

**FCC FACT SHEET\***

**Allocation of Spectrum for Non-Federal Space Launch Operations; Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations; and Federal Space Station Use of the 399.9-400.05 MHz band**

Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 13-115, RM-11341

**Background:** The United States is poised to be a world leader in space exploration and commercialization with many activities increasingly being shifted from government to the private sector. Reliable communication is an essential part of these space-based activities and the U.S. space industry's leadership. Currently, commercial space launch operators must obtain a grant of Special Temporary Authority (STA) under Part 5 of the Commission's rules in order to access the required spectrum for their communications needs for each launch operation. In 2013, the Commission issued a Notice of Proposed Rulemaking and Notice of Inquiry (2013 NPRM) that proposed several new allocations for commercial space launch operations, as well as expanded Federal access to commercial satellites and increased flexibility for Federal satellite operations in certain frequency bands. If adopted, the *Report and Order and Further Notice of Proposed Rulemaking* would be the first step in enabling the Commission to issue licenses for spectrum use during commercial space launches.

**What the Report and Order Would Do:**

- Propose to add a secondary non-Federal Space Operation allocation to the 2200-2290 MHz band through use of an Allocation Table footnote.
  - The footnote will limit use of this allocation to pre-launch testing and space launch operations in four five-megahertz sub-bands and require coordination with NTIA prior to each launch.

**What the Further Notice of Proposed Rulemaking Would Do:**

- Seek comment on adopting primary non-Federal allocations in the 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands for use during commercial space launches.
- Seek comment on adding a non-Federal Mobile allocation to the 2200-2290 MHz band, removing the limitation to four sub-bands for non-Federal operations, and upgrading the non-Federal Space Operation allocation from secondary to primary.
- Propose service rules for commercial space launch operations in all of these frequency bands.
  - These service rules include licensing and technical rules, as well as coordination procedures with other services that share these bands.
- Refresh the record on proposals in the 2013 NPRM to evaluate opportunities for increased Federal access to non-Federal frequencies through either new allocations or footnotes to the Allocation Table.
- Seek additional comment on a proposal in the 2013 NPRM to remove a restriction in an Allocation Table footnote prohibiting Federal satellites in the 399.9-400.05 MHz band, which has Federal and non-Federal Mobile Satellite Service allocations.

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\* This document is being released as part of a "permit-but-disclose" proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in ET Docket No. 13-115, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR § 1.1200 et seq.

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

In the Matter of
Allocation of Spectrum for Non-Federal Space
Launch Operations
Amendment of Part 2 of the Commission's Rules
for Federal Earth Stations Communicating with
Non-Federal Fixed Satellite Service Space Stations;
and
Federal Space Station Use of the 399.9-400.05
MHz Band
ET Docket No. 13-115
RM-11341

REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING\*

Adopted: []

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Comments Date: [30 days after date of publication in the Federal Register]

Reply Comment Date: [60 days after date of publication in the Federal Register]

By the Commission:

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\* This document has been circulated for tentative consideration by the Commission at its April 2021 open meeting. The issues referenced in this document and the Commission's ultimate resolution of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Acting Chairwoman has determined that, in the interest of promoting the public's ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The FCC's ex parte rules apply and presentations are subject to "permit-but-disclose" ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR §§ 1.1200(a), 1.1203.

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**I. INTRODUCTION**

1. The United States has long been a leader in space exploration and development, which supports important national interests in national security, economic prosperity, and scientific advancement. While the nation initially relied primarily on the resources of the Federal government for these endeavors, we now look to the private sector to help facilitate the future sustainability of space exploration and development. Access to radio spectrum is important for the commercial space launch industry to ensure reliable communications with launch vehicles. As a result, we seek to have a clear, stable, and predictable regulatory framework to enable and support the competitiveness of United States commercial space services and systems authorized by the Federal Communications Commission. In establishing such a framework, we also seek the input of other government agencies with mission and authority to facilitate space exploration and development in order to accomplish our shared goals.

2. Today, we take steps towards establishing a spectrum allocation and licensing framework that will provide regulatory certainty and improved efficiency and that will promote innovation and investment in the United States commercial space launch industry. Specifically, in the Report and Order, we allocate the 2200-2290 MHz band for space operations on a secondary basis and permit non-federal use in specific portions of this band for purposes of space launch operations to help meet the increasing demands for space exploration and development. In the Further Notice of Proposed Rulemaking, we seek comment on the definition of space launch operations, the potential allocation of other bands for these commercial communications purposes, including the frequency ranges at 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz. In addition, we seek comment on establishing service rules, including licensing and technical rules and coordination procedures, for the use of spectrum for commercial space launch operations. Finally, we seek to refresh the record on potential ways to facilitate Federal use of commercial satellite services in what are currently non-Federal satellite bands and enable more robust federal use of the 399.9-400.05 MHz band. Through these actions, we seek to encourage the continued

development of a robust U.S. commercial space sector, to the benefit of national interests in security, prosperity, and science.

## II. BACKGROUND

3. Commercial space launch entities are proliferating and are increasingly involved in all aspects of U.S.-based space activities, such as transportation of cargo and people into space, orbital launches to place satellites and other payloads into space, and suborbital launches. There are a growing number of companies offering services to both private entities and government organizations. For example, the National Aeronautics and Space Administration (NASA) has engaged two private companies to take cargo and crew to the International Space Station (ISS),<sup>1</sup> and companies such as Space Exploration Technologies (SpaceX) and Northrop Grumman have completed numerous successful missions to the ISS.<sup>2</sup> SpaceX has recently ferried people to the ISS, and Boeing is developing a spacecraft to do the same.<sup>3</sup> Other companies, such as Virgin Galactic and Blue Origin, intend to take private citizens on suborbital flights.<sup>4</sup> These commercial space launch companies are also actively transporting communications satellites into orbit. SpaceX, for example, has conducted over 100 launches.<sup>5</sup> Several companies, such as Rocket Lab and Astra, are focusing on propelling small satellites into orbit.<sup>6</sup> Bigelow Aerospace plans to deploy a manned space station.<sup>7</sup> To support these commercial space ventures, entities such as the New Mexico Spaceport Authority, the Virginia Commercial Space Flight Authority and the Houston Airport System have established non-Federal spaceports.<sup>8</sup>

4. Five frequency bands are commonly used for communications with and tracking of space launch vehicles: 420-430 MHz, 2025-2110 MHz, 2200-2290 MHz, 2360-2395 MHz, and 5650-5925 MHz.<sup>9</sup> The 420-430 MHz band is used for sending flight termination commands to the launch vehicle, if

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<sup>1</sup> NASA, *Commercial Crew and Cargo: NASA Commercial Orbital Transportation Services*, <http://www.nasa.gov/offices/c3po/about/c3po.html> (last visited Mar. 31, 2021).

<sup>2</sup> See generally Comments of Space Exploration Techs. Corp., ET Docket No. 13-115 (Aug. 30, 2013) (SpaceX Comments); SpaceX, *SpaceX Missions Summary*, <https://spacex-info.com/launch-list/> (last visited Mar. 31, 2021). SpaceX has conducted over 100 commercial launches, including twenty-two successful missions to the ISS, while Northrop Grumman, formerly Orbital Sciences or Orbital ATK, has completed thirteen successful missions. Northrop Grumman purchased Orbital ATK. Orbital ATK was formerly known as Orbital Sciences Corporation.

<sup>3</sup> NASA, *NASA Astronauts Launch from America in Historic Test Flight of SpaceX Crew Dragon* (June 11, 2020), <https://www.nasa.gov/press-release/nasa-astronauts-launch-from-america-in-historic-test-flight-of-spacex-crew-dragon>; Boeing, *CST-1000 Starliner*, <https://www.boeing.com/space/starliner/> (last visited Mar. 31, 2021).

<sup>4</sup> Mike Wall, *Virgin Galactic Gearing up to Start Selling Suborbital Spaceflight Tickets Again* (Feb. 26, 2020), <https://www.space.com/virgin-galactic-spaceshiptwo-reservations-one-small-step.html>; Blue Origin, *Unparalleled Views of the Earth from Space*, <https://www.blueorigin.com/new-shepard/become-an-astronaut/> (last visited Mar. 31, 2021).

<sup>5</sup> SpaceX, *SpaceX Mission Summary*, <https://spacex-info.com/launch-list/> (last visited Mar. 31, 2021).

<sup>6</sup> Rocket Lab, *We Open Access to Space to Improve Life on Earth*, <https://www.rocketlabusa.com/about-us/> (last visited Mar. 31, 2021); Astra, *Reserve a Small Satellite Launch*, <http://www.astra.com> (last visited Mar. 31, 2021).

<sup>7</sup> Adam Higginbotham, *Robert Bigelow Plans a Real Estate Empire in Space*, Bloomberg Businessweek (May 2, 2013), <http://www.bloomberg.com/bw/articles/2013-05-02/robert-bigelow-plans-a-real-estate-empire-in-space#p1>.

<sup>8</sup> Federal Aviation Administration, *Active Licenses*, [https://www.faa.gov/data\\_research/commercial\\_space\\_data/licenses/](https://www.faa.gov/data_research/commercial_space_data/licenses/) (last visited Mar. 31, 2021); Federal Aviation Administration, *U.S. Spaceports* (June 2020), [https://www.faa.gov/space/additional\\_information/faq/media/Spaceport\\_Map\\_June\\_2020.pdf](https://www.faa.gov/space/additional_information/faq/media/Spaceport_Map_June_2020.pdf).

<sup>9</sup> *Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations*, ET Docket No. 13-115, Notice of Proposed Rulemaking and Notice of Inquiry, 28 FCC Rcd 6698, 6727-28, 6730, paras. 76, 79, 85 (2013) (*Space NPRM*). Launch vehicles, commonly known as rockets, are used for delivering payloads, such as satellites and spacecraft, into space. The Commission's

(continued....)

necessary, during the launch. The flight termination signal link must be extremely reliable to avoid endangering lives from a launch vehicle that has gone astray. The 2025-2110 MHz band has been used during some space launches to send control signals to guide the launch vehicle boosters to a controlled landing so that it may be reused. The 2200-2290 MHz band is used to send telemetry data from the launch vehicle to the controllers on the ground. Telemetry is diagnostic information, transmitted from the launch vehicle to ground controller stations during the flight, which allows the ground controller station to track the performance of the launch vehicle. Three frequencies in the 2360-2395 MHz band are available for telemetering and associated telecommand operations of expendable and reusable launch vehicles under a limited aeronautical mobile allocation.<sup>10</sup> The 5650-5925 MHz band supports launch vehicle radar tracking. Oftentimes, a transponder is placed on the launch vehicle that transmits a signal in this band in response to the radar tracking signal to allow more accurate tracking of the launch vehicle.

5. An allocation indicates an entry in the Table of Frequency Allocations<sup>11</sup> of a given frequency band for the purpose of its use by one or more terrestrial or space communications services under certain conditions.<sup>12</sup> Spectrum allocations in the U.S. Table may be established for Federal use, non-Federal use, or shared Federal/non-Federal use, and can be either primary or secondary. Stations of a service with a secondary allocation are entitled to protection from stations operating without an allocation but may not cause harmful interference to, and must accept interference from, stations of a primary service.<sup>13</sup> The 420-430 MHz band has a primary Federal Radiolocation allocation and a secondary non-Federal amateur allocation.<sup>14</sup> In addition, portions of the 420-430 MHz band are allocated for non-Federal use by the Land Mobile Service in three cities. The band may also be used for Federal low-power radio control operations, and a portion of the band is allocated on a secondary basis for the Mobile Service for use by MedRadio.<sup>15</sup> The 2200-2290 MHz band has primary allocations for Federal Earth Exploration Satellite, Space Operation, Space Research, Fixed, and Mobile services.<sup>16</sup> The 2360-2395 MHz band has a primary Federal and non-Federal Mobile allocation, a primary Federal Radiolocation allocation, and a secondary Federal Fixed allocation.<sup>17</sup> The 5650-5925 MHz band has a primary Federal Radiolocation allocation and a secondary non-Federal Amateur allocation.<sup>18</sup> The 5850-5925 MHz portion of the band also has primary non-Federal Fixed-Satellite and Mobile allocations and the 5830-5850 MHz portion has a secondary Amateur-Satellite allocation.<sup>19</sup>

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rules define spacecraft as “a man-made vehicle which is intended to go beyond the major portion of the Earth’s atmosphere.” 47 CFR § 2.1.

<sup>10</sup> 47 CFR § 2.106 footnote US276; 47 CFR § 87.303(d)(1).

<sup>11</sup> The Table of Frequency Allocations is comprised of the International Table and the United States Table of Frequency Allocations (U.S. Table). The International Table is described in 47 CFR § 2.104 and the U.S. Table is described in 47 CFR § 2.105.

<sup>12</sup> See e.g., ITU Radio Regulations 1.16; 47 CFR § 2.1.

<sup>13</sup> 47 CFR § 2.105(c)(2).

<sup>14</sup> 47 CFR § 2.106.

<sup>15</sup> United States (US) and Government (G) Footnotes, 47 CFR § 2.106, footnotes US230, G8, US64(b).

<sup>16</sup> 47 CFR § 2.106. Non-Federal space stations may transmit to the Tracking and Data Relay System in 2285-2290 MHz. 47 CFR § 2.106, footnote US303.

<sup>17</sup> 47 CFR § 2.106. The mobile service is limited to aeronautical telemetering and associated telecommand operations for flight testing of aircraft, missiles, or major components. 47 CFR § 2.106 footnote US276.

<sup>18</sup> 47 CFR § 2.106. The amateur satellite service may operate in the 5650-5670 MHz band, on the condition that it not cause interference to other services. International Footnote, 47 CFR § 2.106, footnote 5.282.

<sup>19</sup> The fixed-satellite allocation is limited to use by inter-continental systems. 47 CFR § 2.106, footnote US245. The mobile allocation is limited to the Intelligent Transportation System radio service. 47 CFR § 2.106, footnote NG160.

