket No. 07-293, Order on Reconsideration, 27 FCC Rcd 13651, 13717, para. 169 (2012).

[452] *See* Boeing/Wisk Comments at 19 (supporting "the Commission's proposal to provide generally applicable out-of-band emissions limits to protect 5091-5150 MHz flight testing operations").

[453] *See* 47 CFR § 27.73.

[454] In the *UAS NPRM*, the Commission sought comment on whether guard bands at the edges of the 5030-5091 MHz band were necessary to ensure protection of adjacent band services, including AMT. As we discuss in connection with AeroMACS and RNSS, we defer decision on this issue until the final band plan is determined. Similarly, if spectrum closer to the 5091 MHz band edge is designated for NNA operations at that time, we will consider the impact of that change on the adequacy of our technical requirements for the protection of AMT.

[455] *See Amendment of Parts 2, 25 and 97 of the Commission's Rules with Regard to the Mobile-Satellite Service Above 1 GHz*, ET Docket No. 98-142, Report and Order, 17 FCC Rcd 2658, 2659, para. 1 (2002); 47 CFR § 2.106(c)(444)(i) (footnote US444A).

[456] *See id.* § 2.106(c)(444)(i)(B) (footnote 5.444A(B)).

global mobile satellite service.[457] Globalstar states that it is not aware of any technical concerns related to the development of UAS operations in the 5030-5091 MHz band.[458] It requests that the Commission clarify, however, that UAS operators must accept any interference that UAS systems experience near Globalstar's gateway sites.[459]

153. We do not anticipate that rule-compliant fixed earth stations in the 5091-5250 MHz band will cause harmful interference to NNA operations in the 5030-5091 MHz band. The Commission previously found that operation of these feeder uplinks would not harm MLS operations in the adjacent 5030-5091 MHz band, and we find no reason to anticipate greater risks to NNA operations in the same spectrum.[460] Accordingly, we do not expect any incidents of harmful interference. Nevertheless, to address the unlikely possibility of interference to UAS operations, we find it appropriate to adopt a clarification consistent with Globalstar's request. MSS feeder links have been allocated in the 5091-5250 MHz band for more than twenty years, and in the 5091-5150 MHz band are limited to those sites already authorized and deployed, while UAS operations are being newly introduced and manufacturers have yet to certify equipment for the band. Placing the responsibility to resolve interference between rule-compliant fixed earth stations and UAS on the new UAS services is consistent with the first-in-time principle that typically governs interference issues between two primary stations absent rules to the contrary.[461] It will also be easier for the UAS industry to ensure that, in designing and developing the nascent equipment ecosystem for the band, they implement the requisite receiver immunity, than for an MSS feeder link licensee to retrofit existing stations, and placing the responsibility on UAS operations will also create the proper incentives for NNA equipment manufacturers.[462] Further, no commenters raise any objections to Globalstar's request. We therefore clarify that an MSS feeder link licensee in the 5091-5250 MHz band will only be responsible for curing harmful interference from its earth station to NNA operations in the neighboring 5030-5091 MHz band to the extent such interference is the result of the licensee's non-compliance with applicable license or regulatory requirements.

[457] *See* Globalstar Comments at 1; *see also Aviation NPRM*, 34 FCC Rcd at 5000, para. 43. In MSS architecture, a message transmitted from a subscriber's mobile transceiver is received by an MSS satellite and relayed to a gateway earth station, which may relay the message to another satellite or route it to a destination on the public switched network. *See L/Q Licensee, Inc.*, Order and Authorization, 11 FCC Rcd 16410, 16411, para. 2 (1996). Return messages follow the same path in reverse, being transmitted from the earth station gateway to the satellite. *See id*. The term "feeder link" refers to the transmission of users' messages between satellites and gateway earth stations. *See id.* at 16411, para. 3. Globalstar states that its gateway antennas transmit feeder uplinks up to Globalstar's satellites at 5091-5250 MHz, carrying traffic intended for its satellite service subscribers from either the public switched telephone network, wireless networks, or the Internet. *See* Globalstar Comments at 3.

[458] *See* Globalstar Comments at 3.

[459] *See id.* at 3-4.

[460] *See Amendment of Parts 2, 25 and 97 of the Commission's Rules with Regard to the Mobile-Satellite Service Above 1 GHz*, ET Docket No. 98-142, Report and Order, 17 FCC Rcd 2658, 2688, para. 17 (2002).

[461] *See, e.g.*, *Single Network Future: Supplemental Coverage from Space*, GN Docket No. 23-65, Notice of Proposed Rulemaking, 38 FCC Rcd 2790, 2845, para. 148 (2023); *see also Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range; Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the l2.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates*, ET Docket No. 98-206, Memorandum Opinion and Order and Second Report and Order, 17 FCC Rcd 9614, 9659, para. 111 (2002) (finding application of first-in-time rule between two services was equitable and consistent with the co-primary status of the services).

[462] *See Principles for Promoting Efficient Use of Spectrum and Opportunities for New Services Promoting Efficient Use of Spectrum Through Improved Receiver Interference Immunity Performance*, ET Docket Nos. 23-122, 22-137, Policy Statement, 38 FCC Rcd 3682 (2023).

6. Radio Astronomy

154. Footnote US211 of the Table of Frequency Allocations provides that in a number of specified frequency bands, including the 5000-5250 MHz band, "applicants for airborne or space station assignments are urged to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference," subject to footnote US74.[463] Footnote US74, in turn, provides that, in specified bands, including the 4990-5000 MHz band adjacent to the 5000-5250 MHz band, "the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates."[464]

155. The Commission has also adopted requirements in section 1.924(a) of the Commission's rules to protect radio astronomy observations in the National Radio Quiet Zone (NRQZ) from emissions more generally. The NRQZ is a specified area designed to minimize interference to radio astronomy observations at the Green Bank Observatory (GO) site located at Green Bank, Pocahontas County, West Virginia, and the Sugar Grove Research Station (SGRS) site at Sugar Grove, Pendleton County, West Virginia.[465] Section 1.924(a) requires that applicants or licensees seeking to establish a new or modified station at a fixed, permanent location in the NRQZ must notify the National Radio Quiet Zone Administrator in writing, either prior to or simultaneously with their application to the Commission.[466] The Commission then allows a period of 20 days for comments and objections, unless the applicant submits written consent from the National Radio Quiet Zone Administrator with its application.[467] If objections from the National Radio Quiet Zone Administrator are filed prior to the end of the 20-day period, the Commission will, after consideration of the record, take whatever action is deemed appropriate.[468] Section 1.924(a) currently applies to applicants and licensees for the wide range of services that fall under the category of the Wireless Radio Service, including, for example, part 27 commercial services, part 87 aviation services, and part 95 license-by-rule services.[469]

156. In the *UAS NPRM*, the Commission sought comment on measures necessary to protect radio astronomy, and proposed, consistent with the recommendations of NTIA, to require coordination of UAS operations within the NRQZ, and to continue to apply the requirements of footnote US211 to operations in the 5030-5091 MHz band.[470] With regard to the NRQZ, the Commission proposed requiring parties to submit a concurrence letter from the NRQZ administrator with any request to a DFMS for a frequency assignment within the NRQZ, but also sought comment on whether to apply the requirements

[463] *See* 47 CFR § 2.106(c)(211) (footnote US211).

[464] *See* 47 CFR § 2.106(c)(74) (footnote US74). We note that 4990-5000 MHz is also subject to footnote US246, which provides in relevant part that no station shall be authorized to transmit in the 4990-5000 MHz band. *See* 47 CFR § 2.106(c)(246) (footnote US246).

[465] *See* 47 CFR § 1.924(a).

[466] *See* 47 CFR § 1.924(a)(1).

[467] *See* 47 CFR § 1.924(a)(2).

[468] *See* 47 CFR § 1.924(a)(3).

[469] *See* 47 CFR §§ 1.901 (providing that the purpose of part 1, subpart F, encompassing, *inter alia*, section 1.924, "is to establish the requirements and conditions under which entities may be licensed in the Wireless Radio Services"), 1.907 (defining "Wireless radio services" as "[a]ll radio services authorized in parts 13, 20, 22, 24, 26, 27, 30, 74, 80, 87, 90, 95, 96, 97 and 101 of this chapter, whether commercial or private in nature").

[470] *See UAS NPRM*, 38 FCC Rcd at 520, para. 105; *see also* NTIA *Refresh Public Notice* Comments at 2 (recommending protection of radio astronomy operations through coordination of UAS usage within the NRQZ); NTIA *Refresh Public Notice* Reply at 1 (requesting that footnote US211 continue to apply to any regulatory measures that might emerge in this proceeding).

of section 1.924(a) of the Commission's rules as the NRQZ coordination process.[471] The Commission also sought comment on NTIA's proposal that requirements for licensees include passing a RAS knowledge test or similar effort to promote awareness of radio astronomy sites.[472]

157. Commenters on these issues take varied positions. CORF asserts that the Commission should adopt an exclusion zone around the NRQZ, and also adopt 80-kilometer radius exclusion zones around fifteen other RAS sites identified in footnote US385 of the Table of Allocations.[473] CORF argues that these exclusion zones are necessary to protect RAS observations occurring in both the adjacent 4990-5000 MHz band and inside the 5030-5091 MHz band.[474] ENTELEC/API also support the use of exclusion zones for the protection of RAS in the NRQZ.[475] FPL, however, argues that exclusion zones are inefficient and unnecessary to protect RAS and advocates a coordination requirement for the NRQZ, and that, for RAS in 4990-5000 MHz, licensees should merely be required to take all practicable steps to protect RAS from harmful interference.[476] Boeing/Wisk also support a coordination requirement for the NRQZ, and otherwise support reaffirming the application of footnote US211 to the band.[477] In a filing made in response to the *Refresh Public Notice*, NTIA requested that the Commission should both ensure protection of radio astronomy through coordination with the NRQZ and continue to apply footnote US211 to any regulatory measures that emerge from the proceeding.[478]

158. *NRQZ.* We adopt our proposal to require coordination within the NRQZ. As described in detail below, we model the coordination requirements after the NRQZ coordination procedures applicable to other services under section 1.924(a) of the Commission's rules. The general policy of protecting RAS observation in the NRQZ through coordination, as codified in section 1.924(a), applies to the broad range of services covered by the category of the Wireless Radio Services (which will now include NNA), and we see no reason this long-standing and generally applicable policy should exclude NNA operations. We further find substantial support in the record for this approach.[479]

159. We find arguments that we should instead adopt an exclusion zone that categorically prohibits NNA service in the NRQZ are unpersuasive. First, we note that no other service is subject to an exclusion zone around the NRQZ under section 1.924(a), and that our approach treats the NNA service the way all other services are treated. Further, we agree with FPL that requiring coordination strikes a better balance between the goal of protecting RAS and the benefits of UAS access to the band.[480] CORF expresses concern that coordination with license-by-rule operations will be difficult logistically, particularly for UAS operations by individual consumers and small enterprises, and it asserts that there is

[471] *See id.*

[472] *See UAS NPRM*, 38 FCC Rcd at 519-20, paras. 104-05.

[473] *See* CORF Comments at 9, 10-11.

[474] *See* CORF Comments at 7, 10-11.

[475] *See* ENTELEC/API Comments at 8.

[476] *See* FPL Reply at 7-8 (arguing, *inter alia*, that exclusion zones to protect RAS in the 4990-5000 MHz band "are too blunt an instrument for making efficient use of spectrum that is effectively separated by a thirty megahertz guard band").

[477] *See* Boeing/Wisk Comments at 19.

[478] *See* NTIA *Refresh Public Notice* Reply at 1.

[479] *See* Boeing/Wisk Comments at 19; FPL Reply at 7-8; *see also* NTIA *Refresh Public Notice* Comments at 2. We also note that, while preferring an exclusion zone to protect the NRQZ, CORF supports coordination as an alternative. *See* CORF Comments at 9.

[480] *See* FPL Reply at 8 (arguing that coordination more appropriately balances the competing interests of respective licensees).

a "strong possibility" of non-compliance.[481] We do not agree. While NNA stations will be licensed by rule and will not need individual licenses, the operators will still be required to obtain individual frequency assignments from a DFMS, which will be in an effective position to enforce the coordination requirement through the process described below. Further, these parties will be required to follow the same process of notifying the NRQZ Administrator as applies to other services under section 1.924(a), so the logistics of identifying and coordinating should not be significantly different. In sum, the Commission has relied successfully on this 1.924(a) process to provide protection for the NRQZ from numerous other services, including part 95 license-by-rule services, and we fully expect that it will be successful here.[482]

160. As stated above, we model the coordination requirements applicable to NNA operations after the procedures applicable to stations in the NRQZ under section 1.924(a), but because these procedures assume that a station license application is being submitted to the Commission, we modify them to work with the instant context in which a frequency assignment request will be submitted instead to a DFMS. Specifically, we provide that parties planning to operate an NNA station at locations within the NRQZ must notify the National Radio Quiet Zone Administrator (NRQZ Administrator) in writing in advance or simultaneously with the filing of the request. Although section 1.924(a) procedures are limited to fixed permanent stations, we agree with CORF that procedures for UAS in the 5030-5091 MHz band should apply more broadly.[483] Given the inherently short-term nature of NNA operations, such operations are likely to often rely on temporary stations. Limiting coordination to permanent stations, particularly with the aeronautical focus of the service, might therefore not provide adequate coordination. We also adopt, however, two measures to reduce the burden of coordinating short term operations. First, we provide that the NRQZ Administrator may provide safe harbors for NNA operations in the NRQZ that do not require notification, but a party submitting a frequency assignment request under this exception must certify that their request meets the criteria for a safe harbor and provide any additional supporting documentation required by the DFMS. We further provide that, if a party's operation or revision of an operation is within the scope of an approval previously granted to the party by the NRQZ Administrator, including any time limits on the approval, altitude limits, or other applicable conditions, the party need not provide notification of the operation or revision to the NRQZ Administrator, but must submit the approval with its assignment request.

161. CORF recommends that the coordination notice should be sent to nrqz@nrao.edu.[484] We adopt the same mailing address specified in section 1.924(a) and applicable to every other service as the initial point of contact, but we will also permit notification to be sent by electronic mail to nrqz@nrao.edu, which should facilitate a more rapid coordination. The coordination process based on this notification will largely follow the procedures under section 1.924(a), with appropriate changes made to reflect the role of the DFMS. Thus, when a request for frequency assignment is filed with the DFMS, the notification may be submitted prior to or simultaneously with the request. After receipt, the DFMS will allow a period of 20 days for objections. If a DFMS determines that a request is subject to one of the two exceptions to notification discussed above, it shall process the request without waiting the 20-day period.