6. Because three of these frequency bands do not have provisions in the Table of Allocations for non-Federal access to the allocations that provide interference protection to communications to support commercial space launches, the Commission cannot license commercial entities to use these bands on an interference-protected basis during space launches.<sup>20</sup> Instead, the Commission grants space launch providers special temporary authority (STA) under the Part 5 experimental licensing rules to use frequencies in the 2200-2290 MHz and 5650-5925 MHz bands during their operations. These STAs allow the space launch operations to use the Federal spectrum on a non-interference basis. The Commission coordinates use of the spectrum with the National Telecommunications and Information Administration (NTIA), which consults with affected Federal agencies. These experimental STAs are valid for a single launch and expire after six months. The STAs have included pre-launch communications operations and communications with the space launch vehicle and payload during orbital and reentry phases of the operations. These STAs are issued with the condition that any future launches by the grantees would be considered on a case-by-case basis and that there is no expectation that experimental STAs for future launches would be approved.

7. In a 2013 *Notice of Proposed Rulemaking and Notice of Inquiry (NPRM)*, the Commission proposed to provide a primary allocation of spectrum in the three aforementioned bands for non-Federal use during space launches.<sup>21</sup> The *NPRM*:

- sought comment on adding a primary non-Federal Aeronautical Mobile allocation in the 420-430 MHz band to the U.S. Table to permit non-Federal entities to transmit self-destruct signals (*i.e.*, flight termination signals) from ground controllers to launch vehicles, when necessary;<sup>22</sup>
- made alternative proposals to either 1) add a footnote to the U.S. Table that would provide for a primary non-Federal Space Operation allocation in the 2200-2290 MHz band or 2) amend the U.S. Table by adding a primary non-Federal Space Operations allocation in the 2200-2290 MHz band. Either alternative proposal would limit non-Federal space operation service allocations to portions of the 2200-2290 MHz band for launch telemetry, *i.e.*, the 2207-2219 MHz, 2270.5-2274.5 MHz, and 2285-2290 MHz portions of the band;<sup>23</sup> and
- made alternative proposals to either 1) add a footnote to the U.S. Table that would provide a primary non-Federal Radiolocation allocation in the 5650-5925 MHz band or 2) amend the U.S. Table by adding a non-Federal Radiolocation allocation in the 5650-5925 MHz band. Under either alternative proposal, use of the allocation would be limited to transmission of radar signals to track launch vehicles.<sup>24</sup>

8. In addition to proposing to add non-Federal allocations in these three bands to support space launches, the *NPRM* also proposed to add either a Federal Fixed Satellite Service (FSS) or Mobile

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<sup>20</sup> NTIA regulates the use of spectrum with Federal allocations and the Commission regulates use of spectrum with non-Federal allocations. Generally, if there is no non-Federal radio service allocation for a frequency band, non-Federal stations may not operate in that band. However, the Commission may authorize non-Federal users to use Federal frequencies on a non-interference basis in bands with only Federal allocations after coordination with NTIA. *See* 47 CFR § 2.102(c).

<sup>21</sup> *Space NPRM*, 28 FCC Rcd at 6727-31, paras. 76-87. The *NPRM* alternatively proposed to add these allocations to the Allocation Table instead of providing the allocations using a footnote to the Allocation Table. *Id.* at 6727-28, 6731, paras. 78, 79, 87.

<sup>22</sup> *Space NPRM*, 28 FCC Rcd at 6727-28, para. 78.

<sup>23</sup> *Space NPRM*, 28 FCC Rcd at 6728, para. 79. The Space Operation Service is a radiocommunication service concerned exclusively with the operation of spacecraft, in particular space tracking, space telemetry, and space telecommand. 47 CFR § 2.1.

<sup>24</sup> *Space NPRM*, 28 FCC Rcd at 6731, para. 87.

Satellite Service (MSS) allocation or a footnote to allow Federal access to several frequency bands for satellite services that currently only support commercial satellite systems.<sup>25</sup> In 2006, NTIA filed a petition requesting that the Commission “initiate a rulemaking to amend the National Table of Frequency Allocations to permit all Federal earth stations to have primary status with other services when using non-Federal satellites” in a number of frequency bands currently allocated for the non-Federal FSS and the non-Federal MSS on a primary basis.<sup>26</sup> Earth stations authorized by NTIA must currently operate on a non-interference basis to non-Federal services in these bands. NTIA requested that “this allocation should be patterned after US319 of the National Table, which allows mobile-satellite service communications between Federal earth stations and non-federal space stations.”<sup>27</sup> The Federal Table, for example, can be modified to add a primary FSS allocation along with a footnote that would restrict primary Federal use of these bands to Federal earth stations accessing non-Federal satellites.

9. The *NPRM* also addressed a 2012 NTIA request to change a footnote in the U.S. Table to enable Federal space stations to operate in the 399.9-400.05 MHz MSS band.<sup>28</sup> The footnote restricts Federal earth stations in the band to communicating only with non-Federal space stations. According to NTIA, removing this restriction will allow some applications to be shifted from the Argos satellite system operated by the National Oceanic and Atmospheric Administration (NOAA) to a new satellite network in the 399.9-400.05 MHz band.<sup>29</sup>

10. The *Notice of Inquiry (NOI)* sought comment broadly on the future spectrum needs of the commercial space sector.<sup>30</sup> The Commission received fifteen comments and four reply comments in response to the *NPRM* and *NOI*.<sup>31</sup>

### III. REPORT AND ORDER

11. We adopt a footnote to the Allocation Table for specified frequencies in the 2200-2290 MHz band to support commercial space launches and enable continued growth of a vibrant commercial space industry. This allocation shall be limited to use by space operations for the telemetry, tracking, and telecommand operations of launch vehicle or spacecraft during pre-launch testing and space launch operations.

12. The 2200-2290 MHz band is used for launch telemetry—*i.e.*, sending diagnostic information from the space launch vehicle to ground controller stations during the launch to allow tracking of the performance of the launch vehicle. The *NPRM* made two alternative proposals for

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<sup>25</sup> *Space NPRM*, 28 FCC Rcd at 6716-17, paras. 43, 47.

<sup>26</sup> Petition for Rulemaking of the National Telecommunications and Information Administration, RM-11341, filed Aug. 4, 2006 ([NTIA Petition](#)).

<sup>27</sup> *Id.*

<sup>28</sup> See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, U.S. Department of Commerce, to Julius P. Knapp, Chief, Office of Engineering and Technology, July 10, 2012, ET Docket 13-115 (*NTIA US319 Letter*).

<sup>29</sup> *Id.*

<sup>30</sup> *Space NPRM*, 28 FCC Rcd at 6731-32, paras. 88-90.

<sup>31</sup> We received comments from the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), Aerospace Industries Association, Bigelow Aerospace, LLC (Bigelow), Boeing Company (Boeing), Commercial Spaceflight Federation (CSF), Comsearch, EchoStar Satellite Operating Corp. and Hughes Network Services, LLC (EchoStar), Fixed Wireless Communications Coalition (FWCC), Lockheed Martin Corp. (Lockheed), Marcus Spectrum Solutions (Marcus), New Mexico Spaceport Authority (NMSA), Orbital Sciences Corporation (now Northrop Grumman), Satellite Industry Association, Space Exploration Technologies (SpaceX), and XCOR Aerospace. We received reply comments from Boeing, Engineers for the Integrity of the Broadcast Auxiliary Services Spectrum, FWCC, and the Satellite Industry Association.

providing access to this band for launch telemetry use.<sup>32</sup> Under the first proposal, the Commission would add a footnote to the U.S. Table providing primary non-Federal Space Operation service allocations to portions of the 2200-2290 MHz band. This footnote would require successful coordination of the assignment and use of the band for space launch operations with NTIA; restrict non-Federal use of the band to pre-launch testing and launches at Federal ranges; limit non-Federal transmissions to the 2207-2219 MHz, 2270.5-2274.5 MHz, and 2285-2290 MHz portions of the band; and limit non-Federal use of the band to channel bandwidths less than 5 megahertz by launch vehicles. Under a second proposal, we would amend the U.S. Table to add a primary non-Federal Space Operation service allocation to the 2200-2290 MHz band. This allocation would be accompanied by a footnote to the U.S. Table with the same restrictions specified in the footnote proposed in the first alternative. The *NPRM* also asked whether there is sufficient spectrum available to support the growth of the commercial launch industry.<sup>33</sup>

13. The 2200-2290 MHz band is currently allocated on a primary basis to multiple services for Federal use and is widely used. The only permitted non-Federal use of the band is for stations in the space research, space operation, and Earth exploration-satellite services to transmit to NASA's Tracking and Data Relay Satellite System (TDRSS) on a non-interference basis.<sup>34</sup> According to NTIA, the 2200-2290 MHz band is heavily used by the Department of Defense (DoD) and other agencies and these uses are vital for mission-critical systems.<sup>35</sup> NTIA emphasizes that use of the band during commercial launches must be carefully coordinated to protect these Federal operations and suggests that the commercial space launch industry be limited to four frequency segments to facilitate this coordination. Because of the importance of Federal systems in the band, NTIA supports adding a secondary non-Federal space operations allocation to this band instead of the proposed primary allocation.<sup>36</sup> As the private sector began to participate in launch activities, companies needed access to spectrum to facilitate communications associated with launch activities, a need that has continued to increase in recent years. The STA mechanism that the Commission and NTIA have used to provide access to the 2200-2290 MHz band during launches is not ideal to handle the increased volume of commercial space launch activities because applicants are often required to file multiple STAs for a single launch and the STAs expire after six months.<sup>37</sup> STA requests are coordinated with NTIA manually, through e-mail, whereas other non-Federal applications requiring coordination are processed through the Office of Engineering and Technology's Frequency Assignment System (OFACS). In the *NPRM*, the Commission tentatively concluded that creating a non-Federal allocation for this band would be preferable to continuing to issue STAs on a launch-by-launch basis because licenses would better support the forecasted increased number of commercial launches in the future.<sup>38</sup> Accordingly, in the *NPRM* the Commission invited comment on adopting such allocation, as a first step towards establishing rules that would allow for issuing licenses to

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<sup>32</sup> *Space NPRM*, 28 FCC Rcd at 6728, para. 79.

<sup>33</sup> *Space NPRM*, 28 FCC Rcd at 6728, para. 81.

<sup>34</sup> 47 CFR § 2.106 footnote US303.

<sup>35</sup> See *NTIA 2016 Letter* at 4.

<sup>36</sup> *Id.*

<sup>37</sup> An experimental STA allows operation only on a non-interference basis. Stations operating on a non-interference basis have no protection from and must not cause harmful interference to stations operating under a primary or secondary allocation. *Guidance on Obtaining Experimental Authorizations for Commercial Space Launch Activities*, Public Notice, DA 13-446, 28 FCC Rcd 2560 (2013). As of February 24, 2021, Space Exploration Technologies Corp. (SpaceX) had conducted 117 launches using STAs. A list of SpaceX launches can be found at <https://spacex-info.com/launch-list/>. Northrop Grumman, formerly Orbital ATK and Orbital Sciences Corporation, has conducted 14 launches. Lockheed Martin Corp. has also conducted a launch using an STA. SpaceX, Northrop Grumman, and Lockheed Martin did not apply for STAs for the 420-430 MHz band.

<sup>38</sup> *Space NPRM*, 28 FCC Rcd at 6724-25, para. 71.



commercial launch operators to permit their use of this spectrum band on an interference-protected basis.<sup>39</sup>

14. Although commenters disagreed as to whether a non-Federal allocation is warranted or whether continued reliance on STAs is acceptable, all commenters agreed that access to this band for telemetry during launches is necessary. The Commercial Spaceflight Federation expressed the importance of access to this band on a co-primary basis for launch telemetry and pointed out that allocating spectrum even on a secondary basis can eliminate the unnecessary STA process.<sup>40</sup> A coalition of several space launch providers asserted that they must make one or more requests for STAs for every launch and reentry because no spectrum is currently allocated for these purposes, even on a secondary basis.<sup>41</sup> SpaceX supports the first proposal to add a footnote to the U.S. Table providing a primary non-Federal allocation with the understanding that such a Table footnote is the legal equivalent of a Table allocation, while the Commercial Spaceflight Federation and XCOR have no preference between the two proposals.<sup>42</sup> Blue Origin prefers adding a non-Federal co-primary allocation to the band.<sup>43</sup> SpaceX states that it will need an additional 4 megahertz of bandwidth beyond what is provided in the proposals to support operations of its heavy lift launch vehicles.<sup>44</sup> Orbital ATK favors adding non-Federal allocations in the band at 2225.5 MHz, 2241.5 MHz, 2259.5 MHz, 2269.5 MHz, and 2288.5 MHz.<sup>45</sup>

15. SpaceX states that the STA process is suboptimal as commercial space launches are occurring more frequently.<sup>46</sup> SpaceX explains that the STA process creates significant business planning challenges due to the lack of certainty regarding approval timing as it relates to the scheduled launch date as well as the inherent uncertainty of non-interference status.<sup>47</sup> Both SpaceX and the Commercial Spaceflight Federation note that applicants have no visibility into the coordination process.<sup>48</sup> According to SpaceX, implementing the proposed allocation will streamline licensing, reduce the amount of required coordination, and provide greater certainty regarding approvals.<sup>49</sup> Orbital Sciences (now Northrop

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<sup>39</sup> *Space NPRM*, 28 FCC Rcd at 6726-27, para. 74.

<sup>40</sup> Comments of Com. Spaceflight Fed'n, ET Docket No. 13-115, at 2 (Aug. 30, 2013) (Commercial Spaceflight Federation Comments); Letter from Karina Drees, President, Commercial Spaceflight Federation to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, 1 (filed Feb. 3, 2021).

<sup>41</sup> Letter from Audrey Powers of Blue Origin, Steve Lindsey of Sierra Nevada Corp., Caryn Schenewerk of Relativity Space, David Goldman of SpaceX to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, 1 (filed Jan. 28, 2021).

<sup>42</sup> SpaceX Comments at 9; Commercial Spaceflight Federation Comments 2; Comments of XCOR Aerospace, ET Docket No. 13-115, at 3 (May 22, 2013) (XCOR Comments). An additional suggestion by SpaceX — that the footnote provide that the licensee may request spectrum for multiple planned launches simultaneously — would be more appropriately considered as part of the Further Notice, and we invite SpaceX to raise its comments in that context. SpaceX Comments at 9.