162. If the DFMS receives a NRQZ Administrator approval of operations that includes the operation associated with the request, if the request is within the scope of a safe harbor established by the

[481] *See* CORF Comments at 9.

[482] Prior to the operation of a DFMS, we will rely on the current FAA deconfliction process rather than the DFMS, as discussed above, to provide the requisite protection of radio astronomy in the NRQZ. *See supra* Section III.B.6. Accordingly, we add provisions to the coordination process addressing how the coordination will work during this period.

[483] *See* CORF Comments at 8.

[484] *See* CORF Comments at 9 n.7.

NRQZ Administrator, or if the 20-day period passes without objection, the DFMS shall process the request under normal procedures, except with regard to the restriction established above that requests may not be granted more than seven calendar days in advance. To accommodate the 20-day period for objections, we provide that, when this period is applicable, requests may be approved for periods commencing more than seven calendar days after the submission of the request, but no more than seven calendar days after the date of DFMS decision. If objections are received in the 20-day period, the DFMS administrator will forward the record, including the frequency request, to the Commission. After consideration of the record, the Commission will take whatever action is deemed appropriate, including, potentially, providing direction to the relevant DFMS administrator regarding resolution of the request.

163. *RAS Outside the NRQZ.* With regard to radio astronomy observations in the adjacent 4990-5000 MHz band, we confirm, as recommended by NTIA and other commenters, that NNA operations remain subject to footnote US211 of the Table of Allocations.[485] For clarity, we will incorporate in the rules for NNA operations that NNA users should take all practicable steps to protect radio astronomy observations in the 4990-5000 MHz band, consistent with footnote US211.[486]

164. We decline to adopt CORF's proposal for exclusion zones to protect observations at sites in both the 4990-5000 MHz band and inside the 5030-5091 MHz band. First, we disagree with CORF that RAS observations made inside the 5030-5091 MHz band are entitled to any protection. CORF argues that radio astronomy in the 5030-5091 MHz band is protected under footnote US211, which provides that applicants for airborne assignments in certain listed bands, including the 5000-5250 MHz band, "are urged to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference[.]"[487] CORF argues that, in urging applicants to protect RAS in "the adjacent bands," footnote US211 is referencing the bands adjacent to whatever particular frequencies an applicant has been assigned rather than the bands adjacent to the listed bands in footnote US211.[488] Thus, in CORF's view, a UAS operator with an assignment in 5040-5050 MHz would be required to protect RAS observations in the spectrum "adjacent" to 5040-5050 MHz (e.g., 5030-5040 MHz) rather than just the bands adjacent to the relevant band specified in the footnote, 5000-5250 MHz.

165. We disagree with this interpretation, and find that the term "the adjacent bands" in footnote US211 refers to the bands adjacent to the bands specifically listed in the footnote. Thus, as one of the listed bands is the 5000-5250 MHz band, footnote US211 protects radio astronomy in the bands adjacent to the 5000-5250 MHz band, but does not protect radio astronomy inside the 5000-5250 MHz band. As even CORF concedes, this interpretation best comports with the footnote's language.[489] We further find our interpretation is consistent with Commission precedent. For example, the Commission has stated that footnote US211 requires applicants in the band 31.8-32 GHz "to take all practicable steps

[485] *See* Boeing/Wisk Comments at 19; FPL Reply at 7-8. *See also* NTIA *Refresh Public Notice* Comment at 2 (recommending "reminding UAS users that applicants for airborne assignments take all practicable steps to protect radio astronomy observations in adjacent bands"); NTIA *Refresh Public Notice* Reply at 1 (noting that footnote US211 provides this caution and requesting that footnote US211 continue to apply to any regulatory measures adopted in the proceeding).

[486] We note that a DFMS must be capable of receiving reports of interference and requests for additional protection from authorized users in bands adjacent to the 5030-5091 MHz band and promptly address interference issues. *See supra* Section III.B.1. We do not require a DFMS to implement any specific measures in this regard, or implement greater protection than is required under the rules, but we anticipate that the participation of the DFMSs through this mechanism will promote rule compliance by NNA users and promote compatibility between NNA and other authorized services.

[487] *See* CORF Comments at 10 & n.5; 47 CFR § 2.106(c)(211) (footnote US211).

[488] *See* CORF Comments at 10 & n.5.

[489] *See* CORF Comments at n.5 (stating that "observations at frequencies immediately above and below 5000-5250 MHz" is "the most obvious meaning of 'adjacent to'") (emphasis in original).

to protect radio astronomy observations in the adjacent band 31.3-31.8 GHz."[490] And in addressing the obligations of 42-42.5 GHz licensees under footnote US211, the Commission expressly distinguished in-band service protection from adjacent band protection and found that footnote US211 only applies to the latter, and that footnote US211 urged applicants in the 40.5-42.5 GHz band to "protect radio astronomy observations in the 42.5-43.5 GHz band . . . ."[491]

166. CORF asserts that certain Commission orders support its position.[492] We find that CORF misinterprets the orders, however. In the *SpaceX Order*, for example, the Commission authorized an applicant to operate a satellite system in the 40-42 GHz band, subject to the condition that, "in accordance with footnote US211," the applicant protect observations "in the adjacent bands from harmful interference from its operations in the 40.5-42 GHz band."[493] As relevant to that decision, footnote US211 applies to applicants in the band 40.5-42.5 GHz, i.e., ending at 42.5 GHz rather than SpaceX's 42 GHz.[494] Thus, CORF views the decision as requiring SpaceX to protect RAS in the 42-42.5 GHz spectrum, as well as the band adjacent to 40.5-42.5 GHz. But in specifying that the applicant must protect adjacent bands "in accordance with footnote US211," the Commission was merely requiring SpaceX to protect those RAS operations that are subject to protection under the footnote, i.e. RAS operations in the adjacent 42.5-43.5 GHz spectrum where RAS has a primary allocation. Indeed, the Commission did not note any RAS observations in the 42-42.5 GHz band (which is not allocated for RAS) that would need protection. CORF's other cited cases apply similar conditions requiring protection of RAS in "adjacent bands" in accordance with footnote US211, and we interpret them in comparable fashion.

167. CORF's request for exclusion zones therefore seeks priority for wholly unallocated RAS observations over a primary allocated service. Our general rules, however, provide that when RAS observations are conducted on frequencies or frequency bands not allocated to the radio astronomy service, "protection from interference will not be afforded such operations by stations in other services."[495] Indeed, even in a case where RAS was allocated to operate but on an unprotected basis, the Commission declined to adopt exclusion zones or coordination requirements, finding that these would be "tantamount to upgrading radioastronomy from secondary to primary status."[496] Accordingly, we do not adopt measures to protect the RAS in the 5030-5091 MHz band outside of the NRQZ. We note, however, that consistent with long-standing policy reflected in section 1.924(a), the requirement to coordinate operations inside the NRQZ applies to protect RAS observations without regard to which frequency band the observations are in.[497] Therefore, coordination in the NRQZ will include coordination with RAS observations in the 5030-5091 MHz band.

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[490] *Amendment of Parts 2 and 87 of the Commission's Rules Regarding the Radionavigation Service at 31.8-32.3 GHz*, ET Docket No. 98-197, Report and Order, 15 FCC Rcd 18587, 18588 n.13 (2000).

[491] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8153, para. 400 & n.1006 (2016).

[492] *See* CORF Comments at n.5 (citing *O3B Limited*, Order and Declaratory Ruling, 33 FCC Rcd 5508 (2018); *Space Exploration Holdings, LLC*, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 11434 (2018) (*SpaceX Order*); *Theia Holdings A, Inc.*, Memorandum Opinion, Order and Authorization, 34 FCC Rcd 3526 (2019)).

[493] *See SpaceX Order*, 33 FCC Rcd at 11436, para. 6.

[494] 47 CFR § 2.106(c)(211) (footnote US211).

[495] *See* 47 CFR § 2.107(c).

[496] *See Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, WT Docket No. 02-8, Report and Order, 17 FCC Rcd 9980, 10038, para. 151 (2002).

[497] *See* 47 CFR § 1.924(a); *see also Amendment of the General Mobile Radio Service (Part 95)*, SS Docket No. 78-352, Report and Order, 85 FCC 2d 738, 738-39, para. 2 (1981) ("The concept of the NRQZ is that of a national

(continued….)

168. We are also not persuaded that we should adopt exclusion zones to protect RAS observations in the 4990-5000 MHz band. While CORF points to footnote US385 as requiring such zones, we find it is mistaken. While footnote US385 does identify the sites at which radio astronomy observations are performed in 4990-5000 MHz,[498] the footnote does not govern the protection that operators in 5030-5091 MHz band should provide these sites. That standard is provided by footnote US211. Far from specifying exclusion zones for protection of radio astronomy,[499] footnote US211, through the incorporation of footnote US74, provides that parties in the 5030-5091 MHz band are only obligated to protect RAS in 4990-5000 MHz from unwanted emissions "to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates."[500]

169. Creating exclusion zones as suggested by CORF therefore goes far beyond the protection to which the RAS allocation at 4990-5000 MHz is legally entitled. In addition, the cost of such zones to the public interest would be significant. Adopting 80-kilometer exclusion zones, as proposed by CORF, could exclude more than a hundred thousand square miles of the country from any access to what is anticipated to be a unique resource for safety-critical UAS control links. We also note again that our instant action in this Report and Order limits UAS access to the core of the band, separated by 40 megahertz from the 4990-5000 MHz band, which, along with the strict limit on OOBE that will apply to UAS operations in the NNA spectrum, should greatly reduce the risks of harmful interference.[501] Accordingly, we decline, at this time, to alter or expand the protection currently afforded RAS under the Table of Allocations. When broader UAS access in the 5030-5091 MHz band is considered in the future, whether in the context of a Commission-led Federal Advisory Committee, a Further Notice of Proposed Rulemaking, or some other study or effort, the protection of radio astronomy observations in adjacent spectrum can be further explored. To facilitate operation of both UAS systems and radio astronomy systems, however, we will require a DFMS to immediately notify the National Science Foundation, Division of Astronomical Sciences, Electromagnetic Spectrum Management Unit, by email of any assignments that it approves for UAS operations in the vicinity of the radio astronomy facilities identified in footnote US385 of the Table of Allocations, which identifies the sites at which radio astronomy observations are performed in 4990-5000 MHz.[502] Further, for clarity, we will list these facilities in the relevant part 88 rule.

170. Finally, we decline to require NNA operators to pass a radio astronomy knowledge test, as suggested by NTIA, or to require UAS equipment to be labeled with such information, as proposed by CORF.[503] We generally expect parties to be familiar with their obligations under the rules, including RAS protection rules, and no other WRS licensees subject to NRQZ coordination or other RAS coordination requirements have been required to pass such a test or engage in equipment labeling to promote such knowledge. We see no justification for treating UAS operators in the 5030-5091 MHz band differently in

(Continued from previous page)
environmental asset where the level of man-made electromagnetic activity is suppressed and actively maintained at low levels to provide premium radio receiving conditions for . . . national facilities near Green Bank and Sugar Grove.").

[498] *See* 47 CFR § 2.106(c)(74) (footnote US74) (listing the 4990-5000 MHz band among others, and providing that "[r]adio astronomy observations in these bands are performed at the locations listed in US385").

[499] *See* 47 CFR § 2.106(c)(211) (footnote US211).

[500] *See* 47 CFR § 2.106(c)(74) (footnote US74). We note that, in describing the protection provided under footnote US211, CORF ignores the statement in footnote US211 that "US74 applies." *See* CORF Comments at 7.

[501] *See* 47 CFR § 2.106(b)(443)(iii) (footnote 5.443C).

[502] *See* 47 CFR § 2.106(c)(74) (footnote US74) (listing the 4990-5000 MHz band among others, and providing that "[r]adio astronomy observations in these bands are performed at the locations listed in US385").

[503] *See* NTIA *Refresh Public Notice* Reply at 2.

this respect. Further, as discussed above, the DFMSs will be in a position to enforce the NRQZ coordination requirement, and accordingly, we have even less reason to anticipate that a knowledge test or labeling requirement would provide significant benefits in terms of improved compliance. We encourage DFMSs, however, to provide relevant information regarding RAS to UAS operators seeking to use NNA spectrum at an appropriate time, such as at registration.

7. Canadian and Mexican Coordination

171. International agreements with Mexico and Canada do not currently address the use of the 5030-5091 MHz band for UAS communications near the borders with those countries.[504] In the *UAS NPRM*, the Commission sought comment on whether to adopt an interim measure to address UAS communications in the 5030-5091 MHz band that may cause harmful interference to operations in Mexico or Canada during the period prior to any adjustments made to the agreements between the United States, Mexico, and/or Canada regarding use of the band.[505] No commenter proposed any measure or otherwise addressed this issue. Neither Canada nor Mexico filed comments in response to the *UAS NPRM*.[506]

172. We note that the 5030-5091 MHz band is allocated internationally for AM(R)S to support UAS control links, which should promote compatibility of uses across the borders. Further, while we adopt frequencies for NNA operations in this Report and Order, the NNA service may be relocated to different frequencies within the 5030-5091 MHz when a final band plan is adopted for the 5030-5091 MHz band, which may affect what coordination terms or measures are necessary or appropriate. Accordingly, we do not adopt any measure at this time to address operations near the border.

173. Instead, we will follow the approach taken with regard to the SASs in the 3.5 GHz band. The *UAS NPRM* sought comment on what aspects to the SAS approach would be appropriately applied to the DFMS.[507] Among other functions, the Commission required SASs to implement the terms of current and future international agreements as they related to the Citizens Broadband Radio Service in the 3.5 GHz band, finding this approach consistent with usual practice for new services.[508] We adopt a similar requirement for DFMSs. DFMS administrators will be required to demonstrate that their systems can and will enforce agreements between the U.S., Canadian, and Mexican governments regarding commercial operations in the 5030-5091 MHz Band. The specific methods of enforcement will be determined and implemented by DFMS administrators, with appropriate Commission oversight, after such agreements are in place.