<sup>43</sup> Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 17 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*).

<sup>44</sup> SpaceX Comments at 9.

<sup>45</sup> Letter from John L. Flynn, Counsel to Orbital Sciences Corp. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 2 (filed Feb. 6, 2014) (Orbital ATK Feb. 6, 2014 *Ex Parte*).

<sup>46</sup> SpaceX Comments at 6.

<sup>47</sup> SpaceX Comments at 6.

<sup>48</sup> SpaceX Comments at 6; Commercial Spaceflight Federation Comments at 2. As noted above, STAs are coordinated via e-mail. While the status of all non-Federal applications coordinated through OFACS is available on NTIA's web site, information on STA requests is not. See "Status of Non-Federal License Applications Being Coordinated via the IRAC", available at <https://www.ntia.gov/webcoord/>.

<sup>49</sup> SpaceX Comments at 8.

Grumman)<sup>50</sup> endorses the addition of a co-primary allocation to a subset of the frequencies in the relevant band to remedy the STA process shortcomings—notably, that communications can be interrupted at any time and that it takes a significant amount of time to obtain STAs.<sup>51</sup>

16. The Satellite Industry Association, Boeing, and Lockheed Martin argue that a non-Federal allocation in this band is unnecessary and that non-Federal launches currently enjoy *de facto* interference protection because they are coordinated with Federal frequency coordinators.<sup>52</sup> Boeing claims that a non-Federal allocation will not simplify Federal coordination in these bands because non-Federal users will not be empowered to interfere with Federal users except to the extent coordinated with a Federal spectrum coordinator.<sup>53</sup> Boeing suggests that once SpaceX gains experience with the current process, it will realize that the process provides reliable interference-free access to launch spectrum and that the current well-understood and effective system should not be abandoned without a clear, superior alternative.<sup>54</sup> Boeing also suggests that, instead of adding a non-Federal allocation, the Commission could adopt a U.S. Table footnote that provides that non-Federal stations may access the spectrum for launch operations without an allocation under the condition they may not cause harmful interference to Federal stations.<sup>55</sup>

17. We conclude that adopting a non-Federal secondary allocation for this band for use during commercial space launches will help meet the future needs of the growing commercial space industry. Adopting this new allocation is the first step in a process that will allow the Commission to adopt technical and other service rules to govern commercial launch operations which, in turn, will give operators more certainty with respect to spectrum use in these bands during commercial space launches. Access to spectrum under a more predictable, collaborative, and transparent regulatory process is important to the fledgling commercial space launch industry because of the large monetary investment required for each launch. By operating on a regular, licensed basis, commercial space operators will have certainty as to which frequency bands can be used for non-federal space launch operations, which will promote the advance planning and investment necessary for future space launch activities. Although there will be coordination with NTIA prior to each launch, we will continue to work with NTIA to facilitate efforts to streamline the coordination process to further improve certainty with respect to spectrum access. The need for reliable access to launch spectrum is becoming even more important as commercial launch operators shift beyond cargo supply activities into manned space missions. SpaceX recently completed a successful manned mission to the ISS and Boeing is developing a craft to take people to the ISS.<sup>56</sup> We also note that the current process of obtaining an STA places burdens on launch providers, which must prepare numerous duplicative applications. Significantly, SpaceX and Blue Origin, who have obtained dozens of STAs for spectrum in the 2200-2290 MHz band, favor an allocation

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<sup>50</sup> Northrop Grumman, *Northrop Grumman Completes Orbital ATK Acquisition, Blake Larson Elected to Lead New Innovation Systems Sector* (June 6, 2018), <https://news.northropgrumman.com/news/releases/northrop-grumman-completes-orbital-atk-acquisition-blake-larson-elected-to-lead-new-innovation-systems-sector>.

<sup>51</sup> Orbital ATK Feb. 6, 2014 *Ex Parte*, Attach. at 1-2.

<sup>52</sup> Comments of Satellite Indus. Ass'n, ET Docket No. 13-115, at 9-10 (Aug. 30, 2013) (Satellite Industry Association Comments); Comments of Boeing Co., ET Docket No. 13-115, at 7-9 (Aug. 30, 2013) (Boeing Comments); Comments of Lockheed Martin Corp., ET Docket No. 13-115, at 7 (Aug. 30, 2013) (Lockheed Comments).

<sup>53</sup> Reply Comments of Boeing Co., ET Docket No. 13-115, at 5 (Sept. 30, 2013) (Boeing Reply).

<sup>54</sup> Boeing Reply at 5; *see also* Reply Comments of Satellite Indus. Ass'n, ET Docket No. 13-115, at 4 (Sept. 30, 2013) (Satellite Industry Association Reply).

<sup>55</sup> Boeing Comments at 11-12 (Boeing's suggested footnote would resemble US303).

<sup>56</sup> NASA, *NASA Astronauts Launch from America in Historic Test Flight of SpaceX Crew Dragon* (May 30, 2020), <https://www.nasa.gov/press-release/nasa-astronauts-launch-from-america-in-historic-test-flight-of-spacex-crew-dragon>; Boeing, *CST-1000 Starliner*, <https://www.boeing.com/space/starliner/> (last visited Mar. 31, 2021).

in lieu of continued reliance on STAs.<sup>57</sup> As the U.S. commercial space industry continues to expand, we expect the burdens and uncertainties associated with continuing the current STA process would only increase.

18. We are not convinced by the claims of several commenters that there is no need for change because the current STA process provides *de facto* interference protection. While that may be the case today when there are still relatively few launches, there is no guarantee that the current approach is sustainable as the number of commercial launches increases. In 2012, there were only seven Federal Aviation Administration (FAA) licensed commercial launches; in 2020, there were 39 FAA-licensed commercial launches.<sup>58</sup> We expect that number will continue to increase. In addition, use of private spaceports located outside of the established Federal ranges do not fit the existing pattern we have established for issuing STAs. Thus, as the space launch landscape continues to evolve, the current *ad hoc* experimental licensing approach based on uncertain temporary authorizations becomes increasingly risky.

19. Adopting a non-Federal Space Operation allocation for the 2200-2290 MHz band will allow us to develop rules that meet the specific needs of the commercial space industry, rather than trying to stretch the experimental rules to meet these unique needs. There are several reasons for this. First, because the dynamics for frequency use during launch activities are now well established, they are no longer considered truly experimental and should be transitioned to a set of permanent rules to bring certainty to the process. Second, because of the nature of experimentation, which often involves transmitters that have not gone through the equipment approval process, the rules governing experimental use do not provide any long term sustainability or interference protection from allocated services. Third, we find that carving out a specific exemption from our experimental rules to provide interference protection for launch activities—as requested by Boeing, Lockheed Martin, and the Satellite Industry Association—could create confusion among licensees and is an inferior solution compared to providing an allocation and adopting service rules.<sup>59</sup> Fourth, because the experimental rules are not intended to cover long-term commercial enterprises and STAs are limited by the Communications Act to periods of no more than 180 days,<sup>60</sup> they are not suited to covering multiple launches over time. Thus, the current STA process cannot accommodate multiple launches over extended time periods as requested by Boeing, SpaceX, and Orbital ATK.<sup>61</sup>

20. As advised by NTIA, we are adopting a secondary Space Operation service allocation for the 2200-2290 MHz band rather than the primary allocation proposed in the *NPRM*.<sup>62</sup> Given that the use of this band necessitates close coordination with NTIA, adopting a secondary allocation for this band would accomplish many of the goals we sought to achieve with the proposed primary allocation. With a secondary allocation, we will be able to adopt service rules for use of the band and issue spectrum

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<sup>57</sup> SpaceX Comments at 6; Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 17 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*). Since 2016, Blue Origin has submitted 8 STA requests for these frequencies (*see* call signs WJ2XEB, WQ9XIF, WQ9XMB, WQ9XMD, WR9XIZ, and WR9XKN). SpaceX has submitted 11 STA requests for these frequencies (*see* call signs WJ2XYJ, WH2XUB, WF9XGI, WP9XLD, WQ9XHX, WQ9XPT, WJ2XNZ, and WI2XPL).

<sup>58</sup> Federal Aviation Administration, *Licensed Launches, Commercial Space Data*, [http://www.faa.gov/data\\_research/commercial\\_space\\_data/launches/?type=license](http://www.faa.gov/data_research/commercial_space_data/launches/?type=license) (last visited Mar. 31, 2021).

<sup>59</sup> Satellite Industry Association Comments at 11; Boeing Comments at 10; Lockheed Comments at 7-8.

<sup>60</sup> 47 U.S.C. § 309(f); 47 CFR § 1.931(a)(3), (b).

<sup>61</sup> Boeing Comments at 5-7; Boeing Reply at 6-7; SpaceX Comments at 6; Orbital ATK Feb. 6, 2014 *Ex Parte*, Attach. at 2.

<sup>62</sup> *NTIA 2016 Letter* at 4 (stating that “[t]his frequency band is heavily used by the Department of Defense and other agencies for vital, mission-critical systems and, if allocated for use during commercial space launches, must continue to be carefully coordinated. Moreover, in order to protect these existing and projected federal operations and facilitate coordination, non-federal access should be . . . on a secondary basis.” *Id.*

authorizations for space launch operations. This will reduce the uncertainty of the launch-by-launch STA process and provide well-defined technical rules that licensees can design their equipment to comply with. While individual launches will still need to be coordinated, once the service rules are adopted and applicants will no longer have to apply for STAs for each launch, a streamlined process that will save time and effort on the part of space launch operators, NTIA, and the Commission will be more achievable. We note that even if we had adopted a primary non-Federal allocation for this band, individual launches would still have needed to be coordinated because of the heavy existing Federal use of the band. Several commenters advocate adoption of a primary allocation claiming that it will lead to streamlined licensing, eliminate repeated licensing work, require less coordination, and provide greater certainty with respect to approvals.<sup>63</sup> The service rules we will be able to adopt under a secondary allocation should be able to provide these benefits to the same extent as rules adopted under a primary allocation. We defer further consideration of adopting a primary allocation for this band to the Further Notice of Proposed Rulemaking (FNPRM).

21. We believe that providing access to the spectrum by adding a footnote to the U.S. Table is a better alternative than establishing an allocation in the U.S. Table for these bands.<sup>64</sup> Adding a footnote instead of establishing an allocation is consistent with existing precedent that an allocation that is lightly used or highly restricted is implemented by using a footnote rather than placing in the U.S. Table. In this case, use of the band will continue to be restricted even as the U.S. commercial space industry continues to grow because of the need to coordinate with the Federal operations in the band. We note that either a direct table entry or footnote entry will provide future space operations licensees with equivalent status in the band.

22. Hence, we are implementing this secondary non-Federal Space Operation allocation by adding a footnote (US96) to the 2200-2290 MHz band in the U.S. Table. This footnote limits use of the allocation to use during pre-launch testing and during space launch operations; requires coordination with NTIA prior to each launch; and limits non-Federal use to the 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz portions of the 2200-2290 MHz band. The limitation to use during pre-launch testing and space launches is consistent with NTIA's advisement as well as the proposal in the *NPRM*.<sup>65</sup> Despite this limitation, the current use of the space operation allocation to enable access to TDRSS will continue to be permitted on a non-interference basis under the current allocation.<sup>66</sup> The requirement that the channel assignments be coordinated with NTIA was proposed in the *NPRM* and is necessary because of the existing Federal use of the band.<sup>67</sup>

23. The limitation on non-Federal use of the band to the 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz portions of the band was requested by NTIA.<sup>68</sup> The *NPRM* proposed that non-Federal use of the band be restricted to a slightly different set of subbands: 2207-2219

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<sup>63</sup> SpaceX Comments at 2,6; Bigelow Comments at 8,20; Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 14,16 (filed July 23, 2020); Letter from Robert Hurwitz, Rocket Lab, to Marlene Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 14 (filed July 31, 2020).

<sup>64</sup> This differs from Boeing's suggestion that access to the band for space launch telemetry be provided by a footnote that does not provide an allocation. Boeing Comments at 11-12.

<sup>65</sup> *NTIA 2016 Letter* at 4-5. While the U.S. Table footnote proposed in the *NPRM* could be read as permitting non-Federal use of the space operation allocation for uses other than pre-launch testing and launches, the discussion of the band in the *NPRM* is only directed at use of the band for telemetry during launches and for pre-launch testing. *Space NPRM*, 28 FCC Rcd at 6728-30, 6754, paras. 79-84, App. A (proposed 47 CFR § 2.106 USyyy).

<sup>66</sup> 47 CFR § 2.106 footnote US303.

<sup>67</sup> *Space NPRM*, 28 FCC Rcd at 6728, para. 79.

<sup>68</sup> *NTIA 2016 Letter* at 4.

MHz, 2270.5-2274.5 MHz, and 2285-2290 MHz.<sup>69</sup> SpaceX has indicated that its recent launches have used a set of frequencies that differ both from what was proposed in the *NPRM* and what is requested by NTIA.<sup>70</sup> Blue Origin states that it has used two frequencies that match NTIA's request and two that are different.<sup>71</sup> Boeing suggests that the Commission avoid identifying discrete portions of the 2200-2290 MHz band as available for non-Federal launches as non-Federal and Federal launch vehicles must be interoperable.<sup>72</sup> We identify the four portions of the 2200-2290 MHz band for non-Federal use, as specified by NTIA, but propose in the *FNPRM* that we consider extending the secondary allocation to the full 90 megahertz. We also note that until service rules are adopted, non-Federal use of even the four subbands will continue to require an STA. In the event that these portions of the band cannot be used for a particular launch, we are permitting other frequencies to be used on a case-by-case basis using the existing STA processes while considering in the *FNPRM* a more permanent solution. We note that launches precipitated by successful coordination with NTIA have been conducted using this spectrum for many decades. We see no indication that this legacy of successful coexistence between launch operations and Federal users cannot continue to thrive under the allocation we adopt today.

24. In addition, we will not add developmental testing to the permitted uses of the Space Operations allocation, as requested by SpaceX and the Commercial Spaceflight Federation.<sup>73</sup> As SpaceX admits, developmental testing is relatively infrequent and likely to occur at only a few discrete locations.<sup>74</sup> Such testing can, and should, be conducted under Part 5 experimental licenses.