D. Digital Equity and Inclusion

174. As part of our continuing effort to advance digital equity for all,[509] including people of color, persons with disabilities, persons who live in rural or Tribal areas, and others who are or have been historically underserved, marginalized, or adversely affected by persistent poverty or inequality, we

[504] *See UAS NPRM*, 38 FCC Rcd at 521, para. 110.

[505] *See id.* at 522, para. 110.

[506] Canada filed a comment to the *Refresh Public Notice* that raised issues with the use of RTCA DO-362A as a source of technical criteria, but did not address either the adoption of an international agreement to address UAS operations in the band or interim measures regarding operations near the border. *See* Canada *Refresh Public Notice* Comments.

[507] *See UAS NPRM*, 38 FCC Rcd at 487, para. 27.

[508] *See* 47 CFR § 96.53(n); *3.5 GHz R&O*, 30 FCC Rcd at 4037, para. 299.

[509] Section 1 of the Communications Act provides that the FCC "regulat[es] interstate and foreign commerce in communication by wire and radio so as to make [such service] available, so far as possible, to all the people of the United States, without discrimination on the basis of race, color, religion, national origin, or sex." 47 U.S.C. § 151.

invited comment on any equity-related considerations[510] and benefits (if any) that may be associated with the proposals and issues associated with the *UAS NPRM*.[511] Specifically, the Commission sought comment on how the *UAS NPRM's* proposals to promote access by UAS operators to spectrum with the reliability necessary to support safety-critical communications may promote or inhibit advances in diversity, equity, inclusion, and accessibility. We did not receive comments that specifically responded to the Commission's request for comment on equity-related considerations. However, the Choctaw Nation of Oklahoma (CNO) notes that widespread UAS operations have the potential to directly benefit society, including in rural locales and tribal communities,[512] in important areas such as supporting disaster response and recovery during natural disasters and addressing agricultural needs.[513] The CNO also highlights UAS's potential to deliver life-saving emergency medicine, which it notes "is all the more important in rural and remote areas, where communities often lack speedy access to vital treatments."[514] We agree with the CNO's assessment of the important role UAS plays in areas including disaster and emergency response, scientific research, and agriculture functions, particularly for rural and remote areas and tribal communities, and we believe our actions in this Report and Order take the first steps in helping to bring these benefits to these underserved communities.

IV. PROCEDURAL MATTERS

175. *Regulatory Flexibility Act*. The Regulatory Flexibility Act of 1980, as amended (RFA),[515] 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."[516] Accordingly, the Commission has prepared a Final Regulatory Flexibility Analysis (FRFA) concerning rule and policy changes in the Report and Order. The FRFA is set forth in Appendix B.

176. *Paperwork Reduction Act*. The Report and Order contains new information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13.[517] All such new requirements will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. OMB, the general public, and other federal agencies will be invited to comment on any new or modified information collection requirements contained in this proceeding. The Commission will publish a separate document in the Federal Register at a later date seeking these comments. In addition, we note that, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. § 3506(c)(4), the Commission previously sought specific comment on how it might further reduce the information collection burden for small business concerns with fewer than

[510] The term "equity" is used here consistent with Executive Order 13985 as "the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality." See Exec. Order No. 13985, 86 Fed. Reg. 7009, Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (Jan. 20, 2021).

[511] *UAS NPRM*, 38 FCC Rcd at 539, para. 163.

[512] CNO Comments at 4.

[513] CNO Comments at 2.

[514] CNO Comments at 2.

[515] 5 U.S.C. §§ 601–612. The RFA was amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[516] 5 U.S.C. § 605(b).

[517] Pub. L. No. 104-13.

25 employees. We have described impacts that might affect small businesses in the FRFA in Appendix B.

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

178. *Accessing Materials.* The Office of Federal Register (OFR) regulations require that agencies must discuss in the preamble to the Federal Register summary of a final rule the ways that the materials incorporated by reference are reasonably available to interested parties and that interested parties can obtain the materials.[518] In addition, OFR regulations require that the preamble to the Federal Register summary of a final rule summarize the material incorporated by reference.[519]

179. Sections 88.101, 88.103, 88.105, 88.107, and 88.109 of the rules adopted herein incorporate by reference certain requirements in standards established by the RTCA Special Committee-228, referred to as RTCA, Inc. Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial), RTCA-DO-362A (December 17, 2020). These standards provide the technical requirements for equipment manufacturers and operators of equipment used for UAS NNA operations in the 5030-5091 MHz band as discussed in this Report and Order. In particular, the standards provide information regarding the following technical parameters: transmitter output power, emissions bandwidth, out-of-band emissions, emission mask, and the applicable time division duplexing frame rate. The text of RTCA DO-362A is available online for a fee at https://my.rtca.org/productdetails?id=a1B1R00000LoYFZUA3.

180. *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).

181. *Additional Information*. For further information about this proceeding, please contact Peter Trachtenberg, Mobility Division, Wireless Telecommunications Bureau, at 202-418-7369, or by email at Peter.Trachtenberg@fcc.gov.

V. ORDERING CLAUSES

182. Accordingly, IT IS ORDERED, pursuant to Sections 1, 4, 301, 303, 307, and 310 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154, 301, 303, 307, and 310, that this Report and Order IS HEREBY ADOPTED.

183. IT IS FURTHER ORDERED that this Report and Order, including the rules as set forth in Appendix A, SHALL BE EFFECTIVE thirty (30) days after publication in the Federal Register, with the exception of sections 88.27, 88.31, 88.33, 88.35, 88.111, 88.113, 88.115, 88.135, 88.137, and 88.141 of the Commission's rules, 47 CFR §§ 88.27, 88.31, 88.33, 88.35, 88.111, 88.113, 88.115, 88.135, 88.137, 88.141, which may contain new or modified information collection requirements that require review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act and will take effect after the Wireless Telecommunications Bureau publishes a notice in the Federal Register announcing the completion of such review and the relevant effective date(s).

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

[518] 1 CFR § 51.5(b)(2).

[519] 1 CFR § 51.5(b)(3).

185. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of this Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A
Final Rules

The Federal Communications Commission amends Parts 0, 1, 2, 87, and 95 of Title 47 of the Code of Federal Regulations (CFR) and adds a new Part 88 to Title 47 of the CFR, as follows:

PART 0 – COMMISSION ORGANIZATION

1. The authority citation for part 0 continues to read as follows:

AUTHORITY: 47 U.S.C. 151, 154(i), 154(j), 155, 225, 409, and 1754, unless otherwise noted.

2. Amend § 0.241 by adding paragraph (a)(1)(iii) and paragraph (l) to read as follows:

§ 0.241 Authority delegated.

(a) * * *

(1) * * *

(iii) The Chief of the Office of Engineering and Technology is delegated authority, along with the Chief of the Wireless Telecommunications Bureau, by notice-and-comment rulemaking if required by statute or in the public interest, to issue an order amending rules in part 88 of this chapter that reference industry standards to specify revised versions of the standards. These delegations are limited to modifying rules to reference revisions to standards that are already in the rules and not to incorporate a new standard into the rules, and are limited to the approval of changes that do not raise major compliance issues.

* * * * *

(l) The Chief of the Office of Engineering and Technology is delegated authority jointly with the Chief of the Wireless Telecommunications Bureau to administer the Dynamic Frequency Management System (DFMS) and DFMS Administrator functions set forth in part 88 of this chapter. The Chief is delegated authority to administer the process of DFMS Administrator approval in close consultation with the FAA and NTIA, including authority to develop specific methods that will be used to designate DFMS Administrators; to designate DFMS Administrators; to develop procedures that these DFMS Administrators will use to ensure compliance with the requirements for DFMS operation; and to make determinations regarding the continued acceptability of individual DFMS Administrators.

3. Amend § 0.331 by revising paragraph (d) and adding paragraph (g) to read as follows:

§ 0.331 Authority delegated.

* * * * *

(d) *Authority concerning rulemaking proceedings*. The Chief, Wireless Telecommunications Bureau, shall not have the authority to act upon notices of proposed rulemaking and inquiry, final orders in rulemaking proceedings and inquiry proceedings, and reports arising from any of the foregoing except such orders involving ministerial conforming amendments to rule parts, or orders conforming any of the applicable rules to formally adopted international conventions or

agreements where novel questions of fact, law, or policy are not involved. Orders conforming any of the applicable rules in part 17 of this chapter to rules formally adopted by the Federal Aviation Administration also need not be referred to the Commission if they do not involve novel questions of fact, law, or policy. In addition, revisions to the airport terminal use list in § 90.35(c)(61) of this chapter and revisions to the Government Radiolocation list in § 90.371(b) of this chapter need not be referred to the Commission. Adoption of certain technical standards applicable to hearing aid compatibility under § 20.19 of this chapter made together with Chief of the Office of Engineering and Technology, as specified in § 20.19(k) of this chapter, also need not be referred to the Commission. Adoption of amendments to rules in part 88 of this chapter by notice-and-comment rulemaking, along with the Chief of the Office of Engineering and Technology as specified in § 0.241(a)(1)(iii), that reference industry standards to specify revised versions of the standards, need not be referred to the Commission, however, these delegations are limited to modifying rules to reference revisions to standards that are already in the rules and not to incorporate a new standard into the rules, and are limited to the approval of changes that do not raise major compliance issues.

Also, the addition of new Marine VHF frequency coordination committee(s) to § 80.514 of this chapter need not be referred to the Commission if they do not involve novel questions of fact, policy or law, as well as requests by the United States Coast Guard to:

(1) Designate radio protection areas for mandatory Vessel Traffic Services (VTS) and establish marine channels as VTS frequencies for these areas; or

(2) Designate regions for shared commercial and non-commercial vessel use of VHF marine frequencies.

(3) Designate by footnote to frequency table in § 80.373(f) of this chapter marine VHF frequencies are available for intership port operations communications in defined port areas.

* * * * *

(g) The Chief of the Wireless Telecommunications Bureau is delegated authority jointly with the Chief of the Office of Engineering and Technology to administer the Dynamic Frequency Management System (DFMS) and DFMS Administrator functions set forth in part 88 of this chapter. The Chief is delegated authority to administer the process of DFMS Administrator approval in close consultation with the FAA and NTIA, including authority to develop specific methods that will be used to designate DFMS Administrators; to designate DFMS Administrators; to develop procedures that these DFMS Administrators will use to ensure compliance with the requirements for DFMS operation; and to make determinations regarding the continued acceptability of individual DFMS Administrators.

PART 1 – PRACTICE AND PROCEDURE

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

AUTHORITY: 47 U.S.C. chs. 2, 5, 9, 13; 28 U.S.C. 2461 note; 47 U.S.C. 1754, unless otherwise noted.

5. Section 1.901 is revised to read as follows:

§ 1.901 Basis and purpose.

The rules in this subpart are issued pursuant to the Communications Act of 1934, as amended, 47 U.S.C. 151 et seq. The purpose of the rules in this subpart is to establish the requirements and conditions under which entities may be licensed in the Wireless Radio Services as described in this part and in parts 13, 20, 22, 24, 27, 30, 74, 80, 87, 88, 90, 95, 96, 97, and 101 of this chapter.

6. Section 1.902 is amended to read as follows:

§ 1.902 Scope.

In case of any conflict between the rules set forth in this subpart and the rules set forth in parts 13, 20, 22, 24, 27, 30, 74, 80, 87, 88, 90, 95, 96, 97, and 101 of title 47, chapter I of the Code of Federal Regulations, the rules in this part shall govern.

7. Section 1.907 is amended to revise the definitions of "Private Wireless Services" and "Wireless Radio Services" to read as follows:

§ 1.907 Definitions.

* * * * *

Private Wireless Services. Wireless Radio Services authorized by parts 80, 87, 88, 90, 95, 96, 97, and 101 of this chapter that are not Wireless Telecommunications Services, as defined in this part.

*** * * * ***

Wireless Radio Services. All radio services authorized in parts 13, 20, 22, 24, 26, 27, 30, 74, 80, 87, 88, 90, 95, 96, 97 and 101 of this chapter, whether commercial or private in nature.

* * * * *

8. Section 1.924 is amended by adding paragraph (a)(4) to read as follows:

§ 1.924 Quiet Zones.

(a)* * *

(4) Parties subject to subpart B of part 88 of this chapter shall follow the requirements of § 88.35 of this chapter instead of the requirements of paragraph (a) of this section.

* * * * *

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

9. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

10. Section 2.1055 is amended by revising paragraph (a)(2) to read as follows:

§ 2.1055 Measurements required: Frequency stability.

(a) * * *

(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, uncrewed aircraft stations (as defined in § 88.5 of this chapter) in the Uncrewed Aircraft System Services under part 88 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

* * * * *

PART 87 – AVIATION SERVICES

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

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

12. Section 87.1 is amended by revising paragraph (b) to read as follows:

§ 87.1 Basis and purpose.

* * * * *

(b) ***Purpose.*** Except as provided in part 88 of this chapter, this part states the conditions under which radio stations may be licensed and used in the aviation services. These rules do not govern U.S. Government radio stations.

13. Add part 88 to read as follows:

PART 88 – UNCREWED AIRCRAFT SYSTEM SERVICES

AUTHORITY: 47 U.S.C. 154(i), 303, 307.

Subpart A – GENERAL RULES

§ 88.1 Scope.

§ 88.3 Application of Other Rule Parts.

§ 88.5 Definitions.

Subpart B – NON-NETWORKED ACCESS

§ 88.25 Scope.

§ 88.27 Authorization.

§ 88.29 Frequencies.

§ 88.31 Non-Networked Access Use.

§ 88.33 Information requirements.

§ 88.35 National Radio Quiet Zone coordination.

Subpart C – (reserved)

Subpart D – TECHNICAL REQUIREMENTS

§ 88.101 Transmitter power.

§ 88.103 Emissions bandwidth.

§ 88.105 Emission mask.

§ 88.107 Out-of-band emission limits.

Subpart A – GENERAL RULES

§ 88.1 Scope.

This part sets forth the regulations governing the use of the 5030-5091 MHz band by Uncrewed Aircraft Systems.

§ 88.3 Application of Other Rule Parts.

(a) Except as expressly provided under this part, part 87 of this chapter shall not apply to uncrewed aircraft systems communications in the 5030-5091 MHz band.

(b) Non-Networked Access (NNA) devices, as defined in this part, are considered part of the Citizens Band Radio Service, as defined in § 95.303 of this chapter. Except for the definitions of Citizens Band Radio Service and Uncrewed Aircraft System Services in § 95.303, the rules of part 95 of this chapter shall not apply to such devices.

§ 88.5 Definitions.

The following terms and definitions apply only to the rules in this part.

Control and Non-payload Communications (*CNPC*). Any transmission that is sent between the UA component and the UAS ground station of the UAS and that supports the safety or regularity of the UA's flight.

Dynamic Frequency Management System (*DFMS*). A frequency coordination system operating in the 5030-5091 MHz band that (1) is highly automated and capable of providing rapid responses to frequency assignment requests from registered NNA operators, and (2) in response to such requests, is capable of assigning to the requesting operator temporary protected use of certain frequencies for a particular geographic area and time period tailored to the operator's submitted operation, to the extent such frequencies are available.

Dynamic Frequency Management System (DFMS) Administrator. An entity authorized by the Commission to operate a DFMS in accordance with the rules and procedures set forth in subpart E of this part.

Interim Access Mechanism (*IAM*). A process by which non-networked access users will be allowed temporary, short-term access to 5040-5060 MHz frequencies in the period before the first DFMS is approved and placed into operation.

Non-Networked Access (*NNA*). Temporary, interference-protected access to the 5030-5091 MHz band consistent with subpart B of this part.

Non-Networked Access (NNA) station. An uncrewed aircraft system ground station or uncrewed aircraft station authorized under this part and designed to communicate using NNA assignments consistent with subparts B and D.

Non-Networked Access (NNA) user. An authorized user of spectrum in the 5030-5091 MHz band operating on an NNA basis, as set forth in subpart B.

Payload. Information that is sent to or from a UA component to achieve mission objectives and is not CNPC.

Uncrewed Aircraft (*UA*). An aircraft operated without the possibility of direct human intervention from within or on the aircraft.

Uncrewed Aircraft Station. A mobile station authorized under this part and located on board a UA.

Uncrewed Aircraft System (*UAS*). A UA and its associated elements (including an uncrewed aircraft station, communication links, and the components not on board the UA that control the UA) that are required for the safe and efficient operation of the UA in the airspace of the United States.

Uncrewed Aircraft System (UAS) ground station. Radio communications equipment on the ground used to maintain control over or otherwise communicate with a UA.

Subpart B – NON-NETWORKED ACCESS

§ 88.25 Limitations on NNA communications.

(a) Transmissions over an NNA assignment are limited to CNPC.

(b) UAS ground stations may be fixed or mobile, but mobile ground stations cannot be used while in motion or at locations other than those approved under the applicable frequency assignment.

§ 88.27 Authorization.

(a) Any entity, other than those precluded by section 310 of the Communications Act of 1934, as amended, 47 U.S.C. 310, and that otherwise meets the technical, financial, character, and citizenship qualifications that the Commission may require in accordance with such Act, is eligible to be an NNA user and operate NNA stations under this part.

(b) NNA users are licensed by the rules in this part and do not need an individual license issued by the Commission. Even though an individual license is not required, an NNA user licensed by the rules in this part must comply with all applicable operating requirements, procedures, and technical requirements found in this part.

(c) To transmit in the frequencies of the 5030-5091 MHz band designated for NNA operations, an NNA user must register with a DFMS and comply with its instructions and the rules in this part.

(d) Registered NNA users may transmit in the frequencies of the 5030-5091 MHz band designated for NNA operations only using NNA stations compliant with the rules of this part, and only pursuant to and consistent with the terms of a frequency assignment from a Commission-approved DFMS.

§ 88.29 Frequencies.

(a) The 5040-5050 MHz band is designated to NNA users for CNPC use.

(b) In the period prior to the approval and commencement of operation by the first DFMS administrator, NNA users may access the 5040-5060 MHz band pursuant to the IAM process, as set forth in § 88.141.

§ 88.31 Non-Networked Access.

(a) Parties registered with a DFMS may submit a request to the DFMS for temporary frequency assignments for CNPC limited to the duration and geographic coverage necessary to support a single submitted UAS flight. Requests may also be made either prior to or during the relevant operation to modify an assignment. Such requests must be made to the same DFMS responsible for the original assignment.

(b) If frequencies meeting the request are available, the DFMS shall assign them on an exclusive but temporary basis. The scope of the assignment shall be tailored in both duration and geographic coverage to ensure interference-free communications for the entire submitted UAS flight.

(c) When registering with or using the services of a DFMS, a party shall comply with all DFMS Administrator instructions, including those regarding registration process and procedures, requests and other submissions to the DFMS, and operational use of NNA assignments.

(d) UAS operations using NNA assignments within the National Radio Quiet Zone (NRQZ) are prohibited without the prior coordination with the NRQZ administrator required under § 88.35. Consistent with § 2.106(c)(211) of this chapter, NNA users should take all practicable steps to protect radio astronomy in the 4990-5000 MHz band, subject to § 2.106(c)(74) of this chapter.

(e) Any UAS ground station using an NNA assignment to support a UAS flight, or proxy software acting on the ground station's behalf, must be capable of communicating with the assigning DFMS to achieve the following: (1) confirm that all NNA stations used in the operation, including any UAS ground station or airborne station used in the flight, are programmed to limit communications in the 5030-5091 MHz band, during the period of the frequency assignment, to the specific frequencies assigned by the DFMS and in accordance with the other terms of the assignment; and (2) send updates on flight status when a UA has launched and when it has landed.

§ 88.33 Information requirements.

(a) Information submitted to a DFMS with registration or a frequency assignment request must be accurate, complete, and made in good faith. Registration information must include a party's legal name and contact information, as well as other information required by the DFMS.

(b) Parties must keep registration information up to date, and must keep frequency assignment request information up to date until the scheduled time of the operation.

§ 88.35 National Radio Quiet Zone coordination.

(a) Except as provided in paragraphs (a)(1) and (a)(2) of this section, parties planning to operate an NNA station within the area bounded by N 39°15′0.4″ on the north, W 78°29′59.0″ on the east, N 37°30′0.4″ on the south, and W 80°29′59.2″ on the west must notify the National Radio Quiet Zone Administrator (NRQZ Administrator) in writing at Post Office Box No. 2, Green Bank, West Virginia 24944, or by email to nrqz@nrao.edu, of the technical details of the proposed operation. The notification must include the geographical coordinates of ground station antenna locations, associated ground station antenna height, antenna directivity (if any), the maximum airborne station altitude, the maximum airborne station flight altitude (MSL or AGL), the frequencies, the emission type, and power.

(1) If an operation or revision of an operation is within the scope, including any applicable conditions, of a previously granted approval from the NRQZ Administrator, parties need not provide notification of the operation or revision to the NRQZ Administrator, but must submit the approval with any frequency assignment request relying on this exception.

(2) If the NRQZ Administrator establishes criteria for NNA operations in the NRQZ that do not require notification to the NRQZ Administrator, and an operation or revision of an operation is within the scope of such criteria, a party need not provide notification of the operation or revision to the NRQZ Administrator, but, when submitting their request, must certify that their request meets the criteria for NNA operations in the NRQZ that do not require notification to the NRQZ Administrator and provide any additional supporting documentation required by the DFMS.

(b) When a request for concurrence is submitted to the FAA under the Interim Access Mechanism provided under § 88.141, the request must state the date that notification in accordance with paragraph (a) of this section was made or provide an approval from the NRQZ Administrator for operations within the NRQZ or portions thereof along with the maximum operating altitude allowed.

(c) When a request for frequency assignment involving an NNA station subject to paragraph (a) of this section is submitted to a DFMS, the required notification must be made prior to or simultaneously with the request. The request must state the date that notification in accordance with paragraph (a) of this section was made. After receipt of such a request, the DFMS shall allow a period of 20 days for objections in response to the notifications indicated. If a DFMS determines that a request is subject to an exception to notification under paragraphs (a)(1) or (2) of this section, it shall process the request without waiting the 20-day period. In instances in which notification has been made to the NRQZ Administrator prior to the submission of the request, the requesting party must also provide notice to the NRQZ Administrator upon actual submission of the request with the DFMS, specifying which DFMS has received the request. Such notice will be made simultaneous with the submission of the request and shall comply with the requirements of paragraph (a) of this section.

(d) If an objection from the NRQZ Administrator is received by a DFMS during the 20-day period specified in paragraph (c), the DFMS shall forward the record, including the assignment request, associated NNA station details, and objection, to the FCC. The FCC will, after consideration of the record, take whatever action is deemed appropriate.

Subpart C – (reserved)

Subpart D – TECHNICAL REQUIREMENTS

§ 88.101 Transmitter power.

Transmitters operating in the 5030-5091 MHz band must comply with the transmitter output power specified in technical standard RTCA DO-362A (incorporated by reference, see § 88.117) § 2.2.1.6.1 and associated subsections.

§ 88.103 Emissions bandwidth.

The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station. Transmitters operating in the 5030-5091 MHz band must comply with the channel width requirements, channel placement requirements, tunability requirements, and non-video channel bandwidth limitations specified in technical standard RTCA DO-362A (incorporated by reference, see § 88.117) §§ 2.2.1.5.2, 2.2.1.5.3, 2.2.1.5.4, and 2.2.1.5.6, respectively.

§ 88.105 Emission mask.

Transmitters operating in the 5030-5091 MHz band must comply with the ARS and GRS radio transmitter power spectral density (PSD) limits specified in technical standard RTCA DO-362A (incorporated by reference, see § 88.117) § 2.2.1.6.2.1.

§ 88.107 Out-of-band emission limits.

Transmitters operating in the 5030-5091 MHz band must comply with the out-of-band-emission limits specified in technical standard RTCA DO-362A (incorporated by reference, see § 88.117) § 2.2.1.8.2 and associated subsections. On any frequency outside the 5030-5091 MHz band that is not addressed by RTCA DO-362A § 2.2.1.8.2 and associated subsections, the power of any emission, as measured over a 1 megahertz resolution bandwidth, shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10\log(P)$ dB.

§ 88.109 Time division duplex requirement.

Transmitters operating in the 5030-5091 MHz band must comply with the time division duplex (TDD) frame structure and timing accuracy requirements specified in technical standard RTCA DO-362A (incorporated by reference, see § 88.117) § 2.2.1.3 and §2.2.1.3.1.

§ 88.111 Certification required.

Each transmitter utilized for operation under this part and each transmitter marketed as set forth in § 2.803 of this chapter must be certified by the Commission for use in part 88 services following the procedures set forth in part 2, subpart J of this chapter.

§ 88.113 Authorization of equipment.

An applicant for certification of equipment intended for transmission in the 5030-5091 MHz band must notify the FAA of the filing of a certification application. The letter of notification must be mailed to: FAA, Spectrum Engineering Service Group, AJW-1900, 800 Independence Ave., SW, Washington, DC 20591 prior to the filing of the application with the Commission.

(a) The notification letter must describe the equipment, and give the manufacturer's identification, antenna characteristics, rated output power, emission type and characteristics, the frequency or frequencies of operation, and essential receiver characteristics if protection is required.

(b) The certification application must include a copy of the notification letter to the FAA. The Commission will not act until it receives the FAA's determination regarding whether it objects to the application for equipment authorization. The FAA should mail its determination to: Office of Engineering and Technology Laboratory Division, Equipment Authorization and Compliance Branch, 7435 Oakland Mills Rd., Columbia, MD 21046. The Commission will consider the FAA determination before taking final action on the application.

§ 88.115 RF safety.

Licensees and manufacturers are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions and technical information showing the basis for this statement must be submitted to the Commission upon request.

§ 88.117 Incorporation by reference.

The standards referenced in this section are incorporated by reference into this part with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The approved material is available for inspection at the Federal Communications Commission (FCC), 45 L Street NE, Reference Information Center, Room 1.150, Washington, DC 20554, (202) 418-0270. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email fedreg.legal@nara.gov or go to www.archives.gov/federal-register/cfr/ibr-locations.html. Copies of RTCA standards also may be obtained from RTCA, 1150 18th Street NW, Suite 910, Washington, DC 20036, or by email to info@rtca.org or by going to http://RTCA.org.

(a) RTCA document titled "Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial)," Document No. RTCA-DO-362A, dated December 17, 2020 (RTCA-DO-362A).

(b) Reserved.

Subpart E – DYNAMIC FREQUENCY MANAGEMENT SYSTEMS

§ 88.135 DFMS requirements.

(a) A DFMS must provide a process for NNA users to register with the system for the purpose of submitting frequency assignment requests and obtaining frequency assignments.

(b) All DFMSs must require the same registration and frequency assignment request information. Registration shall require, among other information, the registrant's legal name and contact information.

(c) A DFMS must be capable of processing frequency assignment requests nationwide and across the entire 5030-5091 MHz band. However, a DFMS may only grant assignments for spectrum within those frequencies specified under § 88.29(a).

(d) In response to a frequency assignment request from a registered party, a DFMS shall determine and provide, through a process that is highly automated and capable of rapid responses to frequency assignment requests, an assignment of frequencies for a particular geographic area and time period tailored to the submitted UAS flight, to the extent that frequencies are available to meet the request and grant of the assignment is otherwise consistent with this part. Assignments must provide protected access to frequencies over a duration and geographic area sufficient to cover and support the entire UAS flight. Assignments may specify channels and maximum transmit power level.

(e) A DFMS may not terminate an assignment while a flight is ongoing or modify the assignment during this time unless pursuant to a revision request from the assignee.

(f) Assignments must account for the need to protect other authorized operations.

(g) Models and methodologies for interference determinations used by a DFMS should be both effective in avoiding harmful interference and consistent between different DFMSs.

(h) For each frequency assignment request, a DFMS must confirm through certifications in the frequency assignment request process that the requesting party has flight authorization from the FAA to cover the flight associated with the frequency assignment request, and that any remote pilots that will be involved in the flight have all necessary FAA remote pilot authorization, to the extent such authorization is required. Any party challenging a DFMS action with regard to this requirement or otherwise seeking a Commission determination regarding a party's FAA authorization in this context must submit, with its filing to the Commission, a determination from the FAA regarding whether the NNA frequency assignee in question has the relevant authorization under FAA rules and requirements.

(i) A DFMS must be capable of responding to in-flight revision requests.