25. When the Commission proposed allocating the three band segments in the 2200-2290 MHz band for commercial launch operations, it also invited comment on whether the spectrum in those band segments would be sufficient to support the expected growth of the commercial launch industry.<sup>75</sup> In its comments, SpaceX requests that we expand the lower sub-band proposed in the *NPRM* by 4 megahertz to meet the needs of future launches—*i.e.*, establish a 16 megahertz (2205-2221 MHz) band segment.<sup>76</sup> While we are cognizant that as launch technology continues to develop there may be a need for greater amounts of telemetry data which will require wider bandwidths, we decline to expand the band segments available for telemetry beyond those bands specified in the previous two paragraphs. Instead, we believe any need for wider bandwidths can be adequately met on a case-by-case basis using the STA process.<sup>77</sup>

26. Adopting a non-Federal allocation for the 2200-2290 MHz band, however, is only a first step in providing licenses for commercial launch operations. In the *FNPRM*, we propose non-Federal

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<sup>69</sup> *Space NPRM*, 28 FCC Rcd at 6728, para. 79.

<sup>70</sup> SpaceX indicates they have used sub-channels centered at 2232.5 MHz, 2247.5 MHz, 2255.2 MHz, 2272.5 MHz. They have also used a frequency centered at 2287.5 MHz to communicate with NASA's Tracking and Data Relay Satellite System. Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 8 (filed July 6, 2020).

<sup>71</sup> Blue Origin has used the 2202 MHz, 2250 MHz, 2211 MHz, and 2272.5 MHz frequencies. Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 9 (filed July 23, 2020).

<sup>72</sup> Boeing 3-15-16 ex parte at 2

<sup>73</sup> Commercial Spaceflight Federation Comments at 2; SpaceX Comments at 5, 8.

<sup>74</sup> SpaceX Comments at 5.

<sup>75</sup> *Space NPRM*, 28 FCC Rcd at 6729, para. 82.

<sup>76</sup> SpaceX Comments at 9.

<sup>77</sup> *NTIA 2016 Letter* at 4-5 (Noting that the four specified channels align with the necessary bandwidth restrictions in Section 8.2.41 of the *NTIA Manual*. Section 8.2.41 provides that bandwidths of greater than 5 MHz can be used in the 2200-2290 MHz band with justification). NTIA also suggested that "relaxed technical restrictions, and other parameters can be considered." *Id.* at 5.

allocations for three more bands and we seek comment on appropriate service rules for each band that will enable spectrum sharing between Federal users and commercial space operators. We fully intend that the important Federal operations in these bands will be protected when introducing a new licensing regime to accommodate existing and future non-Federal launch activities. Until service rules for these bands are adopted, we will continue to accept and process STA applications to approve and authorize commercial space launch activities. A separate STA will continue to be required for each launch and the Commission will coordinate these STAs with NTIA prior to each launch.

27. *Use of spectrum other than 2200-2290 MHz for launch telemetry.* The *NPRM* pointed out that three frequencies in the 2360-2395 MHz band are “available for both Federal and non-Federal use for telemetry and telecommand of launch and reentry vehicles.”<sup>78</sup> The *NPRM* sought comment on the use of these and other frequencies as an alternative to the 2200-2290 MHz band for communications during launches.<sup>79</sup> The *NPRM* also noted that the 2360-2395 MHz band is primarily used for aeronautical telemetry and telecommand operations for flight testing of aircraft and missiles and sought comment on whether the current and expected future use of the 2360-2395 MHz band for aeronautical telemetry for flight testing make it unsuitable for communications associated with launch activity.<sup>80</sup> SpaceX, the Aerospace Industries Association, Boeing, the New Mexico Spaceport Authority, and the Commercial Spaceflight Federation assert that the 2360-2395 MHz band is not an appropriate alternative for telemetry because of the additional cost of supporting different frequency bands depending on whether a launch is Federal or non-Federal.<sup>81</sup> Orbital ATK claims that using this band would require the Federal launch ranges to modify their equipment and would require Orbital ATK to replace radios costing millions of dollars.<sup>82</sup> The Aerospace and Flight Test Radio Coordinating Council (AFTRCC) questions whether there is a demand for the frequencies in the 2360-2395 MHz band for launch telemetry, and it notes that the spectrum requirements for flight test in the band have changed dramatically since frequencies in the band were made available for space launch telemetry.<sup>83</sup> The Commercial Spaceflight Federation supports keeping the 2360-2395 MHz band available for space launch telemetry as an alternative to 2200-2290

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<sup>78</sup> *Space NPRM*, 28 FCC Rcd at 6729-30, para. 83; 47 CFR § 2.106 footnote US276; 47 CFR § 87.303(d)(1); *Amendment of the Frequency Allocation and Aviation Services Rules (Parts 2 and 87) to Provide Frequencies for Use by Commercial Space Launch Vehicles*, GEN Docket No. 89-16, Report and Order, 5 FCC Rcd 493, 495, para. 15 (1990) (*Space Launch R&O*); *Establishment of Rules and Policies for the Digital Audio Radio Service in the 2310-2360 MHz Frequency Band*, IB Docket No. 95-91, GEN Docket No. 90-357, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754, 5805-06, paras. 124-26 (1997); *Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range*, ET Docket No. 02-305, Report and Order, 18 FCC Rcd 23426, 23441-43, paras. 37-40 (2003); *Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 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*, CG Docket No. 06-181, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 14598, 14623, para. 57 (2012); *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*, ET Docket Nos. 12-338, 15-99, IB Docket No. 06-123, Report and Order, Order, and Notice of Proposed Rulemaking, 30 FCC Rcd 4183, 4211, para. 65 (2015). These frequencies have been available since 1990.

<sup>79</sup> *Space NPRM*, 28 FCC Rcd at 6729-30, para. 83.

<sup>80</sup> *Id.*

<sup>81</sup> Comments of Aerospace Indus. Ass'n, RM-11341, at 4 (Aug. 30, 2013) (Aerospace Industry Association Comments); SpaceX Comments at 10-11; Commercial Spaceflight Federation Comments at 2; Comments of New Mexico Spaceport Auth., ET Docket No. 13-115, at 4-5 (Aug. 28, 2013) (New Mexico Spaceport Authority Comments); *cf.* Boeing Comments at 14-15.

<sup>82</sup> Orbital ATK Feb. 6, 2014 *Ex Parte*, Attach. at 2.

<sup>83</sup> Comments of Aerospace & Flight Test Radio Coordinating Council, ET Docket No. 13-115, at 2 (Aug. 30, 2013) (AFTRCC Comments).

MHz, rather than as a replacement.<sup>84</sup> Blue Origin views use of the 2360-2395 MHz band as an addition to the 2200-2290 MHz band and states that it would evaluate use of the band for future architectures that require additional transmitters.<sup>85</sup> However, XCOR, which does support adding an allocation to 2200-2290 MHz, strongly encourages use of the 2360-2395 MHz band for commercial launch requirements because it would be able to use the same antenna for the nearby 2312.5 and 2352.5 MHz frequencies that it has been examining for telemetry use.<sup>86</sup> In the *FNPRM*, we seek comment on the technology development for the 2360-2395 MHz band.

28. We conclude based on the record that other bands are not suitable alternatives to the 2200-2290 MHz band for telemetry to support space launch operations. No commenters supported use of 2360-2395 MHz as a replacement for the 2200-2290 MHz band. The increasing use of the 2200-2290 MHz band for space launch telemetry justifies the allocation we are adopting. Allowing access to the 2200-2290 MHz band for commercial space launches will allow space launch providers to benefit from the economies of scale inherent from using the same radio systems for both Federal agencies and commercial customers. Requiring commercial space launches to use another band, such as 2360-2395 MHz, would require space launch providers to develop separate communications systems for use depending on whether the space launch operation they are conducting is considered a Federal or non-Federal launch. Such an approach would impose considerable burden on the nascent commercial space launch industry, undermining the United States' leadership on space-based services.

29. *No Restriction to use at Federal Ranges.* The *NPRM* proposed restricting the non-Federal Space Operation allocation for the 2200-2290 MHz band to use at Federal ranges.<sup>87</sup> Federal ranges are designated areas over which rocket and missile launches occur. These ranges are typically located over sparsely populated areas or over the ocean, and they have a designated launch site and associated radar tracking facilities. This proposal would limit use of the allocation to Federal launch ranges, such as the eastern range, which extends eastward over the Atlantic Ocean from Cape Canaveral.<sup>88</sup> The *NPRM* stated that this restriction would limit the potential for interference to Federal operations to a few locations, and it asked whether this restriction would unduly limit the growth of the commercial space launch industry.<sup>89</sup>

30. All industry commenters who addressed this issue opposed the restriction to Federal launch ranges. The New Mexico Spaceport Authority is concerned that this restriction may prevent access to spectrum for launches at FAA-licensed commercial launch sites and argues that limiting use of this band to Federal ranges would be inconsistent with the National Space Policy.<sup>90</sup> SpaceX claims to be

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<sup>84</sup> Commercial Spaceflight Federation Comments at 2.

<sup>85</sup> Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 20 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*).

<sup>86</sup> XCOR Comments at 3. XCOR has ceased operations. Jeff Foust, *XCOR Aerospace filed for bankruptcy*, SpaceNews (Nov. 9, 2017), <https://spacenews.com/xcor-aerospace-files-for-bankruptcy/>.

<sup>87</sup> *Space NPRM*, 28 FCC Rcd at 6728-29, paras. 79, 82.

<sup>88</sup> NASA, *What is the "Range?"*, [https://www.nasa.gov/centers/kennedy/home/eastern\\_range.html](https://www.nasa.gov/centers/kennedy/home/eastern_range.html) (last visited on Mar. 31, 2021).

<sup>89</sup> *Space NPRM*, 28 FCC Rcd at 6729, para. 82.

<sup>90</sup> New Mexico Spaceport Authority Comments at 3; Office of Space Commerce, *National Space Policy* <https://www.space.commerce.gov/policy/national-space-policy/#:~:text=On%20December%209%2C%202020%2C%20President,all%20United%20States%20space%20activities.&text=The%202020%20National%20Space%20Policy,on%20our%20Space%20Policies%20page> (last visited Mar. 31, 2021).

pursuing a launch site that is not in a Federal range.<sup>91</sup> The New Mexico Spaceport Authority and SpaceX suggest permitting use of the spectrum at both Federal ranges and FAA-licensed launch sites.<sup>92</sup> Blue Origin would not be able to operate its New Shepard launch vehicle in its current configuration with the Federal range limitation, because it launches from a private site in West Texas that is not an FAA-licensed launch site and is not co-located with a Federal range.<sup>93</sup> NTIA has requested that non-Federal use of the 2200-2290 MHz band be limited to use during space launches and pre-launch testing at Federal ranges and FAA-licensed launch sites.<sup>94</sup>

31. We will not restrict the locations where the new non-Federal allocation for the 2200-2290 MHz band may be used. We recognize that as the commercial space industry continues to develop, launches will likely not be limited to Federal ranges, and, consequently, we do not believe it would be in the public interest to limit future non-Federal space launch operations to Federal ranges. We also will not adopt the alternative suggested by NTIA and some commenters that we limit use of this non-Federal allocation to FAA-licensed launch sites. As the FAA does not require that all launches be conducted at locations where it has issued a launch site license, restricting use of the allocation to launches at FAA-licensed launch sites would prevent some launch providers from obtaining a license for this spectrum band.<sup>95</sup> Regardless of where a launch occurs, we will require coordination with NTIA. However, because of the expense involved in constructing a launch site and the need to conduct launches at remote locations because of safety concerns, we expect the number of locations where launches will occur to remain small. Consequently, our decision should not significantly increase the burden on NTIA and Federal agency coordinators.

32. *420-430 MHz and 5650-5925 MHz Bands.* The *NPRM* also proposed new non-Federal allocations for the 420-430 MHz<sup>96</sup> and 5650-5925 MHz bands.<sup>97</sup> However, in recent *ex parte* submissions, several commercial space launch providers have indicated that they do not use either of

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<sup>91</sup> SpaceX Comments at 7-8; Kyle Arnold, *SpaceX Expects Texas Site to Launch Humans to the Moon and Mars*, Dallas Morning News (Sep. 29, 2019), <https://www.dallasnews.com/business/2019/09/29/spacex-expects-texas-site-to-launch-humans-to-the-moon-and-mars/>. XCOR Aerospace, which has since ceased operations, indicated that they operate primarily off of Federal ranges. XCOR Aerospace Comments at 4; Mark Harris, *The Short Life and Death of a Space Tourism Company*, Air & Space Magazine (Dec. 2017), <https://www.airspacemag.com/space/fate-of-the-lynx-180967118/>. Boeing also suggests consideration of non-Federal facilities is appropriate. See Boeing Comments at 8.

<sup>92</sup> SpaceX Comments at 8; New Mexico Spaceport Authority Comments at 4.

<sup>93</sup> Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 18 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*).

<sup>94</sup> Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information, Department of Commerce, to Tom Wheeler, Chairman of the Federal Communications Commission, ET Docket 13-115, at 4-5 (filed Sept. 30, 2016) (*NTIA 2016 Letter*).

<sup>95</sup> The FAA has issued licenses for launches to occur at three locations referred to as “exclusive use sites,” where there is no launch site operator license. Federal Aviation Administration, *Spaceport Licenses*, [https://www.faa.gov/space/licenses/spaceport\\_license/](https://www.faa.gov/space/licenses/spaceport_license/) (last visited Mar. 31, 2021). The FAA has issued launch site operator licenses for Cape Canaveral Air Force Base, Vandenberg Air Force Base, and Wallops Flight Facility — all of which are associated with active Federal launch ranges — as well as for launch sites not associated with Federal installations, such as Spaceport America in New Mexico. The FAA has issued twelve launch site operator licenses in total. Federal Aviation Administration, *Active Licenses*, [https://www.faa.gov/data\\_research/commercial\\_space\\_data/licenses/](https://www.faa.gov/data_research/commercial_space_data/licenses/) (last visited Mar. 31, 2021).