(j) A DFMS must be capable of communicating directly with a UAS ground station operating in the NNA spectrum, or with proxy software acting on the ground station's behalf, to achieve the following: (1) ensure that all NNA stations used in an operation, including any ground or airborne station used in the flight, are programmed to limit communications in the 5030-5091 MHz band, during the period of the frequency assignment, to the specific frequencies assigned by the DFMS and in accordance with the other terms of the assignment; and (2) receive updates on flight status when a UA has launched and when it has landed.

(k) Frequency assignment requests may not be approved (1) for periods commencing on or after eight calendar days after the date on which the request is submitted, except to the extent that lack of frequency availability in that time frame or the coordination requirement under § 88.35 justify a later assignment, or (2) for an operation lasting more than 24 hours.

(l) A DFMS must communicate and coordinate with other DFMSs as necessary to ensure consistent data and assignments, the safe and robust operation of authorized services, and compliance with the rules.

(m) A DFMS must employ protocols and procedures to ensure that all communications between the DFMS and users or NNA stations in connection with a DFMS's NNA functions are secure and that unauthorized parties cannot access, shut down, or alter the DFMS or its stored information.

(n) Communications between users and a DFMS and between different DFMSs must be secure to prevent corruption or unauthorized interception of data. A DFMS must be protected from unauthorized data input or alteration of stored data.

(o) A DFMS must verify that the NNA stations to be used in operations are FCC-certified devices and must not provide assignments to an uncertified device.

(p) A DFMS must retain information on, and enforce, exclusion zones sufficient to protect Microwave Landing Systems (MLS) in the 5030-5091 MHz band.

(q) A DFMS shall maintain all records for at least 60 months, including but not limited to date, time, and requester identification records for all requests for, approval of, denial of, or termination of approval for all assignments of frequencies or revisions of such assignments, and all certifications submitted in connection with such requests.

(r) A DFMS must be capable of receiving reports of interference and requests for additional protection from MLS users in the 5030-5091 MHz band or authorized users in adjacent bands and promptly address interference issues.

(s) A DFMS must implement § 88.35 in its frequency assignment process.

(t) A DFMS must implement the terms of any international agreements with Canada and Mexico adopted to address coordination and compatibility of near-border UAS operations in the 5030-5091 MHz band.

(u) Except as provided under paragraphs (v) and (w) of this section, a DFMS must process frequency assignment requests on a non-discriminatory first-come-first-served manner.

(v) In the event of emergencies, a DFMS should, to the extent feasible and consistent with the interests of aviation safety, prioritize requests from public safety entities. Prioritization may not terminate or modify an NNA user's assignment while the assignment is in use during a UAS flight.

(w) During extended periods of congestion, the DFMS should prioritize requests involving flights relying on a single ground station over requests that rely on multiple stations, to the extent feasible and consistent with the interests of aviation safety.

(x) A DFMS must immediately notify the National Science Foundation, Division of Astronomical Sciences, Electromagnetic Spectrum Management Unit, by email at esm@nsf.gov when a request for frequency assignment is approved that will support operation of a UAS within 25 miles of a radio astronomy site listed in the table below. Notification must include the operation details.

Allen Telescope Array, Hat Creek, CA	Rectangle between latitudes 40° 00' N and 42° 00' N and between longitudes 120° 15'W and 122° 15' W.	
NASA Goldstone Deep Space Communications Complex, Goldstone, CA	80 kilometers (50 mile) radius centered on 35° 20' N, 116° 53' W.	
National Astronomy and Ionosphere Center, Arecibo, PR	Rectangle between latitudes 17° 30' N and 19° 00' N and between longitudes 65° 10' W and 68° 00' W.	
National Radio Astronomy Observatory, Socorro, NM	Rectangle between latitudes 32° 30' N and 35° 30' N and between longitudes 106° 00' W and 109° 00' W.	
National Radio Astronomy Observatory, Green Bank, WV	Rectangle between latitudes 37° 30' N and 39° 15' N and between longitudes 78° 30'W and 80° 30' W.	
National Radio Astronomy Observatory, Very Long Baseline Array Stations	80 kilometers radius centered on:	
	North Latitude	West Longitude
Brewster, WA	48° 08'	119° 41'
Fort Davis, TX	30° 38'	103° 57'
Hancock, NH	42° 56'	71° 59'
Kitt Peak, AZ	31° 57'	111° 37'
Los Alamos, NM	35° 47'	106° 15'
Mauna Kea, HI	19° 48'	155° 27'
North Liberty, IA	41° 46'	91° 34'
Owens Valley, CA	37° 14'	118° 17'
Pie Town, NM	34° 18'	108° 07'
Saint Croix, VI	17° 45'	64° 35'
Owens Valley Radio Observatory, Big Pine, CA	Two contiguous rectangles, one between latitudes 36° 00' N and 37° 00' N and between longitudes 117° 40'W and 118° 30'W, and the second between latitudes 37° 00' N and 38° 00' N and between longitudes 118° 00'W and 118° 50' W.	

§ 88.137 DFMS administrators.

The Commission will approve one or more DFMS administrators to manage access to the 5030-5091 MHz band on a nationwide basis as specified in § 88.135. Each DFMS administrator is responsible for ensuring that its DFMS is fully functional and meets all the rule requirements in this part and providing services to NNA users in the Uncrewed Aircraft System Services. Each DFMS administrator approved by the Commission:

(a) Must operate a DFMS consistent with the rules of this part.

(b) Must establish and follow protocols and procedures to ensure compliance with the rules set forth in this part.

(c) Must provide service for a ten-year term. This term may be renewed at the Commission's discretion.

(d) Must securely transfer all the information in the DFMS to another approved entity in the event it does not continue as the DFMS administrator at the end of its term. It may charge a reasonable price for such conveyance.

(e) Must cooperate with other approved DFMS administrators to develop a standardized process for coordinating operations, avoiding any conflicting assignments, and maximizing shared use of available frequencies.

(f) Must coordinate with other DFMS administrators including sharing assignment and other information, facilitating non-interference to and from operations relying on assignments from other DFMSs, and other functions necessary to ensure that use of available spectrum is safe and efficient and consistent with this part.

(g) Must ensure that the DFMS shall be available at all times to immediately respond to requests from authorized Commission personnel for any and all information stored or retained by the DFMS, including through either or both provision of the information or provision of direct access to the DFMS database, at the discretion of the Commission.

(h) Must establish and follow protocols to comply with enforcement instructions from the Commission.

(i) May implement such reasonable limits on requests as are necessary to prevent the hoarding, warehousing, monopolization, or otherwise excessive reservation of NNA spectrum by a particular party.

§ 88.139 DFMS administrator fees.

(a) A DFMS administrator may charge users a reasonable fee for services provided, including usage-based fees for frequency assignments.

(b) The Commission, upon request, will review the fees and can require changes in those fees if they are found to be excessive.

§ 88.141 Interim Access Mechanism.

(a) In the period prior to the approval and commencement of operation by the first DFMS administrator, NNA users may access the 5040-5060 MHz band for NNA communications pursuant to the IAM. After the date on which the first DFMS administrator commences operations, NNA communications will be restricted to the 5040-5050 MHz band, as specified in § 88.29(a). After such date, any existing IAM frequency assignments terminates and NNA users may not seek or use frequency assignments pursuant to the IAM. NNA users will be required to request frequency assignments from the DFMS administrator once the DFMS is operational.

(b) *IAM Process*. NNA users seeking to transmit in the band must first obtain concurrence from the FAA for the requested use, and must ensure that any such operations comply with the scope of approval, terms, conditions, and restrictions of the FAA concurrence. Upon receipt of FAA concurrence, NNA users must submit to the FCC an online NNA registration form regarding the requested use, certifying that:
(1) They have complied with the FAA concurrence process;
(2) The operation is in compliance with the Commission's NNA rules and technical requirements;
(3) All equipment utilized in the NNA operation meets equipment certification requirements; and
(4) Their IAM frequency assignment terminates immediately in the event a DFMS becomes operational prior to the end of the IAM frequency assignment.

PART 95 – PERSONAL RADIO SERVICES

14. The authority citation for part 95 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303, 307.

15. Section 95.303 is amended by adding the following definition in alphabetical order:

§ 95.303 Definitions.

*** * * * ***

Uncrewed Aircraft System Services. The rules for these services, including technical rules, are contained in part 88 of this chapter. Only NNA stations authorized on a Non-Networked Access basis, as those terms are defined in § 88.3 of this chapter, are considered part of the Citizens Band Radio Services.

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APPENDIX B

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 in the *Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems; Petition of AIA for Rulemaking to Adopt Service Rules for Unmanned Aircraft Systems Command and Control in the 5030-5091 MHz Band, Notice of Proposed Rulemaking* (*NPRM*) released in January 2023.[2] The Federal Communications Commission (Commission) sought written public comment on the proposals in the *NPRM*, including comments on the IRFA.[3] No comments were filed addressing the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[4]

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

2. In the *Report and Order*, the Commission takes significant action to adopt initial service rules for uncrewed aircraft systems (UAS) in the 5030-5091 MHz band and enable UAS operators to access dedicated spectrum with the required reliability to support safety-of-flight, control-related communications while also allowing flexibility for the industry to further develop. Specifically, the Commission adopts service rules that provide operators the ability to obtain direct frequency assignments in a portion of the 5030-5091 MHz band. These service rules are necessary to provide a critical first step to promote access by UAS operators to dedicated spectrum while also allowing a consensus to emerge on key issues for this industry. Achieving the extraordinary potential of UAS technology will require integrating UAS operations into the National Airspace System (NAS), including in the controlled airspace in which commercial passenger flights operate and in circumstances with heightened risk, such as flights involving large aircraft or carrying passengers or flights beyond line of sight of the remote pilot. To ensure that these flights are sufficiently safe for routine operation, highly reliable wireless two-way communications for flight control and telemetry are required. Therefore, the Commission adopts initial service rules for the 5030-5091 MHz band.

3. In furtherance of these objectives, the Commission adopts service rules where one or more dynamic frequency management systems (DFMSs) will manage and coordinate access to the spectrum and enable its safe and efficient use, by providing requesting operators with temporary frequency assignments to support UAS control link communications with a level of reliability suitable for operations in controlled airspace and other safety-critical circumstances. To provide this level of reliability, the Commission adopts technical requirements drawn from minimum operational performance standards that were developed by an aviation industry standards body specifically to support UAS control links in the 5030-5091 MHz band and were approved by the Federal Aviation Administration (FAA) for this purpose. To address concerns regarding the impact of these aeronautical operations on adjacent services, the Commission locates these operations, for now, in the central part of the band, with substantial separation from the bands adjacent to the 5030-5091 MHz band. The Commission finds wide support in the record for enabling early, direct access to a portion of the band for protected assignments under DFMS coordination and expects that such access will help to facilitate the safe integration of UAS operations into the NAS so that the United States can realize the enormous potential benefits that UAS operations can provide.

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

[2] *Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems; Petition of AIA for Rulemaking to Adopt Service Rules for Unmanned Aircraft Systems Command and Control in the 5030-5091 MHz Band*, WT Docket No. 22-323, Notice of Proposed Rulemaking, 38 FCC Rcd 474 (2023) (*UAS NPRM*).

[3] *UAS NPRM*, 38 FCC Rcd at Appx. B, para. 1.

[4] 5 U.S.C. § 604.

4. The Commission is addressing service rules for UAS operations in the 5030-5091 MHz band in phases. In this initial step, the Commission opens a portion of the band for NNA operations to enable early, low-cost access to the benefits of dedicated spectrum for UAS control communications. The Commission anticipates that subsequent phases will address broader use of the band, potentially with the assistance of a Federal Advisory Committee or other efforts to further assess and engage stakeholders on the potential uses of the band and the appropriate regulatory measures to enable such uses, including but not limited to studies pursuant to the implementation of the National Spectrum Strategy. In subsequent phases, the Commission intends to resolve issues including (1) the final band plan for the 5030-5091 MHz band, which may include moving NNA operations to another location in the band; (2) measures to ensure compatibility between UAS stations operating at and near the edges of the 5030-5091 MHz band and services in adjacent spectrum; and (3) service rules for exclusive-use licenses enabling network-supported services in the band, including the scope of such services. The Commission further intends to continue close coordination with our federal partners, including the FAA and the National Telecommunications and Information Administration (NTIA), to ensure that UAS operations supported by this band remain compatible with aviation safety and concerns, and to develop an appropriate long-term framework for the accommodation of federal agencies seeking access to the federal allocation in the band for their own UAS operations.

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

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

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

6. 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.[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

7. 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 rules adopted herein.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A small business concern is one that: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9]

[5] 5 U.S.C. § 604(a)(3).

[6] *Id.* § 604(a)(4).

[7] *Id.*. § 601(6).

[8] *Id.* § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

[9] 15 U.S.C. § 632.

8. *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.[10] 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.[11] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 33.2 million businesses.[12]

9. 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."[13] The Internal Revenue Service (IRS) uses a revenue benchmark of $50,000 or less to delineate its annual electronic filing requirements for small exempt organizations.[14] Nationwide, for tax year 2022, there were approximately 530,109 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.[15]

10. 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."[16] U.S. Census Bureau data from the 2022 Census of Governments[17] indicate there were 90,837 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.[18] Of this number, there were

[10] 5 U.S.C. § 601(3)-(6).

[11] *See* SBA, Office of Advocacy, "What's New With Small Business?" (Mar. 2023), https://advocacy.sba.gov/wp-content/uploads/2023/03/Whats-New-Infographic-March-2023-508c.pdf.

[12] *Id.*

[13] 5 U.S.C. § 601(4).

[14] 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 of small organizations in this small entity description. S*ee* 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 (last visited Aug. 19, 2024). 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.

[15] *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 (last visited Aug. 19, 2024). 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 2022 with revenue less than or equal to $50,000 for Region 1-Northeast Area (71,897), Region 2-Mid-Atlantic and Great Lakes Areas (197,296), and Region 3-Gulf Coast and Pacific Coast Areas (260,447) that includes the continental U.S., Alaska, and Hawaii. This data includes information for Puerto Rico (469).

[16] 5 U.S.C. § 601(5).

[17] 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* U.S. Census Bureau, About the Economic Census, https://www.census.gov/programs-surveys/economic-census/year/2022/about.html (last visited Aug. 19, 2024).

[18] *See* U.S. Census Bureau, 2022 Census of Governments – Organization, tbl. 2 (Local Governments by Type and State: 2022 [CG2200ORG02]), https://www.census.gov/data/tables/2022/econ/gus/2022-governments.html (last visited Aug. 19, 2024). 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).

36,845 general purpose governments (county,[19] municipal, and town or township[20]) with populations of less than 50,000 and 11,879 special purpose governments (independent school districts[21]) with enrollment populations of less than 50,000.[22] Accordingly, based on the 2022 U.S. Census of Governments data, we estimate that at least 48,724 entities fall into the category of "small governmental jurisdictions."[23]

11. *Wireless Telecommunications Carriers (except Satellite).* This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves.[24] Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless Internet access, and wireless video services.[25] The SBA size standard for this industry classifies a business as small if it has 1,500 or fewer employees.[26] U.S. Census Bureau data for 2017 show that there were 2,893 firms in this industry that operated for the entire year.[27] Of that number, 2,837 firms employed fewer than 250 employees.[28] Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 594 providers that reported they were engaged in the provision of wireless services.[29] Of these providers, the Commission estimates that 511 providers have 1,500 or fewer

[19] *See id.* at tbl.5 (County Governments by Population-Size Group and State: 2022 [CG2200ORG05]), https://www.census.gov/data/tables/2022/econ/gus/2022-governments.html (last visited Aug. 19, 2024). There were 2,097 county governments with populations less than 50,000. This category does not include subcounty (municipal and township) governments.

[20] *See id.* at tbl.6 (Subcounty General-Purpose Governments by Population-Size Group and State: 2022 [CG2200ORG06]), https://www.census.gov/data/tables/2022/econ/gus/2022-governments.html (last visited Aug. 19, 2024). There were 18,693 municipal and 16,055 town and township governments with populations less than 50,000.

[21] *See id.* at tbl.10 (Elementary and Secondary School Systems by Enrollment-Size Group and State: 2022 [CG2200ORG10]), https://www.census.gov/data/tables/2022/econ/gus/2022-governments.html (last visited Aug. 19, 2024). There were 11,879 independent school districts with enrollment populations less than 50,000. *See also* tbl.4 (Special-Purpose Local Governments by State Census Years 1942 to 2022 [CG2200ORG04], CG2200ORG04 Table Notes_Special Purpose Local Governments by State_Census Years 1942 to 2022).

[22] While the special purpose governments category also includes local special district governments, the 2022 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.

[23] 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 (36,845) and the number of special purpose governments - independent school districts with enrollment populations of less than 50,000 (11,879), from the 2022 Census of Governments - Organizations tbls. 5, 6 & 10.

[24] *See* U.S. Census Bureau, *2017 NAICS Definition, "517312 Wireless Telecommunications Carriers (except Satellite),"* https://www.census.gov/naics/?input=517312&year=2017&details=517312 (last visited Aug. 19, 2024).

[25] *Id.*

[26] *See* 13 CFR § 121.201, NAICS Code 517312 (as of 10/1/22, NAICS Code 517112).

[27] *See* U.S. Census Bureau, *2017 Economic Census of the United States*, *Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIRM, NAICS Code 517312, https://data.census.gov/cedsci/table?y=2017&n=517312&tid=ECNSIZE2017.EC1700SIZEEMPFIRM&hidePreview=false (last visited Aug. 19, 2024).

[28] *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.

[29] Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf (last visited Aug. 19, 2024).

employees.[30] Consequently, using the SBA's small business size standard, most of these providers can be considered small entities.

12. *Satellite Telecommunications.* This industry comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications."[31] Satellite telecommunications service providers include satellite and earth station operators. The SBA small business size standard for this industry classifies a business with $38.5 million or less in annual receipts as small.[32] U.S. Census Bureau data for 2017 show that 275 firms in this industry operated for the entire year.[33] Of this number, 242 firms had revenue of less than $25 million.[34] Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 65 providers that reported they were engaged in the provision of satellite telecommunications services.[35] Of these providers, the Commission estimates that approximately 42 providers have 1,500 or fewer employees.[36] Consequently, using the SBA's small business size standard, a little more than half of these providers can be considered small entities.

13. *All Other Telecommunications.* This industry is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.[37] This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems.[38] Providers of Internet services (e.g. dial-up ISPs) or Voice over Internet Protocol (VoIP) services, via client-supplied telecommunications connections are also included in this industry.[39] The SBA small business size standard for this industry classifies firms with annual receipts of $35 million or less as small.[40] U.S. Census Bureau data for 2017 show that there were 1,079 firms in this industry that operated for the entire year.[41] Of those firms, 1,039 had revenue of less than $25 million.[42] Based on this

[30] *Id.*

[31] *See* U.S. Census Bureau, *2017 NAICS Definition, "517410 Satellite Telecommunications*," https://www.census.gov/naics/?input=517410&year=2017&details=517410 (last visited Aug. 19, 2024).

[32] *See* 13 CFR § 121.201, NAICS Code 517410.

[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 517410, https://data.census.gov/cedsci/table?y=2017&n=517410&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false. (last visited Aug. 19, 2024).

[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 (last visited Aug. 19, 2024).

[35] Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf (last visited Aug. 19, 2024).

[36] *Id.*

[37] *See* U.S. Census Bureau, *2017 NAICS Definition*, "*517919 All Other Telecommunications,*" https://www.census.gov/naics/?input=517919&year=2017&details=517919 (last visited Aug. 19, 2024).

[38] *Id.*

[39] *Id.*

[40] *See* 13 CFR § 121.201, NAICS Code 517919 (as of Oct. 1, 2022, NAICS Code 517810).

[41] *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 517919,

(continued….)

data, the Commission estimates that the majority of "All Other Telecommunications" firms can be considered small.

14. *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.[43] 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.[44] The SBA small business size standard for this industry classifies businesses having 1,250 employees or less as small.[45] U.S. Census Bureau data for 2017 show that there were 656 firms in this industry that operated for the entire year.[46] Of this number, 624 firms had fewer than 250 employees.[47] Thus, under the SBA size standard, the majority of firms in this industry can be considered small.

15. *Uncrewed Aircraft Radio Equipment Manufacturers.* Neither the SBA nor the Commission have developed a small business size standard specifically applicable to uncrewed aircraft radio equipment manufacturers. Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing is the closest industry with a SBA small business size standard.[48] The SBA small business size standard for this industry classifies businesses having 1,250 employees or less as small.[49] U.S. Census Bureau data for 2017 show that there were 656 firms in this industry that operated for the entire year.[50] Of this number, 624 firms had fewer than 250 employees.[51] In addition, the SBA provides a size standard for the Aircraft Manufacturing industry, which includes the manufacture of

(Continued from previous page)
https://data.census.gov/cedsci/table?y=2017&n=517919&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false (last visited Aug. 19, 2024).

[42] *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.

[43] *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 (last visited Aug. 19, 2024).

[44] *Id.*

[45] *See* 13 CFR § 121.201, NAICS Code 334220.

[46] *See* U.S. Census Bureau, *2017 Economic Census of the United States*, *Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIRM, NAICS Code 334220, https://data.census.gov/cedsci/table?y=2017&n=334220&tid=ECNSIZE2017.EC1700SIZEEMPFIRM&hidePreview=false (last visited Aug. 19, 2024).

[47] *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.

[48] *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 (last visited Aug. 19, 2024).

[49] *See* 13 CFR § 121.201, NAICS Code 334220.

[50] *See* U.S. Census Bureau, *2017 Economic Census of the United States*, *Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIRM, NAICS Code 334220, https://data.census.gov/cedsci/table?y=2017&n=334220&tid=ECNSIZE2017.EC1700SIZEEMPFIRM&hidePreview=false (last visited Aug. 19, 2024).

[51] *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.

uncrewed and robotic aircraft.[52] The SBA small business size standard for this industry classifies businesses having 1,500 employees or less as small.[53] U.S. Census Bureau data for 2017 show that there were 254 firms in this industry that operated for the entire year.[54] Of this number, 227 firms had fewer than 250 employees.[55] Based on this data, we conclude that a majority of manufacturers in this industry are small.

16. *Uncrewed Aircraft System Operators.* Neither the Commission nor the SBA have developed a small business size standard specifically applicable to UAS operators. The Commission lacks data on the number of operators in the United States that could be subject to the rules, therefore it is not possible to determine the number of affected small entity operators at this time. We find, however, that the Regulatory Flexibility Analysis of the FAA Remote ID rule is helpful. In this analysis, the FAA assessed the impact of the rule on small entity non-recreational UAS operators based on an analysis that the Association for Uncrewed Vehicle Systems International (AUVSI) performed relating to part 107 waivers.[56] In the analysis, the AUVSI determined that 92 percent of the waivers were issued to entities with fewer than 100 employees. Based on this data, the FAA determined that a majority of entities currently operating uncrewed aircraft for other than recreational purposes are small.[57] Accordingly, based on the FAA's determination we conclude that a majority of uncrewed UAS operators are small entities.

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

17. The rules adopted in the *Report and Order* will implement new reporting, recordkeeping, or other compliance requirements on certain small entities. These requirements, which are summarized below, were thoughtfully considered to minimize burdens to small businesses while also ensuring the level of reliability necessary to support safety-critical UAS communications. We do not expect compliance with the rules adopted in the *Report and Order* to cause small entities to incur significant compliance costs. We further note that while the Commission sought comment from concerned parties regarding costs related to compliance requirements, the record did not include concerns raised by small entities about compliance costs.

18. *Dynamic Frequency Management System.* The *Report and Order* permits more than one DFMS administrator to operate a DFMS in the band, and each approved DFMS will be required to communicate and coordinate with other approved DFMSs as necessary to ensure that their assignments are consistent. It will be critical for DFMS administrators to agree on and implement appropriate DFMS-to-DFMS lines of communication, as well as protocols for coordination and common interference models, that ensure any inconsistencies in assignments are avoided or are otherwise very quickly identified and resolved. Furthermore, the Commission establishes requirements that are high-level guidelines that describe minimum requirements for DFMSs and DFMS administrators. A DFMS will require sufficient information regarding the time, relevant geographic area, and, potentially, altitude of a UAS operation to

[52] *See* U.S. Census Bureau, *2017 NAICS Definition*, "*336411 Aircraft Manufacturing*," https://www.census.gov/naics/?input=336411&year=2017&details=336411 (last visited Aug. 19, 2024).

[53] *See* 13 CFR § 121.201, NAICS Code 336411.

[54] *See* U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIRM, NAICS Code 336411, https://data.census.gov/cedsci/table?y=2017&n=336411&tid=ECNSIZE2017.EC1700SIZEEMPFIRM&hidePreview=false (last visited Aug. 19, 2024).

[55] *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.

[56] *See* Federal Aviation Administration, Department of Transportation, Remote Identification of Unmanned Aircraft, 86 Fed. Reg. 4390, 4494 (Jan. 15, 2021) (*Remote ID Rule*).

[57] *See id.*

model potential interference impacts; however, the Commission does not intend to specify the particular content or format of that information, but to give stakeholders flexibility to develop standards to implement this requirement. The requests must be for spectrum to support a single UAS flight, which should help to ensure that parties reserve spectrum only for those times and frequencies that they actually need, and to maximize the usage of the NNA spectrum.

19. The *Report and Order* adopts the proposed section 88.135 requirements from the *NPRM*, which include that (1) a DFMS must provide a process for NNA users to register with the system for the purpose of submitting frequency assignment requests and obtaining frequency assignments; (2) a DFMS must be capable of processing frequency assignment requests nationwide and across the entire 5030-5091 MHz band; however, a DFMS may only make assignments for spectrum within those frequencies in which NNA operations are permitted; (3) a DFMS shall determine and provide, through an automated (non-manual) process, an assignment of frequencies for a particular geographic area and time period; and (4) assignments must account for the need to protect other authorized operations.

20. The Commission also incorporates a high-level requirement regarding the process of interference calculations. While the Commission does not adopt any detailed requirements regarding the methodology or modeling for interference calculations, the Commission agrees that the models and methodologies for interference determinations should be both accurate and consistent between different DFMSs. The Commission envisions that stakeholders will establish detailed standards for specific models and methods that meet the Commission's requirements, but emphasizes that any standards established must be in compliance with the rules. Furthermore, the Commission includes a requirement to help ensure that parties requesting frequency assignments have the necessary FAA pilot and flight authorizations, obligating a DFMS to confirm through certifications that the party requesting a frequency assignment has flight authorization from the FAA to cover the flight associated with the assignment request, and that the flight will only be piloted by parties that have the necessary FAA remote pilot authorization. The Commission does not expect this requirement to be time-consuming because, while a DFMS may implement additional measures to obtain confirmation, the Commission only requires it to implement certifications. Further, the Commission finds that it will provide further assurance that the NNA spectrum is used for authorized purposes. Finally, the Commission adopts a requirement that a DFMS be capable of responding to in-flight revision requests.

21. Additionally, the Commission authorizes certain requirements for communications between DFMS and NNA stations to better ensure compliance with DFMS assignments, specifically that a DFMS be able to communicate directly with a ground station operating in the NNA spectrum, or proxy software acting on its behalf, to achieve the following: (1) ensure that all NNA stations used in the operation, including any ground or airborne stations, are programmed to limit communications in the 5030-5091 MHz band, during the period of the frequency assignment, to the specific frequencies assigned by the DFMS and in accordance with the other terms of the assignment; and (2) receive updates on flight status when an uncrewed aircraft has launched and when it has landed. The Commission will similarly require NNA ground stations to be capable of communicating with a DFMS as necessary to achieve these functions. These obligations will better ensure compliance with DFMS assignments.

22. In seeking to address concerns that a party may hoard or monopolize the limited spectrum available for NNA operations, the Commission adopts requirements that a DFMS grant assignments sufficient to provide protected access over a duration and geographic area sufficient to cover the entire submitted UAS flight but does not mandate that a DFMS frequency assignment have the specific terms requested. These are solely high-level obligations, and the Commission does not wish to preclude administrators from developing common policies, standards, or approaches regarding the assessment and granting of requests to better meet the industry's collective need for this limited spectrum resource. To further ensure prevention of monopolization and facilitate broader access to NNA spectrum, the Commission provides that requests may only be approved for an operation lasting no more than 24 hours and provides that requests may not be approved for periods commencing eight or more calendar days after the submission of the request, except to the extent that lack of frequency availability in that time frame justifies a later assignment. The Commission also adopts a requirement that a DFMS communicate and

coordinate with other DFMSs as necessary to ensure consistent data and assignments, the safe and robust operation of authorized services, and compliance with the rules to ensure the proper functioning of the DFMSs.