<sup>96</sup> *Space NPRM*, 28 FCC Rcd at 6727-28, paras. 76-78.

<sup>97</sup> *Space NPRM*, 28 FCC Rcd at 6730-31, paras. 85-87.



these bands for their operations.<sup>98</sup> The Commission has never granted an STA for the 420-430 MHz band for space launches. In the past several years only one operator has obtained STAs for a small number of launches for the 5650-5925 MHz band.<sup>99</sup> Given the limited current use of these bands during space launches, we are not convinced that there is need for new allocations for either band. Instead, we seek further comment on these proposed allocations in the *FNPRM* to determine the current need for these allocations.<sup>100</sup>

33. *Non-Federal Launch Definition.* The *NPRM* recognized that there can be confusion when trying to determine whether launch activity spectrum access requires authorization from NTIA or a license from the Commission.<sup>101</sup> Under the Communications Act, the Commission has authority to issue licenses for radio stations except those “belonging to and operated by the United States.”<sup>102</sup> The *NPRM* sought comment on how to determine whether a given launch is non-Federal or Federal for licensing purposes.<sup>103</sup> It asked whether factors such as the nature of the payload, the location of the launch, the provider of the launch vehicle, and FAA classification of the launch as commercial should be considered in making this determination.<sup>104</sup>

34. All commenters addressing this issue urge the Commission to consider all launches licensed by the FAA to be non-Federal.<sup>105</sup> SpaceX claims that none of the factors listed in the *NPRM* are conclusive and that relying on FAA licensing provides the most predictable standard.<sup>106</sup> Boeing and the Satellite Industry Association both point out the similarity between language in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA Manual or Redbook), focusing on who has “effective control” of the radio equipment, and the Commercial Space Launch Act’s definition of a commercial launch provider, which focuses on who has “primary control” of the launch.<sup>107</sup> The Aerospace Industries Association goes further by suggesting that the Commission not require any additional licensing for launches not licensed by the FAA.<sup>108</sup>

35. A threshold issue for deciding whether a Commission license is required is the Communications Act’s provision excluding radio stations “belonging to and operated by the United States” from the Commission’s jurisdiction.<sup>109</sup> If radio equipment used during a launch both belongs to and is operated by the United States Government, no Commission license is necessary.<sup>110</sup> Otherwise, a

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<sup>98</sup> See, e.g., Letter from Audrey Powers, Blue Origin, to Marlene Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 13 (filed July 23, 2020); Letter from Robert Hurwitz, Rocket Lab, to Marlene Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 10 (filed July 31, 2020).

<sup>99</sup> Northrup Grumman conducted two launches in 2019 and two in 2020 that made use of this band.

<sup>100</sup> See *infra* paras. 38-40, 54-58.

<sup>101</sup> *Space NPRM*, 28 FCC Rcd at 6725, para. 72.

<sup>102</sup> 47 U.S.C. § 305(a).

<sup>103</sup> *Space NPRM*, 28 FCC Rcd at 6726, para. 73.

<sup>104</sup> *Space NPRM*, 28 FCC Rcd at 6726, para. 73.

<sup>105</sup> Lockheed Comments at 8; Commercial Spaceflight Federation Comments at 1; SpaceX Comments at 7; Satellite Industry Association Comments at 12; Boeing Comments at 13; Aerospace Industries Association Comments at 5.

<sup>106</sup> SpaceX Comments at 7.

<sup>107</sup> Satellite Industry Association Comments at 11-12; Boeing Comments at 13 (referencing the NTIA Manual § 8.2.17 and 51 U.S.C. § 50101).

<sup>108</sup> Aerospace Industries Association Comments at 5.

<sup>109</sup> 47 U.S.C. § 305(a). See also 47 U.S.C. § 301.

<sup>110</sup> *Id.* Based on the record, there is not a clear answer as to how easy or difficult it has been in practice for parties to make this determination. See *Space NPRM*, 28 FCC Rcd at 6726, para. 73. To the extent that parties have

(continued....)

Commission license is required.<sup>111</sup> While launches that require FAA licensing might be expected to involve operation of non-Federal stations and require a Commission license,<sup>112</sup> our jurisdiction is defined in the Communications Act. The key determination under the Communications Act is whether the radio equipment at issue belongs to and is operated by the United States Government. Consistent with the Communications Act, all radio equipment supporting space launches require a Commission license or authorization prior to transmitting, unless such equipment “belong[s] to and [is] operated by the United States [Government].”<sup>113</sup>

36. *Orbital Debris Mitigation.* Two commenters addressed the issue of orbital debris mitigation. XCOR maintains that orbital debris mitigation associated with launch and reentry operations is the responsibility of the Secretary of Transportation, and that this responsibility has been delegated to the FAA.<sup>114</sup> SpaceX also encourages the Commission to defer to the FAA regarding orbital debris matters for commercial space transportation activities when it develops service rules following this rulemaking.<sup>115</sup> In light of the Commission’s ongoing proceeding regarding orbital debris, we will not address orbital debris mitigation in this proceeding, but any rules adopted in that context may be applicable to space launch operations.<sup>116</sup>

#### IV. FURTHER NOTICE OF PROPOSED RULEMAKING

37. In this *FNPRM*, we continue our efforts to support commercial space launch operations and federal use of commercial space services. Specifically, we propose to add a non-Federal allocation in the 2025-2110 MHz band to support such operations, and we seek further comment on adding non-Federal allocations for commercial space launch operations in the 420-430 MHz, 2200-2290 MHz, and 5650-5925 MHz bands. We further propose to adopt a licensing framework and a set of technical rules to govern space launch operations services in the 2200-2290 MHz band, as well as the other three bands if they are ultimately allocated for commercial space launch purposes. In addition, we seek comment on whether to amend any of the rules applicable to space launch operations in the 2360-2395 MHz bands. We seek comment on various licensing frameworks to authorize a variety of telemetry, tracking, and command operations between launch vehicles and ground stations during the initial launch and reentry phases of space launch operations. We also seek comment on whether there are additional measures that should be considered in order to facilitate radio-frequency licensing of certain other types of space launch operations that may be currently addressed through experimental licensing, including communications between launch vehicles and satellites and communications in connection with certain payload activities. Finally, we seek to refresh the record on the matter of expanding Federal use of certain non-Federal FSS and MSS bands, including removing the footnote restriction on federal earth stations accessing federal space stations operating in the 399.9-400.05 MHz band.

##### A. Non-Federal Allocations for the 420-430 MHz, 2025-2110 MHz, 2200-2290 MHz,

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difficultly evaluating whether one or both of the elements are met for particular launch situations, we encourage them to seek additional guidance from the Commission.

<sup>111</sup> 47 U.S.C § 301.

<sup>112</sup> The FAA’s regulations governing launches exclude launches “carried out by the United States Government on behalf of the United States Government.” 14 CFR § 400.2. The definition of “commercial provider” cited by the Satellite Industry Association and Boeing is in a different chapter of the U.S. code than the chapter containing the licensing requirements for commercial launches. The chapter pertaining to licensing of launches contains a separate definition section and does not use the term “commercial provider.” See 51 U.S.C. § 50902. Therefore, we are unconvinced as to the relevance of the definition of commercial provider to this issue.

<sup>113</sup> 47 U.S.C. § 305(a). See also 47 U.S.C. § 301.

<sup>114</sup> XCOR Comments at 3.

<sup>115</sup> SpaceX Comments at 11.

<sup>116</sup> *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020) (*Orbital Debris R&O and FNPRM*).

**and 5650-5925 MHz Bands**

38. *420-430 MHz Band.* The 420-430 MHz band is used during launches from Federal launch sites to transmit a flight termination signal to a launch vehicle, if necessary.<sup>117</sup> This signal will cause the launch vehicle to self-destruct if it goes off course and poses a danger to a populated area. The *NPRM* sought comment on whether the Commission should make a co-primary non-Federal Aeronautical Mobile allocation for the 420-430 MHz band and whether it should add a footnote to the U.S. Table restricting use of the allocation to self-destruct signals (*i.e.*, flight termination signals) during launches. The Commission has not received any STA requests for this band during space launches. This band is heavily used by Federal users, including the Department of Defense (DoD), for radiolocation applications.

39. The Commercial Spaceflight Federation notes that there has not been a need for this band by commercial companies because launches have occurred at government facilities which transmit the flight termination signals.<sup>118</sup> However, the Commercial Spaceflight Federation claims that, as launches increasingly occur at private spaceports, operators will need licenses for this band. The New Mexico Spaceport Authority agrees that commercial operators will want to operate their own flight safety systems.<sup>119</sup> SpaceX may need access to the band in the future.<sup>120</sup> Orbital ATK endorses adding a co-primary non-Federal allocation for 421 MHz rather than adding the allocation for the entire band.<sup>121</sup> Blue Origin takes no position on use of this band and indicates that it does not use this band during launches.<sup>122</sup>

40. We seek further comment on whether to adopt a footnote to the U.S. Table which adds a primary non-Federal Aeronautical Mobile allocation to the 420-430 MHz band, requires coordination of assignments with NTIA, and restricts use of the band to pre-launch testing of launch vehicles and sending flight termination signals to launch vehicles during launches.<sup>123</sup> Because launches to date have occurred at Federal ranges, access to this band by commercial launch providers has not been necessary. We expect this may change as companies transition towards using commercial launch sites in the future. Thus, adding this Aeronautical Mobile allocation may be critical for protecting the public during space launches. Because the intended use of this band is for safety-of-life applications, we propose to add the Aeronautical Mobile allocation on a primary basis so that its use will be on an interference-protected basis. Further, we propose to add this Aeronautical Mobile allocation for the entire 420-430 MHz band, rather than limit it to just 421 MHz as suggested by Orbital ATK, because we cannot predict what frequencies will be available at the future at launch sites. As NTIA permits range safety operations (*i.e.*, flight termination systems) across 420-450 MHz, should we expand the Aeronautical Mobile allocation to 420-450 MHz?<sup>124</sup> Regardless of the frequency range of the allocation, use of the band would need to be coordinated with NTIA. In this *FNPRM*, we also propose licensing and service rules for use of this band, should the Commission adopt this proposed allocation.

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<sup>117</sup> There is no Federal Mobile allocation for the 420-430 MHz band. 47 CFR § 2.106. However, the NTIA Manual provides that range safety operations may be authorized in the 420-450 MHz band. NTIA Manual § 8.2.54 (Policy on the Use of the Frequency Bands Between 406.1 and 450 MHz by Range Safety Operations).

<sup>118</sup> Commercial Spaceflight Federation Comments at 1.

<sup>119</sup> New Mexico Spaceport Authority Comments at 2-3.

<sup>120</sup> SpaceX Comments at 8.

<sup>121</sup> Orbital ATK Feb. 6, 2014 *Ex Parte*, Attach. at 2.

<sup>122</sup> Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 15 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*).

<sup>123</sup> We note that the 449.75-450.25 MHz is also available for space telecommand (Earth-to-space) at specific locations. See 47 CFR § 2.106 US87.

<sup>124</sup> NTIA Manual § 8.2.54.

41. While the U.S. Table does not have a Mobile allocation in the 420-430 MHz band, the International Table has a Mobile, except aeronautical mobile allocation, for all regions.<sup>125</sup> Therefore, aeronautical mobile use of the 420-430 MHz band is contrary to the International Table. Consequently, other countries may permit radio services in the band that are not compatible with aeronautical mobile use of this band. If we adopt an Aeronautical Mobile allocation for this band, do we need to place restrictions on use of the allocation to prevent harmful interference occurring to radio services in other countries? Such restrictions could include prohibition of operations near international borders, power limitations, or use of directional antennas to direct transmission away from international borders.

42. *2025-2110 MHz Band.* The *NPRM* addressed three frequency bands commonly used by commercial space launch entities at that time.<sup>126</sup> However, since the *NPRM* was adopted in 2013, the commercial space launch industry has also begun to use the 2025-2110 MHz band to transmit control signals to launch vehicles. The Commission has granted access to this band during space launches using STAs issued under its Part 5 experimental licensing rules.<sup>127</sup> We expect that use of this band by the commercial space launch industry will continue to grow in the future and that establishing a permanent allocation for these services will provide more reliable access to this band than the STA process. We therefore propose to amend the Allocation Table by adding a co-primary non-Federal space operation (Earth-to-space) allocation to the 2025-2110 MHz band.

43. The 2025-2110 MHz band is currently allocated for both Federal and non-Federal fixed and mobile uses.<sup>128</sup> The largest non-Federal use of the band is for the Broadcast Auxiliary Service (BAS) operating under Part 74 of the Commission's rules. BAS stations make it possible for television and radio stations to transmit program material from the site of a breaking news story or a major event to the studio for inclusion in a broadcast program.<sup>129</sup> BAS stations are also used to transmit programming material from a studio to the broadcasting transmitter or between television broadcast stations.<sup>130</sup> BAS shares the 2025-2110 MHz band with the Cable Television Relay Service (CARS) and the Local Television Transmission Service (LTTS), which "have technically and operationally similar stations[.]"<sup>131</sup> The Commission's rules encourage BAS, CARS, and LTTS users of this band to consult with local coordination committees in selecting their frequencies to avoid causing harmful interference with each other's operations.<sup>132</sup>

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<sup>125</sup> 47 CFR § 2.106.

<sup>126</sup> *Space NPRM*, 28 FCC Rcd at 6727-31, paras. 76-87.

<sup>127</sup> *See, e.g.*, Blue Origin Texas, LLC, Special Temporary Authorization, OET Experimental Licensing System File No. 0829-EX-CN-2017 (*Blue Origin STA*); Rocket Lab USA, Inc., Special Temporary Authorization, OET Experimental Licensing System File No. 0623-EX-ST-2020 (*Rocket Lab STA*).

<sup>128</sup> 47 CFR § 2.106.

<sup>129</sup> *Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules*, ET Docket No. 01-75, Notice of Proposed Rulemaking, 16 FCC Rcd 10556, 10557, para. 1 (2001).

<sup>130</sup> *Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules*, ET Docket No. 01-75, Notice of Proposed Rulemaking, 16 FCC Rcd 10556, 10557, para. 1 (2001).