23. The Commission does not define the specific information that a party must submit with a frequency assignment request or with registration. To facilitate inter-DFMS coordination, the Commission will mandate that each DFMS require the same registration and request information, and that information submitted to a DFMS be true, complete, correct, and made in good faith. The Commission will further require operators to keep any registration information up to date and keep any request information up to date through the scheduled end of the assignment. Further, the Commission will require a DFMS to maintain all records for at least 60 months.

24. Regarding security, the Commission adopts high-level requirements that (1) a DFMS must employ protocols and procedures to ensure that all communications between the DFMS and users or NNA stations in connection with a DFMS's NNA functions are secure and that unauthorized parties cannot access, shut down, or alter the DFMS or its stored information; and (2) communications between users and a DFMS, and between different DFMSs, must be secure to prevent corruption or unauthorized interception of data, and a DFMS must be protected from unauthorized data input or alteration of stored data; and (3) a DFMS must verify that the NNA stations to be used in operations are FCC-certified devices and must not provide assignments to an uncertified device.

25. Furthermore, the Commission adopts two high-level requirements regarding the prioritization of requests. While the Commission will generally require the DFMS to process requests in a non-discriminatory, first-come-first-served manner, the Commission finds that two priorities in the event of congestion are in the public interest. First, the Commission provides that, in the event of emergencies, a DFMS should, to the extent feasible and consistent with the interests of aviation safety, prioritize requests from public safety entities. The Commission expects that, as with other high-level requirements, stakeholders will develop common standards regarding who qualifies as public safety entities and other such questions. Second, the Commission adopts a requirement that, in extended periods of congestion, the DFMS prioritize requests involving flights relying on a single ground station over requests that rely on multiple stations, to the extent feasible and consistent with the interests of aviation safety. For both of these requirements, the Commission anticipates that stakeholders will work collaboratively to develop appropriate standards and practices to implement them.

26. The Commission also adopts several requirements for DFMS administrators. These obligations include: (1) operate a DFMS consistent with the rules; (2) establish and follow protocols and procedures to ensure compliance with the rules; (3) provide service for a ten-year term, which may be renewed at the Commission's discretion; (4) securely transfer all the information in the DFMS to another approved entity in the event it does not continue as the DFMS administrator at the end of its term; (5) develop a standardized process with other DFMS administrators for coordinating operations with other approved DFMSs, avoiding any conflicting assignments, and maximizing shared use of available frequencies; (6) coordinate with other DFMS administrators including sharing assignment and other information, facilitating non-interference to and from operations relying on assignments from other DFMSs, and other functions necessary to ensure that use of available spectrum is safe and efficient and consistent with the rules; (7) ensure that the DFMS shall be available at all times to immediately respond to requests from authorized Commission personnel for any and all information stored or retained by the DFMS; (8) establish and follow protocols to comply with enforcement instructions from the Commission; and (9) implement such reasonable limits on requests as are necessary to prevent the hoarding, warehousing, monopolization, or otherwise excessive reservation of NNA spectrum by a particular party.

27. To assist in its enforcement responsibilities, the Commission adopts a requirement that DFMS administrators establish and follow protocols to comply with enforcement instructions from the Commission. The Commission expects detailed enforcement mechanisms and procedures employed by DFMSs to be developed during the approval process, including mechanisms and procedures to address

unauthorized use of the spectrum, and the Commission anticipates that most issues will be addressed through these mechanisms.

28. *Radionavigation-Satellite Service.* The 5010-5030 MHz band includes an allocation for the radionavigation-satellite service (RNSS) (space-to-Earth) for potential future use. Footnote 5.443C of the Table of Frequency Allocations addresses requirements in the 5030-5091 MHz band for the protection of RNSS downlinks. Specifically, it provides that "[u]nwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5010-5030 MHz band" and that "[u]ntil such time that an appropriate value is established in a relevant International Telecommunication Union Radiocommunication Sector (ITU-R) Recommendation, the equivalent isotropic radiated power density limit of -75 dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station unwanted emission should be used."[58] Footnote 5.443C further limits aeronautical mobile (route) service (AM(R)S) use of the 5030-5091 MHz band to "internationally standardized aeronautical systems."[59] As NNA operations services would be part of the AM(R)S allocation, the requirements of footnote 5.443C would apply to such operations in the 5030-5091 MHz band.

29. *AeroMACS.* AeroMACS is a wireless broadband aeronautical mobile (route) service system that will enable communications for surface operations at airports between aircraft and other vehicles and between other critical fixed assets. The Commission allocated both the 5000-5030 MHz and 5091-5150 MHz bands for such use but has not yet established service rules in either band. The AeroMACS allocation for 5010-5030 MHz further provides that in making assignments for this band, attempts shall first be made to satisfy requirements in the bands 5000-5010 MHz and 5091-5150 MHz. The Commission concludes that the adopted technical requirements, combined with the frequency separation, will be adequate regulatory measures to provide compatibility between NNA operations and AeroMACS in the upper and lower band. These limits are drawn from the technical requirements of RTCA DO-362A, which are detailed below.

30. *Aeronautical Mobile Telemetry.* The 5091-5150 MHz band is also allocated for federal and non-federal aeronautical mobile telemetry (AMT) communications from aircraft stations, subject to the technical parameters in ITU Resolution 418 (WRC-12) intended to ensure compatibility with other services. According to the NTIA, federal agencies currently use this allocation in the 5091-5150 MHz band to support flight testing. The band is similarly used for non-federal flight-testing operations. As specified in footnote US111 of the Table of Allocations, flight testing in the 5091-5150 MHz band is conducted at seventeen locations, and additional locations may be authorized on a case-by-case basis. The Commission finds that the limits adopted today, drawn from RTCA DO-362A, are sufficient to protect AMT.

31. *Mobile Satellite Service Earth Stations.* As specified in the footnote US444A of the Table of Allocations, the 5091-5250 MHz band is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis for non-Federal use, limited to feeder links of non-geostationary satellite systems in the Mobile Satellite Service (MSS). After January 1, 2016, the 5091-5150 MHz portion of this allocation permitted no new assignments. Globalstar operates gateway earth stations in the 5096-5250 MHz band under this allocation as part of its global mobile satellite service. To address the unlikely possibility of interference with UAS operations, the Commission clarifies that the responsibility to resolve interference between rule-compliant MSS earth stations and UAS is on the new UAS services. MSS earth station licensees in the 5091-5250 MHz band will only be responsible for curing harmful interference from its earth station to NNA operations in the neighboring 5030-5091 MHz band to the extent such interference is the result of the licensee's non-compliance with applicable license or regulatory requirements.

[58] 47 CFR § 2.106(b)(443)(iii).

[59] *Id.*

32. *Radio Astronomy.* In the *Report and Order*, the Commission requires coordination within the National Radio Quiet Zone (NRQZ). The coordination requirements are modeled after the NRQZ coordination procedures applicable to other services under section 1.924(a) of the Commission's rules but modified to work with the instant context in which a frequency assignment request will be submitted instead to a DFMS. Specifically, the Commission provides that parties planning to operate an NNA station at locations within the NRQZ must notify the NRQZ Administrator in writing in advance or simultaneously with the filing of the request. To reduce the burden of coordinating short term operations, the Commission adopts two measures: a provision that the NRQZ Administrator may establish a safe harbor for NNA operations in the NRQZ that do not require notification and a measure that a party need not notify the NRQZ Administrator if the party's operation or revision of an operation is within the scope of an approval previously granted to the party by the NRQZ Administrator. Furthermore, the coordination process will largely follow the procedures under section 1.924(a), with appropriate changes made to reflect the role of the DFMS. Thus, when a request for frequency assignment is filed with the DFMS, the notification may be submitted prior to or simultaneously with the request. After receipt, the DFMS will allow a period of 20 days for objections. If a DFMS determines that a request is subject to one of the two exceptions to notification, it shall process the request without waiting the 20-day period. If the DFMS receives a NRQZ Administrator approval of operations that includes the operation associated with the request, if the request is within the scope of a safe harbor established by the NRQZ Administrator, or if the 20-day period passes without objection, the DFMS will process the request under normal procedures, except that requests may be approved for periods commencing more than seven calendar days after the submission of the request, but no more than seven calendar days after the date of decision. If objections are received in the 20-day period, the DFMS will forward the record, including the frequency request, to the Commission. After consideration of the record, the Commission will take whatever action is deemed appropriate, including, potentially, directions to the DFMS administrator regarding resolution of the request. Finally, to facilitate operation of both UAS systems and radio astronomy systems, the Commission requires a DFMS to immediately notify the National Science Foundation, Division of Astronomical Sciences, Electromagnetic Spectrum Management Unit, by email of any assignments that it approves for UAS operations in the vicinity of the radio astronomy facilities identified in footnote US385 of the Table of Allocations, which identifies the sites at which radio astronomy observations are performed in 4990-5000 MHz.

33. *Canadian and Mexican Coordination.* International agreements with Mexico and Canada do not currently address the use of the 5030-5091 MHz band for UAS communications near the borders with those countries. DFMS administrators will be required to demonstrate that their systems can and will enforce agreements between the United States, Canadian, and Mexican governments regarding commercial operations in the 5030-5091 MHz Band. The specific methods of enforcement will be determined and implemented by DFMS administrators, with appropriate Commission oversight, after the agreements are in place.

34. *Interim Access Mechanism Registration.* The Commission adopts an interim access mechanism (IAM) to enable NNA entities to begin operations in the band during the interim period before the DFMS is operational. For IAM access, NNA operators holding an FAA authorization must subsequently complete an on-line NNA registration form with the Commission providing various basic information and certifications, including a company or individual name, email address, and the following certification statements: (1) they have complied with the FAA authorization process; (2) they have/will comply with the Commission's NNA rules and technical requirements; (3) all equipment utilized in NNA operations meets the equipment certification requirements; and (4) their authorization to use the IAM assignment terminates immediately in the event a DFMS becomes operational prior to the end of the IAM assignment. This registration process will not require a fee, or any subsequent review process. Once the registration form is completed and submitted, a confirmation number of their registration will be provided and NNA operations can commence immediately. During the IAM, the Commission will work with the FAA to resolve disputes or identify and address the sources of harmful interference or unauthorized operations in the 5030-5091 MHz band.

35. *Compliance with RTCA DO-362A.* In the *Report and Order*, the Commission adopts rules based on RTCA DO-362A, which contains Minimum Operational Performance Standards for terrestrial-based control-and-non-payload communications (CNPC) point-to-point or point-to-multipoint links in the 5030-5091 MHz band, including power limits, emission limits, and frequency accuracy requirements. UAS entities are likely familiar with RTCA DO-362A as the FAA recently issued a Technical Standard Order (TSO) establishing minimum standards in the 5030-5091 MHz band based on the requirements in the RTCA DO-362A. It is appropriate to adopt technical requirements based on the RTCA DO-362A for governing the types of safety-of-flight UAS operations in the 5030-5091 MHz band as these requirements are consistent with the AM(R)S allocation for the band, the limitations associated with CNPC-only operations, and because they are consistent with FAA standards.

36. First, as recommended by RTCA, the Commission adopts the requirement of RTCA DO-362A standard related to Time Division Duplexing (TDD) for NNA equipment and operations in the band. To minimize the risk of interference and to achieve consistency with the FAA TSO based on the RTCA DO-362A standard, the Commission finds it appropriate at this time to incorporate into its rules the 50 ms TDD frame structure requirement for NAA equipment and operations for CNPC purposes in the 5030-5091 MHz band. Second, the Commission declines to follow the requirements of rule section 87.139(c) to avoid imposing potentially inconsistent out-of-band emissions requirements with the FAA, which mandates compliance with applicable emissions requirements in section 2 of the RTCA DO-362A standard. To provide stakeholders increased flexibility, and in lieu of mandating the use of specific emission designators, the Commission will permit an applicant seeking equipment certification to specify the emission designator appropriate to its equipment design and proposed operation, provided it meets the technical requirements adopted today governing NNA equipment and operations. Finally, the Commission delegates joint rulemaking authority to the Wireless Telecommunications Bureau (WTB) and the Office of Engineering and Technology (OET) to incorporate into the Commission's rules, after notice and an opportunity for public comment, any updated version of a previously incorporated technical standard applicable to UAS operations in the 5030-5091 MHz band. This delegation will facilitate expedited updates to the Commission's technical rules based on evolving technical standards. The Commission seeks to expedite necessary future changes to accommodate updates in standards relevant to previously adopted technical requirements.

37. *Equipment Authorization.* The Commission adopts the *NPRM*'s proposal to mandate equipment authorization requirements similar to those under sections 87.145 and 87.147 of the Commission's rules to all equipment intended for use in the 5030-5091 MHz band. Section 87.145 requires that each transmitter must be certified for use in the relevant service, and section 87.147 establishes a specific equipment authorization for part 87 equipment, which for the frequencies in the 5030-5091 MHz band, among others, requires coordination with the FAA. The *NPRM*'s stated goal was to ensure that such equipment meets the level of reliability and safety necessary of aviation equipment. The Commission noted that 5030-5091 MHz UAS radio equipment must independently satisfy any applicable FAA requirements and anticipated that this coordination process would ensure that the 5030-5091 MHz equipment authorizations by the Commission and the FAA are consistent and that all equipment approved for use in the band will meet both agencies' requirements. The Commission adopts these requirements as well as requirements that transmitters be certified for use in the relevant service through compliance with OET procedures for equipment authorization under part 2, subpart J of the Commission's rules and provide notification to the FAA when filing the requisite application. This approach will ensure that necessary coordination occurs with the FAA, given its responsibility for ensuring aviation safety in the National Airspace System, and prevent harmful interference through NNA equipment compliance with the relevant technical requirements. The entities required to comply with equipment authorization will primarily be equipment manufacturers, some of which include small entities. Likewise, all entities—including small entities—will use this authorized equipment.

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

38. In the discussion of the issues the *NPRM* sought comment on, the Commission raised alternatives and sought input such as technical studies and cost-benefit analyses from small and other entities. By requesting such information, the Commission gave small entities the opportunity to broaden the scope of the Commission's understanding of impacts, which may be readily apparent, and offer alternatives not already considered that could minimize the economic impact on small entities. The Commission has adopted alternatives that will minimize compliance burdens on small entities, as described below.