<sup>131</sup> 47 CFR §§ 74.602(a), 78.18(a)(6), 101.803(b). In 2002, the Commission updated its rules to permit these three services to operate under consistent regulatory guidelines. *Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules*, ET Docket No. 01-75, Report and Order, 17 FCC Rcd 22979, 22980, para. 1 (2002).

<sup>132</sup> *Id.* 22986, n.23, 23004-05, para. 63; 47 CFR §§ 74.604(b), 74.638(c)(d), 78.36(c)(d), 101.803(b).

44. Since 2000, the 2025-2110 MHz band has been allocated for Federal space operation, space research, and earth exploration satellite services.<sup>133</sup> While these Federal allocations are co-primary, these uses in general are not allowed to constrain BAS, CARS, and LTTS deployment and must be coordinated with these non-Federal operations.<sup>134</sup> Federal use of these allocations continues to increase as Federal users seek to increase resiliency and deploy large constellations of smaller satellites. To date, sharing of this band between Federal operations and BAS, CARS, and LTTS users has been successful.

45. Federal primary fixed and mobile service allocations were added to the 2025-2110 MHz band in 2014.<sup>135</sup> Footnote US92 restricts Federal use of the band to the military services and places specific requirements upon federal systems to facilitate sharing of the band with incumbent Federal and non-Federal services. The military services' transition plans include the relocation of certain terrestrial systems from the 1755-1780 MHz band into the 2025-2110 MHz band.<sup>136</sup> The process of relocating Federal systems into the band is currently on-going.

46. Multiple commercial space launch operators either have used or have indicated that they plan to use the 2025-2110 MHz band to support their launch operations.<sup>137</sup> SpaceX has used this band to send command signals to the first stage of its Falcon 9 launch vehicle as it lands either on a recovery drone ship or on land.<sup>138</sup> Blue Origin has used this band to transmit command signals to its suborbital New Shepard launch vehicle and plans to use it in the future for orbital launches of its New Glenn launch vehicle.<sup>139</sup> Rocket Lab has used this band to conduct ground testing for its Electron Launch Vehicle and plans to use it in the future to command the third stage of its launch vehicles.<sup>140</sup> These operations have been conducted using STAs issued by the Commission under its Part 5 experimental rules. We expect that use of this band by the commercial space launch industry will continue to grow in the future. We seek comment on the projected future use of this band for space launch activities.

47. To support the commercial space launch industry, we propose to amend the Allocation Table by adding a co-primary non-Federal Space Operation (Earth-to-space) (space-to-space) allocation to the 2025-2110 MHz band. Given the heavy use of this band by BAS, CARS, and LTTS, and the increasing Federal use of the band, including for Federal space systems, these service rules will need to provide for coordination with these operations. As we expect the number of launches to continue to increase in the future, we believe that adopting this approach will be more feasible than relying on the current STA process. We seek comment on this allocation proposal.

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<sup>133</sup> *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, ET Docket No. 95-18, Second Report and Order and Second Memorandum Opinion and Order, 15 FCC Rcd 12315, 12320-22, paras. 14-16 (2000).

<sup>134</sup> 47 CFR §§ 2.106 US92, US346, US347.

<sup>135</sup> See 47 CFR § 2.106, footnote US92; *Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, GN Docket No. 13-185, Report and Order, 29 FCC Rcd 4610, 4689, para. 211 (2014).

<sup>136</sup> *Id.* at 4688-89, paras. 210-11.

<sup>137</sup> See, e.g., Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 3 (filed July 6, 2020) (SpaceX July 6, 2020 *Ex Parte*); Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 9, 11, 25 (filed July 23, 2020) (Blue Origin July 23, 2020 *Ex Parte*); Letter from Robert Hurwitz, Senior Legal Counsel, Rocket Lab, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 6 (filed July 31, 2020) (Rocket Lab July 31, 2020 *Ex Parte*).

<sup>138</sup> *SpaceX STA*.

<sup>139</sup> *Blue Origin STA*.

<sup>140</sup> Rocket Lab USA, Inc., Special Temporary Authorization, OET Experimental Licensing System File No. 0623-EX-ST-2020 (*Rocket Lab STA*).

48. We propose to allow use of the entire 2025-2110 MHz band without any restriction on where licensed launches may occur. We note that for the Space Operation allocation for the 2200-2290 MHz band, we considered whether the use of that spectrum should be restricted to launches at Federal ranges.<sup>141</sup> In addition, the Space Operation allocation we are adopting for the 2200-2290 MHz band for space launches restricts non-Federal space operations to specific portions of the band. Both of these restrictions were requested by NTIA to facilitate coordination with the existing Federal users of this bands. We seek comment on whether limiting launches to certain frequencies or locations is needed to facilitate coordination between non-Federal and Federal users. Should use of this band for space launches be limited to only portions of the band? Considering the restrictions placed on Federal uses of the band, should these same restrictions be placed on new non-Federal uses of the band? Are other restrictions also required to protect the incumbent and incoming Federal uses of the band? Is there any reason to restrict use of the band to launches conducted at specific locations such as at Federal ranges or FAA licensed launch sites given that we are not placing any such restrictions on use of the Space Operation allocation we are adopting for the 2200-2290 MHz band? Considering the Federal and non-Federal uses of the band, would it serve the public interest to adopt any of these restrictions? We note that many recent launches using this band have been conducted from either Federal ranges or FAA licensed launch sites. For example, SpaceX has launched from Cape Canaveral, Florida and Rocket Lab has conducted launch testing at Wallops Island, Virginia.<sup>142</sup> However, Blue Origin has launched from Van Horn, Texas, which is neither an FAA licensed launch site or at a Federal range.<sup>143</sup> Should use of the Space Operation allocation be limited to space launches or are there other kinds of space operation uses that may be appropriate for this band? Are there any other restrictions that are needed to facilitate sharing of the band between the non-Federal space operation service and the other users of the band, in particular BAS, CARS, and LTTS?

49. *2200-2290 MHz Band.* In addition to a Space Operation allocation, both the International Table and the Federal Table include a Mobile Service allocation allowing aeronautical mobile use. Would it serve the public interest to modify the non-Federal allocations for the 2200-2290 MHz band to include a Mobile Service allocation in this band to facilitate licensing of commercial space launch operations in the commercial space launch operations context? We note that three frequencies in the 2360-2395 MHz band are available for both Federal and non-Federal use for telemetry and telecommand of launch and reentry vehicles under a Mobile allocation and our Part 87 rules.<sup>144</sup> This use is identical to the launch vehicle telemetry for which space launch providers have obtained STAs for the 2200-2290 MHz band. To harmonize the allocation status and the applicable service rules of the 2200-2290 MHz and 2360-2395 MHz bands, it may be appropriate to adopt a Mobile allocation for the 2200-2290 MHz band in addition to the Space Operation allocation we have adopted. Therefore, we seek comment on whether we should add a non-Federal secondary Mobile allocation to the 2200-2290 MHz band. What are the benefits and costs of subjecting commercial space launch operations to both terrestrial mobile service and space operations regulatory frameworks? Do we need to define the boundary between, when and how mobile service rules or space operations rules apply to space launch operations, if both allocations together cover the operations? If so, would it serve the public interest to make this boundary depend on the stage of the launch vehicle—earlier or later stages? How do we define such stage boundaries? If we were to divide space launch operations into stages, how should we define space launch vehicles and whether such definition should include any spacecrafts caring payloads to their orbital locations? What are the domestic and international legal and policy ramifications of adopting such a clear dual allocation and service rules approach where the communications emanating from the same equipment would be considered under both terrestrial and space services allocations, and be regulated under one or the other, depending on the launch vehicle's position in its trajectory and distance from the

<sup>141</sup> *Space NPRM*, 28 FCC Rcd at 6728-29, paras. 79, 82.

<sup>142</sup> *SpaceX STA; Rocket Lab STA.*

<sup>143</sup> *Blue Origin STA.*

<sup>144</sup> *Space NPRM*, 28 FCC Rcd at 6729-30, para. 83; 47 CFR § 2.106 footnote US276; 47 CFR § 87.303(d)(1).

earth? Alternatively, should the Commission regulate a space launch vehicle's operations throughout its trajectory under a single rule part? Commenters should discuss how we can provide the most flexibility with the least regulatory burden while serving the public interest.

50. If we adopt a non-Federal secondary Mobile allocation, we propose to implement this allocation by modifying the footnote to the U.S. Table we have adopted to implement the Space Operation allocation in the 2200-2290 MHz band. Similar to the non-Federal space operations allocation, this mobile allocation footnote would restrict use of the band to pre-launch testing and space launch operations and require coordination of use of the band with NTIA prior to each launch. Are all of these restrictions appropriate for the Mobile allocation in this band? The Federal Mobile allocation for the 2200-2290 MHz band is currently restricted to line-of-sight use only, including aeronautical telemetry; excludes flight testing of manned aircraft; and prohibits the introduction of high-density mobile systems.<sup>145</sup> Would it be appropriate to adopt any of these limitations on use of the non-Federal Mobile allocation? Are any other limitations on use of the non-Federal Mobile allocation necessary?

51. The Space Operation Service is defined in the Commission's rules as being "concerned exclusively with the operation of spacecraft, in particular space tracking, space telemetry, and space telecommand."<sup>146</sup> As the non-Federal Space Operation allocation we have adopted in the Report and Order is limited to use for pre-launch testing and during space launch operations the use of this allocation is limited compared to what would normally be permitted under a Space Operation allocation. We seek comment on whether a greater range of non-Federal space operations should be permitted under the Space Operation allocation in this band—*i.e.*, should the restrictions we have placed on use of this allocation be modified, reduced, or eliminated? Expanding the scope of this allocation could be especially useful for permitting communication between spacecraft during orbital and suborbital missions. For example, SpaceX has used the 2200-2290 MHz band for communication between its Dragon spacecraft and the International Space Station.<sup>147</sup> As the commercial space industry continues to develop, the need for communication with and tracking of spacecraft is likely to increase. In considering modifying any restrictions on non-Federal use of this band, we must keep in mind the need to protect Federal operations in this band. How could permitting greater non-Federal space operations activities in the band be done while preventing harmful interference to Federal operations?

52. The non-Federal Space Operation allocation we have adopted for the 2200-2290 MHz band is limited by US96 to four subbands: 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz. Recent space launches that have accessed this band for telemetry using STAs have used different portions of the band than these four subbands.<sup>148</sup> The fact that the channels used for these launches were successfully coordinated with NTIA indicates that it may be possible to provide additional flexibility to space launch operators rather than limiting access to only these four subbands. To provide this flexibility, we propose to remove the restriction in US96 limiting use of the band for non-Federal space operations to the four subbands. Instead, under this proposal use of the Space Operation allocation during pre-launch testing and space launch operations could potentially occur in any portion of the 2200-2290 MHz band. Because of the heavy use that Federal agencies make of this band, use of this band for

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<sup>145</sup> 47 CFR § 2.106 Footnote 5.391.

<sup>146</sup> 47 CFR § 2.1.

<sup>147</sup> SpaceX July 6, 2020 *Ex Parte* at 8.

<sup>148</sup> SpaceX indicates they have used sub-channels centered at 2232.5 MHz, 2247.5 MHz, 2255.2 MHz, 2272.5 MHz. Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 8 (filed July 6, 2020). Blue Origin has used the 2202 MHz, 2250 MHz, 2211 MHz, and 2272.5 MHz frequencies. Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 9 (filed July 23, 2020). *See, e.g.*, Space Exploration Technologies Corp, Special Temporary Authorization, OET Experimental Licensing System File Nos. 1895-EX-ST-2020, 0126-EX-ST-2021, 0249-EX-ST-2021.

launches will need to be coordinated with NTIA. As Federal use of this band is likely to evolve over time, this coordination with NTIA will be necessary on a launch-by-launch basis.

53. While we are proposing to remove the limitation on use of the Space Operation allocation to four subbands, it may still be appropriate to place some limitations on the spectrum that may be used during launches because the band will be shared with Federal users. The subbands currently in US96 are each 5 megahertz wide with a total of 20 megahertz of spectrum potentially available for use for each launch. Should non-Federal use of this allocation be limited to channels with a necessary bandwidth of 5 megahertz as is currently required by US96? Should there be a limit on the total amount of spectrum available for use during a launch? If we place limitations on the bandwidth in each channel or total bandwidth per launch, should there also be a means for these limits to be waived if there is sufficient justification? If we leave in place the restriction on non-Federal use of the 2200-2290 MHz band to a limited set of subbands, should the subbands be adjusted to reflect the fact that recent launches have used channels outside of these subbands?

54. While the *NPRM* proposed that we adopt a primary Space Operation allocation for the 2200-2290 MHz band, we have instead adopted a secondary allocation. Several commenters advocate adoption of a primary allocation claiming that it will lead to streamlined licensing, eliminate repeated licensing work, require less coordination, and provide greater certainty with respect to approvals.<sup>149</sup> Although the secondary allocation we adopt is clearly preferable to the current STA process, adopting a primary allocation may nevertheless be the most appropriate long-term band management policy. Adopting a primary allocation would place commercial launch operators on an equal footing with other users of the band and provide greater certainty to incentivize investment as the commercial space industry continues to expand with more frequent launches, privately developed launch facilities, and manned space flights. Therefore, we seek comment on whether we should adopt a primary Space Operation allocation for the 2200-2290 MHz band. We note that even if we adopt a primary non-Federal allocation for this band, individual launches would still have to be coordinated with NTIA because of the heavy existing Federal use of the band.

55. *5650-5925 MHz Band.* The 5650-5925 MHz band is used for radar tracking of launch vehicles during launches.<sup>150</sup> This often involves placing a radar transponder on the launch vehicle, which responds to a ground-based radar signal that transmits tracking information back to the tracking station. Because launches in the past have occurred at Federal ranges, the radar tracking stations used during the launches have been Federal facilities. However, commercial launch providers have obtained experimental STAs for transponders on the launch vehicles that operate in the band.<sup>151</sup>

56. The *NPRM* made two alternate proposals for providing commercial entities access to this spectrum for radar tracking during launches. Under the first proposal, the *NPRM* proposed to add a footnote to the U.S. Table providing a primary non-Federal radiolocation service allocation.<sup>152</sup> The

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<sup>149</sup> SpaceX Comments at 2,6; Bigelow Comments at 8, 20; Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 14,16 (filed July 23, 2020); Letter from Robert Hurwitz, Rocket Lab, to Marlene Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 14 (filed July 31, 2020).

<sup>150</sup> See, e.g., Application for Special Temporary Authority of Orbital Sciences Corp., OET Experimental Licensing System File Nos. 0139-EX-ST-2012.

<sup>151</sup> See, e.g., Space Exploration Technologies Corp. (SpaceX), Special Temporary Authorization, OET Experimental Licensing System File Nos. 0334-EX-ST-2012, 0691-EX-ST-2012, 0072-EX-ST-2013; Orbital Sciences Corp., Special Temporary Authorization, OET Experimental Licensing System File Nos. 0139-EX-ST-2012, 0611-EX-ST-2012.

<sup>152</sup> The *NPRM* erroneously stated in one sentence that under the first proposal the primary allocation would be for portions of the 2200-2290 MHz band. *Space NPRM*, 28 FCC Rcd at 6731, para. 87. Given that the proposal appeared in a section titled “5650-5925 MHz” and that the second proposal stated the correct band, from the context it is clear that the Commission meant the 5650-5925 MHz band for this first proposal.



footnote would restrict use of the allocation to launches and pre-launch testing and would require coordination with NTIA. In a second proposal, the *NPRM* proposed to add a primary non-Federal radiolocation service allocation to the 5650-5925 MHz band with a footnote containing the same restrictions. The *NPRM* asked a number of questions concerning use of the band, such as the operational requirements for radar tracking during space launches, whether other radiolocation bands could be used, and if there are compatibility issues with Intelligent Transportation Systems that are primary in a portion of the band.<sup>153</sup>

57. In response to the 2013 *NPRM*, the Commercial Spaceflight Federation recommended adding a non-Federal allocation to the 5650-5925 MHz band, noting that the band is used by Federal radar facilities to track launches from government-owned facilities.<sup>154</sup> The New Mexico Spaceport Authority applauded the Commission in recognizing the potential to mix Federal and commercial equipment within one system or service and requests that the Commission design future regulations to promote interoperability between Federal and commercial systems.<sup>155</sup> The Aerospace Industries Association argued that no allocation is needed for the band, given that the band is used for radar tracking from the Federal launch range, which is managed by the range.<sup>156</sup> Orbital ATK endorsed adding a non-Federal allocation to the band at 5765 MHz.<sup>157</sup> No commenters who have discussed the needs of the commercial space industry with Commission staff in the past year have indicated an interest in using this band during space launches.<sup>158</sup> In recent years, only one licensee has obtained licenses for use of the 5650-5925 MHz band.<sup>159</sup>

58. We seek further comment on whether to adopt a non-Federal Radiolocation allocation for the 5650-5925 MHz band by adding a footnote to the U.S. Table. Should such an allocation be limited to use for pre-launch testing and tracking of launch vehicles? Radar transponders transmitting from commercial launch vehicles require licenses from the Commission, even if the vehicle is launched from a Federal or commercial launch site and tracked by a Federal ground-based radar tracking facility. As there currently is no non-Federal Radiolocation allocation for this band, the Commission issues experimental STAs to authorize operations in the 5650-5925 MHz band to support commercial launches. This case-by-case procedure may become more burdensome as the commercial launch industry grows. However, given the apparent low interest in this band for radar tracking during launches, there may be no need to adopt this allocation. Hence, we seek comment on the number of launches likely to need access to this band in the future. Given that recent STAs issued for use of this band have used only the 5758-5772 MHz portion of the band, should the allocation be limited only to a portion of the band? Should the allocation be

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<sup>153</sup> *Id.* The 5850-5925 MHz band has a non-Federal mobile primary allocation that is limited to the Intelligent Transportation System radio service. 47 CFR § 2.106 NG160. There is a primary non-Federal FSS allocation in the 5850-5925 MHz portion of the band that is limited to inter-continental satellite systems subject to a case-by-case compatibility analysis. 47 CFR § 2.106 US245.

<sup>154</sup> Commercial Spaceflight Federation Comments at 2.

<sup>155</sup> New Mexico Spaceport Authority Comments at 5.

<sup>156</sup> Aerospace Industries Association Comments at 5. SpaceX explicitly expresses no position regarding the band. SpaceX Comments at 2. SpaceX intends to move to an autonomous flight termination system which would eliminate the need to use the band. SpaceX Comments at 11.

<sup>157</sup> Orbital ATK Feb. 6, 2014 *Ex Parte*, Attach. at 2.

<sup>158</sup> Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 3 (filed July 6, 2020) (SpaceX July 6, 2020 *Ex Parte*); Letter from Audrey Powers, Vice President, Legal and Compliance, Blue Origin, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 9, 11, 25 (filed July 22, 2020) (Blue Origin July 23, 2020 *Ex Parte*); Letter from Robert Hurwitz, Senior Legal Counsel, Rocket Lab, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, Attach. at 6 (filed July 31, 2020) (Rocket Lab July 31, 2020 *Ex Parte*).

<sup>159</sup> See Northrop Grumman, Special Temporary Authorization, OET Experimental Licensing System File Nos. 2273-EX-ST-2019, 0611-EX-ST-2012.

primary or secondary? Should use of the band be limited to specific locations such as Federal ranges or FAA-licensed launch sites?

59. In addition to having an allocation for Federal radiolocation, the 5650-5925 MHz band is shared with other services. The 5850-5925 MHz band has a primary non-Federal Mobile allocation with use of this allocation in the 5895-5925 MHz band limited to the Intelligent Transportation System radio service.<sup>160</sup> Because launch facilities are generally not located near public roads and the signal emanates from high in the sky, ensuring a weak signal at ground level, we expect negligible, if any, impact on Intelligent Transportation Systems in the upper portion of the band. Is this expectation reasonable? If use of this band for space launches would impact Intelligent Transportation Systems in the upper portion of the band, are there specific accommodations we could take to minimize that impact? The 5650-5895 MHz band is currently used by Unlicensed National Information Infrastructure (U-NII) devices operating under the Commission's Part 15 rules.<sup>161</sup> U-NII devices operating in the 5650-5725 MHz portion of the band employ dynamic frequency selection (DFS) to detect the presence of radar signals to avoid causing interference.<sup>162</sup> Will DFS successfully enable coexistence between U-NII devices and space launch radars in this portion of the band? In the 5725-5850 MHz band, U-NII devices operate without the use of DFS. Are there steps the Commission could take to minimize interference between space launch radar operations and U-NII and ITS operations in the upper portion of the band? If interference between these operations is likely, should we limit this new radar allocation to the frequencies below 5725 MHz? The 5850-5925 MHz band is also allocated to the fixed-satellite service in the uplink direction with use limited to international, inter-continental systems.<sup>163</sup> Given the limited number of earth stations and limited number of launch sites, we expect that sharing would be feasible through coordination. We seek comment on this view.

#### **B. Licensing and Technical Rules for Space Launch Operations**

60. In this section, we propose to adopt rules for new non-Federal space launch operations. As an initial matter, we seek comment on how to define non-Federal "space launch operations." The STAs that we have granted in the 2200-2290 MHz band, for example, have included telemetry from the launch vehicle and the payload, during the initial space launch, the orbital phase (including docking with the ISS), and return and reentry of the space launch vehicle. If we were to cover communications needs during these operations, do these operations include all activities that may be needed for a successful commercial space launch operation? Would it serve the public interest to include all of these operations in the definition of "space launch operations"? Is there a need to limit or further expand the definition to include other space operations? We seek to establish rules that flexibly, efficiently, and effectively support the evolving spectrum requirements of commercial space launch operations while continuing to adequately protect vital Federal operations in the bands. In that regard, we seek comment on the appropriate licensing and technical rules to meet these goals. First, we seek comment on the appropriate licensing framework for the non-Federal space launch operations in the 2200-2290 MHz band, the proposed non-Federal space launch operations in the 420-430 MHz and 2025-2110 MHz bands, and the potential non-Federal launch tracking operations in the 5650-5925 MHz band. We also seek comment on which Commission rule parts should apply to different elements of space launch operations, and on how to integrate these various provisions to facilitate operations of space launch services, including potentially by creating a new stand-alone rule part. We propose and seek comment on specific licensing rules, such as rules governing scope of service, eligibility, license period, application processing rules, and coordination requirements, as well as technical rules that will foster interoperability of equipment used for

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<sup>160</sup> 47 CFR § 2.106 Footnote NG160.

<sup>161</sup> 47 CFR § 15.407. The Commission recently expanded U-NII rules to 5850-5895 MHz. *Use of the 5.850-5.925 GHz Band*, ET Docket No. 19-138, Report and Order, 35 FCC Rcd 13440, 13465-479, paras. 58-94 (2020)

<sup>162</sup> 47 CFR § 15.407(g)(2).

<sup>163</sup> 47 CFR § 2.106 Footnote US245.

non-Federal and Federal launches and rules regarding equipment authorization.<sup>164</sup> Finally, we seek comment on whether we should update any rules regarding space launch vehicle use of aeronautical telemetry in the 2360-2395 MHz band.

61. *Applicability of Certain Sections of Part 87 (Aeronautical Mobile).* Existing licensing and operating rules under Part 87 currently support commercial space launch operations in the 2360-2395 MHz band and offer an established regulatory approach.<sup>165</sup> The telemetry and telecommand uses identified for the non-Federal space launch operations in the 2200-2290 MHz band and the proposed non-Federal operations in the 420-430 MHz and 2025-2110 MHz bands are similar to space launch telemetry uses permitted in the non-Federal 2360-2395 MHz band, which are supported under Part 87, Subpart J flight testing rules. We seek comment regarding which rules under Part 87 would be the most appropriate model for non-Federal operations in the 2200-2290 MHz, 420-430 MHz, and 2025-2110 MHz bands, as well as associated telemetry and telecommand functions, and on the benefits and costs of applying such rules. In Appendix D, we set forth proposed Part 87 rules that could be applied to these operations in these bands, if the Part 87 model is adopted.

62. We note that the initial launch and reentry phases of a space launch operation share some, but not all, of the characteristics of conventional aviation services, specifically flight test and aeronautical mobile telemetry uses, which are regulated under Part 87. Space launch operations may need additional flexibility for communications with ground stations in the United States, abroad, in space, and in some instances with other space stations, including satellites. We also note that certain Part 87 licensing and operational rules, while relevant to conventional aviation services generally, may not be appropriate for space launch operations. We seek comment on whether there are Part 87 general licensing and technical rules that may not be applicable for purposes of developing a regulatory framework for commercial space launch operations.

63. *Applicability of Part 90 (Private Land Mobile).* With respect to launch vehicle radar tracking functions, we seek comment on administering the proposed 5650-5925 MHz band radiolocation

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<sup>164</sup> This section of the *FNPRM* addresses only telemetry, tracking, and command (TT&C) transmissions between ground stations and launch vehicles during launch and reentry phases of space operations. In subsequent sections, we address licensing communications between vehicles and satellites (such as space stations) and communications during the payload phase of space operations. This *FNPRM* does not address other potential launch-related radiocommunications uses, such as communications used for air traffic management.

<sup>165</sup> See 47 CFR § 87.303(d)(1). The 2.3 GHz allocation supporting non-Federal space launch telemetry and telecommand was adopted after national space policy changes in the 1980s, which shifted responsibility for launching non-Government payloads from Federal to non-Federal entities. The Commission concluded, with concurrence by NTIA, that the 2310-2390 MHz band was the most suitable at the time to support space launch telemetry and telecommand use and it identified six channels for such use. The Commission later reallocated portions of the aeronautical mobile telemetry band, which reduced the available commercial space launch spectrum to three frequencies in the 2360-2395 MHz band. See *Amendment of the Frequency Allocation & Aviation Servs. Rules (Parts 2 & 87) to Provide Frequencies for Use by Commercial Space Launch Vehicles*, GEN Docket No. 89-16, Report and Order, 5 FCC Rcd 493, 493, para. 2 (1990); *Establishment of Rules and Policies for the Digital Audio Radio Service in the 2310-2360 MHz Frequency Band*, IB Docket No. 97-91, GEN Docket No. 90-357, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754, 5805-06, paras. 124-26 (1997); *Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range*, ET Docket No. 02-305, Report and Order, 18 FCC Rcd 23426, 23441-43, paras. 37-40 (2003); *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*, ET Docket Nos. 12-338 and 15-99, IB Docket No. 06-123, Report and Order, Order, and Notice of Proposed Rulemaking, 30 FCC Rcd 4183, 4210-11, paras. 62-65 (2015); The White House, Office of the Press Secretary, Presidential Directive on National Space Policy (Feb. 11, 1988), [www.hq.nasa.gov/office/pao/History/policy88.html](http://www.hq.nasa.gov/office/pao/History/policy88.html).

allocation as part of the Radiolocation Service, which is currently regulated under Part 90.<sup>166</sup> In what phases of space launch operations is this radar tracking function needed? Are there any space launch operations phases, including orbital phases, that may require us to formulate additional radar tracking rules and, if so, what are those and why would they be needed? The radiolocation uses for the 5650-5925 MHz band differ from the aeronautical telemetry uses governed under the Part 87 rules. Because radiolocation operations are generally regulated under Part 90, we propose to apply the existing licensing framework to the 5650-5925 MHz radiolocation use. This would apply to ground stations as well as to associated transponders affixed to the space launch vehicle for tracking purposes. We seek comment on the benefits and costs of this proposal and on other possible licensing frameworks. Specifically, is Part 90 the appropriate licensing mechanism for ground stations and transponders affixed to the launch vehicle or should ground stations and associated transponders be licensed under Part 87?<sup>167</sup> In Appendix D, we set forth proposed Part 90 rules that could be applied to these operations in this band, if the Part 90 model is adopted.