39. *Industry-focused, Multi-phase Rulemaking.* In adopting these service rules, the Commission intends for rules and policies to be adopted in phases to ensure flexibility and innovation for this industry. This initial phase adopts high-level rules that describe minimum requirements for operation of the DFMS and encourages a multi-stakeholder group addressing issues in the band to work collaboratively to develop technical specifications and standards for DFMS operation, and to explore other issues related to the evolving demands in the band. This approach will allow small entities, to collaborate and reach a consensus on key issues and present innovative solutions satisfactory to the involved parties.

40. Although it imposes new requirements that could impact small entities, in establishing these rules, the Commission balances the administrative burden to entities with ensuring flight safety and protecting against interference in a manner that minimizes the impact to all UAS operators, including small entities. In this initial step, the Commission opens a portion of the band for NNA operations to enable early, low-cost access to dedicated spectrum for UAS control communications. By providing low-cost access, small entities will be able to utilize this spectrum without a significant financial cost.

41. *Licensing Stations by Rule.* In the *Report and Order*, the Commission adopts a licensing approach that would not require individual licensing, which will reduce the administrative burdens on small entities who are UAS operators and the Commission. The Commission implements a license-by-rule authorization for NNA operations, pursuant to section 307(e) of the Communications Act, as amended. Under this license-by-rule framework, parties using rule-compliant stations and operating in compliance with the rules would only need to obtain the requisite temporary frequency assignment from the DFMS in order to have Commission authorization to transmit in the band in the assigned location, frequency, and timeframe. To obtain Commission authorization to use the NNA spectrum, NNA users must use certified, Commission-approved NNA stations, and comply with the applicable NNA rules, but need not obtain individual spectrum licenses from the Commission. A license-by-rule approach will minimize the administrative burdens on users and the Commission and facilitate use of NNA for exclusive, short-term assignments focused on specific needs and operations.

42. The Commission has found that a license-by-rule approach will also minimize the burden on small businesses and expedite the process for UAS operators. More specifically, the Commission finds that licensing by rule of NNA stations will serve the public interest, convenience, and necessity and promote the efficient and robust use of the NNA spectrum. A license-by-rule approach to use the NNA band will avoid the administrative burdens on users and the Commission that would be involved if NNA operations were licensed individually, facilitating the use of NNA for short-term (but exclusive) assignments focused on specific needs and operations rather than longer term authorizations used only intermittently. In addition, the uniform support in the record for this approach bolsters the Commission's confidence that this approach is in the public interest. Because of this licensing approach, the burden for small entities is minimized and provides them with more accessibility to participate in this industry.

43. *Interim Access Mechanism Registration.* The Commission adopts an IAM to enable NNA entities to begin operations in the band during the interim period before the DFMS is operational. IAM registration is accomplished by completing an on-line NNA registration form with the Commission, which requires basic information and certifications. The information required for registration is

straightforward, which lessens the administrative burden on small entities. To further minimize the burden on registering entities, there will be no financial cost for this registration process. Once the registration form is completed and submitted, a confirmation number of their registration will be provided and NNA operations can commence immediately. Therefore, there is not a significant impact on small entities that seek to register. While there is an added administrative burden to register with the Commission during the IAM period, the cost of this added burden is balanced by the ability of UAS operators, including small entities, to gain immediate access to the 5030-5091 MHz band.

44. *Equipment Authorization.* The Commission adopts equipment authorization requirements similar to those under sections 87.145 and 87.147 of the Commission's rules to all equipment intended for use in the 5030-5091 MHz band. Section 87.145 requires that each transmitter must be certified for use in the relevant service, and section 87.147 establishes a specific equipment authorization for part 87 equipment, which for the frequencies in the 5030-5091 MHz band among others, requires coordination with the FAA. The Commission adopts these requirements that transmitters be certified for use in the relevant service through compliance with OET procedures for equipment authorization under part 2, subpart J of the Commission's rules and that the FAA is notified when filing the requisite application. Applying this approach to UAS equipment will ensure that necessary coordination occurs with the FAA, and that equipment authorizations by the Commission and the FAA are consistent and that all equipment approved for use in the band meet both agencies' requirements. The entities required to comply with equipment authorization will primarily be equipment manufacturers, some of which include small entities. However, the Commission balances the regulatory burden imposed by these equipment authorization requirements with the importance of a process that will aid the FAA's aviation safety responsibilities and help protect against harmful interference and believes that these requirements do not impose a significant burden on small entities. Furthermore, all entities—including small entities—will use and, thus, need to certify that they are using authorized equipment, but most small UAS entities will not be directly affected by these requirements beyond using the equipment.

G. Report to Congress

45. The Commission will send a copy of the *Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[60] In addition, the Commission will send a copy of the *Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Report and Order* and FRFA (or summaries thereof) will also be published in the Federal Register.[61]

[60] 5 U.S.C. § 801(a)(1)(A).

[61] 5 U.S.C. § 604(b).

APPENDIX C

List of Commenters

Comments

Access 700, LLC (Access 700)
Aerospace and Flight Test Radio Coordinating Council, Inc. (AFTRCC)
Aerospace Industries Association (AIA)
Air Line Pilots Association, International (ALPA)
Aircraft Owners and Pilots Association (AOPA)
Alliance for Telecommunications Industry Solutions (ATIS)
American Association of State Highway and Transportation Officials, APCO International, Enterprise Wireless Alliance, Forest Industries Telecommunications, Forestry Conservation Communications Association, International Association of Fire Chiefs, International Municipal Signal Association, and MRFAC, Inc. (AASHTO et al.)
Anterix, Inc. (Anterix)
Association for Uncrewed Vehicle Systems International (AUVSI)
AT&T Services, Inc. (AT&T)
AURA Network Systems, Inc. (AURA)
Aviation Spectrum Resources, Inc. (ASRI)
Boeing Company and Wisk Aero LLC (Boeing/Wisk)
Choctaw Nation of Oklahoma (CNO)
Commercial Drone Alliance (CDA)
CTIA-The Wireless Association (CTIA)
Dimetor
Dynamic Spectrum Alliance (DSA)
Edison Electric Institute (EEI)
Federated Wireless, Inc. (Federated Wireless)
Florida Power & Light Company (FPL)
FPV Freedom Coalition & Flite Test Community Association (FPVFC)
HAPS Alliance
Inmarsat Inc. (Inmarsat)
Ligado Networks LLC (Ligado)
Lockheed Martin Corporation (Lockheed Martin)
Mark Colborn (Colborn)
ModalAI, Inc. (ModalAI)
National Academy of Sciences' Committee on Radio Frequencies (CORF)
National Association of Broadcasters (NAB)
National Association of Manufacturers and MRFAC, Inc. (NAM/MRFAC)
National Public Safety Telecommunications Council (NPSTC)
National Telecommunications and Information Administration (NTIA)/ Federal Aviation Administration (FAA)
News Media Coalition (NMC)
Northeast UAS Airspace Integration Research Alliance, Inc. (NUAIR)
NSF Aerial Experimentation and Research Platform on Advanced Wireless (AERPAW)
P.R. China (PRC)
Pyka Inc. (Pyka)
Qualcomm Incorporated (Qualcomm)
RDARS Inc. (RDARS)
Regulatory and Technology Committee of the Energy Telecommunications and Electrical Association and the Telecommunications Subcommittee of the American Petroleum Institute (ENTELEC/API)
RTCA, Inc. (RTCA)
Skydio Inc. (Skydio)

Small UAV Coalition
The Wireless Innovation Forum (WInnForum)
T-Mobile USA, Inc. (T-Mobile)
uAvionix, Inc. (uAvionix)
Verizon
Virginia Tech Mid-Atlantic Aviation Partnership (MAAP)
Wing Aviation LLC (Wing) (filed in Docket RM-11798)
Zipline International Inc. (Zipline)

Replies

Aerospace Industries Association (AIA)
AURA Network Systems, Inc. (AURA)
Aviation Spectrum Resources, Inc. (ASRI)
Boeing Company and Wisk Aero LLC (Boeing/Wisk)
CTIA-The Wireless Association (CTIA)
Drone Racing League (DRL)
Federated Wireless, Inc. (Federated Wireless)
Florida Power & Light Company (FPL)
Globalstar, Inc. (Globalstar)
Iridium Communications Inc. (Iridium)
Ligado Networks LLC (Ligado)
Small UAV Coalition
uAvionix, Inc. (uAvionix)
Utilities Technology Council (UTC)
Verizon
Xcel Energy Services Inc. (Xcel)

STATEMENT OF
CHAIRWOMAN JESSICA ROSENWORCEL

Re: *Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems*, WT Docket No. 22-323, Report and Order (August 29, 2024)

At the Federal Communications Commission, we are committed to making sure that our rules help support technological progress and innovation. That is why we update our policies and organization over time, as we did recently with the creation of the Space Bureau in response to extraordinary advances in space launches and the satellite sector.

Today we update our rules to promote advances in another area where new technology is taking off—drones.

Over the last decade, drones and other unmanned or uncrewed aircraft systems have migrated from novelties in our skies to routine use in modern life. In 2021 there were 2 million drones in operation in the United States. By 2030, we expect that number to more than triple to 6.5 million.

These systems support billions in economic activity and can help power services that improve lives. Drones are a game-changer for inspecting and maintaining critical infrastructure like cell towers or electric transmission lines. They can access hard-to-reach locations faster and more safely than crews on the ground. First responders increasingly rely on these aircraft to help with rescue operations. On top of this, drones have proven invaluable for farmers, providing new ways to monitor field conditions and collect data about crops.

All of this remote-piloted aircraft activity relies on wireless communications. In fact none of these new services work without it. Right now, drone operators largely rely on unlicensed airwaves to communicate with and control these uncrewed aircraft systems. But the use of unlicensed spectrum leaves these aircraft more vulnerable to interference that could disrupt operations. That is why here—for the first time—we are enabling operators of unmanned and uncrewed systems to access dedicated spectrum for control operations in circumstances where safety is essential. To do this, we are adopting service rules that provide operators with the ability to obtain direct frequency assignments in a portion of the 5030-5091 MHz band.

We are taking this action because we started work on this effort to support drone-based wireless activity several years ago. In 2021, the agency expanded its network of "innovation zones" for wireless experimentation with a zone in Raleigh, North Carolina dedicated specifically to studying new communications use cases and drones. The insights gained from this effort have shaped and strengthened our new rules. This includes the innovative approach we take here with the establishment of dynamic frequency management systems that will help this spectrum be used safely and efficiently by a wide array of operators. While work is underway to stand-up this approach, our rules ensure that operators can immediately take advantage of a simple, interim process to access the band and deconflict their flights with the Federal Aviation Administration.

This is a meaningful step forward to help support the innovative potential of drone technologies and help build a digital future that works for everyone. What comes next is exciting—so let's get to it.

STATEMENT OF
COMMISSIONER GEOFFREY STARKS

Re: *Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems*, WT Docket No. 22-323, Report and Order (August 29, 2024)

The public interest benefits of Uncrewed Aircraft Systems (UAS) are substantial. The demand for UAS is growing, and UAS technology is being used by various industries from inspecting power lines and cell towers to gathering of news, helping with sustainable agriculture to delivering medicine at rural locations, and more. Innovation will enable many more UAS uses that we can't even imagine today. In 2020, I visited the Nevada Institute for Autonomous Systems, an FAA designated UAS test site outside Las Vegas, to see how UAS companies are developing new applications, techniques, and technologies to facilitate integration of UAS into the Nation's airspace. In 2021, through our innovation zones, we took steps to encourage research and innovation to incubate next generation UAS technologies and solutions to various challenges. In 2022, we started this rulemaking. We now put the United States on a path forward, and based on the record in this proceeding, we adopt a regulatory framework to facilitate access to dedicated spectrum in a portion of the 5030-5091 MHz band to enable safe operations of UAS. Although this regulatory framework covers only a certain type of UAS operations (*i.e.*, non-networked UAS operations), it is an important step in our ongoing efforts to encourage spectrum-enabled innovation and technological progress for the benefit of all Americans.

UAS technologies continue to play an important role in disaster relief, restoring public safety and protecting our nation's critical infrastructure. Severe weather, fire, and other emergencies can happen at any moment, and are increasing with climate change. Our actions today should enable UAS to be an effective tool in disaster recovery efforts. Although we establish a regulatory framework for UAS operating in radio line of sight of an operator, we also permit the use of some ground infrastructure deployment, such as a string of ground stations deployed over a particular and frequently used flight path. The record shows that such use of ground stations is needed for efficient and effective inspections and maintenance of our nation's critical infrastructures. Use of ground stations will help, for example, the electric utility companies to safely inspect property for damage after a storm, monitor the health of their systems during normal operations, and rapidly identify and address any service disruptions. I thank the Chairwoman for working with me to clarify that UAS operations using ground stations deployed over a frequently used flight path can use the 5030-5091 MHz band under the UAS spectrum access framework we adopt today.

I am pleased that UAS operators will have access to spectrum for exclusive and protected use through dynamic frequency management systems. Through an automated process, these dynamic frequency management systems will assign a requesting operator the temporary use of certain frequencies for a particular geographic area and time period tailored to the operator's submitted UAS flight plan. For the duration of the assignment, the operator would have exclusive and protected use of the assigned frequencies within the assigned area and timeframe, after which the frequencies would be available in that area for assignment to another operator. By making additional spectrum available through such a framework, we ensure that spectrum is used efficiently and effectively while meeting the needs of UAS operations to be robust, reliable, and safe. That's real progress.

Our job, however, is not finished. We still need to address a number of remaining issues, including spectrum for networked UAS operations in the 5030-5091 MHz band to fully realize the promise and public interest benefits of UAS. Of course, securing a vibrant future for UAS requires close interagency coordination to ensure all UAS operations are fully integrated into the U.S. national airspace, developing interoperable standards that include secure networked communications, and addressing other critical issues related to drone operations.

I look forward to continuing to engage with all stakeholders on the remaining challenges. We must work diligently to enable us to take the next step for further development of the UAS ecosystem while maintaining the United States' leadership. Enabling a flexible licensing framework for UAS

operations with exclusive spectrum access and nationwide network coverage will require an all-hands-on-deck approach from all stakeholders, involving standard developments, spectrum policy, intergovernmental coordination, and full integration of these operations into the Nation's airspace.

Thank you to the Commission staff working on this complicated proceeding. This is a significant step forward and it has my full support.