64. *Applicability of Part 25 (Satellite).* The Part 25 rules provide for authorization of both space stations and earth stations.<sup>168</sup> Under Part 25, a “space station” is defined as a station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth’s atmosphere; “space radiocommunications” is defined as any radiocommunication involving the use of one or more space stations.<sup>169</sup> In addition, Part 25 includes a definition for “spacecraft” as a man-made vehicle which is intended to go beyond the major portion of the Earth’s atmosphere.<sup>170</sup> Given that space launch vehicles are intended to go beyond the major portion of the Earth’s atmosphere, safely deliver their payloads (typically satellites), and then reenter the atmosphere, we seek comment on the benefits and costs of applying the definition of space stations under Part 25 of our rules,<sup>171</sup> to radio communications stations on space launch vehicles. Additionally, some communications between launch vehicles and ground stations/earth stations<sup>172</sup> may be conducted consistent with our rules applicable to

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<sup>166</sup> See 47 CFR Part 90, subpart F. The Commission adopted Radiolocation Service rules under Part 90, Subpart F in 1978 as part of its effort to consolidate the rules governing the Private Land Mobile Radio Services. These rules were previously regulated under three separate rule parts, each of which contained similar and often identical requirements relating to general eligibility, application procedures, and technical and operational standards. The Commission adopted Part 90 rules to consolidate and streamline these requirements. See Federal Communications Commission, 43 FR 54791 (Nov. 22, 1978) (Private Land Mobile Radio Service Reregulation). See 47 CFR Part 90, Subpart F. The Radiolocation Service is used to operate stations that determine direction, speed, or position for purposes other than navigation. See 47 CFR §§ 90.101, 2.1(c). The Radiolocation Service bands are shared with, and operate on a secondary basis to, other fixed and mobile services. See 47 CFR § 90.103(c). Federal radiolocation systems include military radar systems used for defense purposes. Non-Federal radiolocation systems are used for a variety of commercial and industrial purposes, including doppler radars that provide weather information to broadcast viewers and security radars that provide service to critical infrastructure entities.

<sup>167</sup> We note that the existing Part 87 framework permits the use of surveillance radar and associated transponders in the 1330-1350 MHz band. See 47 CFR §§ 87.173, 87.187(o), 87.475(b)(8).

<sup>168</sup> Part 25 of our rules addresses satellite communications, except for experimental or amateur satellites. Part 5 of the Commission’s rules addresses experimental operations, which may include satellites, see 47 CFR § 5.64, and Part 97 addresses amateur operations, which may also include amateur space stations, see 47 CFR § 97.207. The majority of satellites, however, including commercial satellites, are authorized under Part 25.

<sup>169</sup> See 47 CFR § 25.103.

<sup>170</sup> *Id.* Aviation services, however, generally involve aircraft and are regulated under Part 87 of our rules. See e.g., 47 CFR § 87.5.

<sup>171</sup> See 47 CFR § 25.103.

<sup>172</sup> A ground station is an “earth station” if it is intended for communications with a space station. Under Part 25, an “earth station” is defined as a station located either on the Earth’s surface or within the major portion of the Earth’s atmosphere intended for communication with one or more space stations. 47 CFR § 25.103.

earth stations<sup>173</sup> and a space operations allocation in the U.S. Table of Frequency Allocations. We note that the Part 25 rules, including space station and earth station licensing processes, are designed to license spectrum use by commercial space services.<sup>174</sup> We seek comment on which Part 25 rules could be applied, or used as a model for, the licensing of a space launch vehicle's communications through its full trajectory, and on the benefits and costs of this approach.

65. *Integrating the Authorization of Space Launch Operations across Rule Parts.* We recognize that while a space launch operation may involve distinct telemetry, tracking, and command operations uses, it may be more practical to address all functions under a stand-alone rule part. Another option would be to create one or more subparts specifically to support commercial space launch telemetry, tracking, telecommand, and other communications needs of space launch operations. These subparts could establish the conditions under which frequencies would be licensed for use during a space launch. We seek comment on these approaches or on any alternate approaches. How can we facilitate reliable access to spectrum while meeting the changing communications needs of space launch operations during any point of a space launch vehicle's trajectory? We seek comment on the best way to authorize the use of the relevant spectrum bands to cover space launch operations, starting at the launch site through the launch vehicle's trajectory and until its final destination, including reentry, in a flexible, efficient, and effective manner. Commenters should discuss the costs and benefits of any licensing approach that they propose.

## 1. Licensing Rules for Space Launch Operations

### a. Scope of Service

66. In the *Report and Order*, we adopt a secondary allocation for the 2200-2290 MHz band to support the current level of commercial launches and enable the continued growth of the commercial space launch industry. Consistent with the *Report and Order*, we propose certain service rules for the 2200-2290 MHz band and for the additional bands discussed herein.

67. As noted, the non-Federal space operations allocation we have adopted for the 2200-2290 MHz band includes a restriction and limits pre-launch testing and space launch operations to the 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz subbands. Consistent with the current allocation, we seek comment on restricting the use of the 2200-2290 MHz band for pre-launch testing and space launch operations to these four subbands in our service rules. Contingent on the adoption of this proposal, we propose to permit licensees to use additional frequencies outside the four subbands upon adequate justification for why such additional frequencies are necessary and in the public interest, on a case-by-case basis. Any requirement for frequencies for use during launches will have to be balanced with the use of the band by Federal systems and coordinated with NTIA. As noted in the *Report and Order*, any use will be limited to the telemetry, tracking, and telecommand operations of launch vehicle or spacecraft during pre-launch testing and during space launch operations. In the *FNPRM* above, however, we also seek comment on whether to remove the allocation restriction limiting use of the 2200-2290 MHz band for non-Federal space operations to the four subbands, such that use of the Space Operation allocation during pre-launch testing and space launch operations could potentially occur in any portion of the 2200-2290 MHz band. Thus, we also seek comment on whether, to provide greater flexibility in spectrum use, we should remove any presumptive limitation to the four subbands in the service rules as well given that the use of any spectrum in the 2200-2290 MHz band would be separately coordinated for each launch.

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<sup>173</sup> For example, Section 25.102(a) of our rules states that “[n]o person shall use or operate apparatus for the transmission of energy or communications or signals by . . . earth stations except under, and in accordance with, an appropriate authorization granted by the Federal Communications Commission.” See 47 CFR § 25.102(a).

<sup>174</sup> See e.g., 47 CFR §§ 25.114 (applications for space station authorizations) and 25.115 (applications for earth station authorizations). See also *Streamlining Licensing Procedures for Small Satellites*, Report and Order, 34 FCC Rcd 13077 (2019) (*Small Satellite R&O*) (adopting a streamlined licensing process for small satellites).

68. We also propose to add a provision restricting use of the proposed 420-430 MHz allocation to the transmission of flight termination signals during pre-launch testing and launches. This transmission would provide for a flight termination signal if a space launch vehicle goes astray. Because a launch vehicle which has gone off-course can endanger lives, the flight termination signal link must be extremely reliable. Therefore, it may not be possible to permit additional uses—particularly those that are not safety-of-life services—in the band.

69. Further, we propose to restrict the commercial launch use of the 2025-2110 MHz band to telecommand uplink transmissions from the ground controller stations to the space launch vehicle in the event that the Commission adds a non-Federal Space Operation allocation to this band. This allocation would enable space launch providers to transmit to their space launch vehicles during the launch and recovery phase of operations. The largest use of the 2025-2110 MHz band is for the BAS.<sup>175</sup> This band is heavily used by BAS, CARS, and LTTS operations, as well as by Federal entities for space operations, space research, and the earth exploration satellite service. Considering these existing operations, as well as operations by non-Federal launches on a special temporary authority basis to date, is it feasible to accommodate uses in addition to the space launch telecommand uses described above?

70. We further propose to add a restriction to limit use of the 5650-5925 MHz band to launch vehicle tracking. Although frequencies in the 5650-5925 MHz band are available to support certain non-Federal uses,<sup>176</sup> the predominant use in the band is radiolocation, with Federal entities using the band for a wide variety of radar applications, including launch vehicle tracking. In order to promote interoperability with existing Federal radar tracking functions and to limit impact to other uses, we propose to restrict commercial space launch vehicle uses of this band to radar tracking.

71. We seek comment on these proposals. In particular, we seek comment on whether these proposals provide sufficient flexibility for existing and future needs of non-Federal launch activities or whether additional uses should be accommodated if technically feasible. Additional uses in the bands beyond those specified above may not currently be possible due to technical characteristics and existing uses of the bands. However, we seek comment on whether to provide flexibility to enable other uses if the Commission determines such uses are technically feasible and will not restrict or cause harmful interference to existing uses and incumbent operations. We seek comment on the costs and benefits of limiting the scope of uses in these bands. Commenters also should discuss what other measures the Commission should consider to promote a competitive marketplace for space launch operations and services.

#### **b. Eligibility**

72. In the *Report and Order*, we explain that opening this spectrum to the commercial space launch industry would encourage entrepreneurial efforts by providing commercial space entities certainty in their access to the spectrum that they need to promote the advance planning and investment necessary for future space launch activities. We therefore propose to limit eligibility to hold authorizations for the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands to non-Federal entities that conduct space launch operations. We seek comment on the extent to which the supplemental eligibility criteria for flight test stations, set forth in section 87.301, would be an appropriate model for space launch license eligibility. To be eligible for a new commercial space launch license, we propose that the applicant must qualify as one of the following: (1) an operator or manufacturer of a commercial space launch or reentry vehicle or space launch or reentry vehicle

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<sup>175</sup> See *supra* para. 43. Federal Government satellite operations are co-primary in the 2025-2110 MHz band, but under the caveat that such operations not constrain the deployment of BAS. See *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by Mobile Satellite Services*, ET Docket No. 95-18, Second Report and Order and Second Memorandum Opinion and Order, 15 FCC Rcd 12315 (2000).

<sup>176</sup> The 5650-5925 MHz band supports non-Federal mobile, except aeronautical mobile; radiolocation; amateur; fixed-satellite service (Earth-to-space) and space research (deep space) services.

components;<sup>177</sup> (2) a parent corporation or its subsidiary if either corporation is an operator or manufacturer of a space launch or reentry vehicle or space launch or reentry vehicle components; or (3) an educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of a launch or reentry vehicle or launch or reentry vehicle components. We also seek comment on whether to allow other entities that provide space-based services, including satellite service providers, to be eligible for commercial space launch licenses. We seek comment on these eligibility restrictions, including whether to expand or further restrict the scope of eligible entities.

73. Currently, each application for a flight test license under Part 87, Subpart J is required to include a certification to establish the applicant's eligibility for a license.<sup>178</sup> Similarly, we propose to use this as a model to require an applicant for any commercial space launch frequencies to certify the eligibility criteria proposed above. We tentatively conclude that requiring this certification would be in the public interest and impose minimal burden on eligible entities. We seek comment on this proposal as well as on whether to impose any additional certification requirements. In some cases, the Commission has also required subsequent certifications by a licensee that stations comply with applicable technical requirements, such as in section 25.133 of the Commission's rules.<sup>179</sup> We seek comment on whether to require such a certification, through an appropriate check-box, by either license applicants or licensees.

### c. Shared Frequency Use and Cooperative Use of Facilities

74. We propose to provide non-Federal space launch operators access to the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands on a shared, non-exclusive basis. The Commission traditionally has issued Part 87 licenses on a shared basis and not for the exclusive use of any licensee.<sup>180</sup> Certain Part 90 radiolocation uses are also authorized on a similar shared basis.<sup>181</sup> Similarly, the Commission's Part 25 satellite licensing rules also include provisions relating to shared and cooperative use of spectrum.<sup>182</sup> Given that there is the potential for many different launch vehicle operators to use a given launch area, authorizing commercial space operations on a shared basis appears to be a reasonable approach for providing spectrum access for multiple space launch entities. It should be noted that, in this context, shared use status, while non-exclusive, does not mean that a licensee will be required to accept interference. The licensee will be entitled to interference protection for its launch operations. We seek comment on this proposal and request comments on other viable options.

75. Further, in the context of flight test operations, Part 87 generally limits authorizations of flight test land stations to only one per airport, but it requires that these stations be made available without

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<sup>177</sup> Under this proposal, we intend to cover manufacturers of components only to the extent that they manufacture components intended primarily or uniquely for space launch purposes. It would not cover manufacturers of generic components merely because they are used in space launch vehicles among other purposes.

<sup>178</sup> See 47 CFR § 87.301.

<sup>179</sup> See 47 CFR § 25.133.

<sup>180</sup> See 47 CFR § 87.41(b); *Reorganization and Revision of Part 87 of the Rules Governing the Aviation Servs.*, PR Docket No. 87-214, Report and Order, 3 FCC Rcd 4171 (1988).

<sup>181</sup> See 47 CFR §§ 90.103(b), (c).

<sup>182</sup> See, e.g., 47 CFR § 25.140(a) (implementing non-exclusive licensing for geostationary orbit satellites operating in the fixed-satellite service, based on certain technical rules and a "two-degree" spacing regime); 47 CFR § 25.122(d)(3); and *Small Satellite R&O*, 34 FCC Rcd at 13108, para. 81 (adopting a process for small satellite licensing including a demonstration that the requested spectrum can be shared with current and future operators, for example, where a satellite operates with a limited number of earth stations and downlinks during relatively short periods of time, with the ability to effectively schedule transmissions such that future satellite entrants can be accommodated).

discrimination to anyone eligible for a flight test station license.<sup>183</sup> This rule has enabled the shared use of facilities, which has reduced costs to licensees and promoted efficient use and competition in the aviation industry.

76. We seek comment on whether a similar non-discrimination policy for all space launch operations in the bands at issue is also necessary. We are aware that there are launch sites that currently have ground transmitters for shared use, and we seek comment on the practices involving ground stations at Federal ranges and FAA-licensed sites. Should the Commission adopt rules providing for non-discriminatory access of these facilities by non-Federal space launch entities? We seek comment on whether non-discriminatory shared use of these facilities is necessary to support the existing and future needs of commercial space launch entities. We seek further comment on the costs and benefits of a cooperative use of facilities approach, as well as other facilities that may require non-discriminatory access and ways to streamline these practices.

#### **d. Site-Based and Other Licensing**

77. In licensing space launch operations, our goals are two-fold: (1) to encourage innovations and investments in the U.S. space commerce; and (2) to ensure a regulatory environment conducive to the establishment of a competitive U.S. commercial space launch sector while protecting Federal and other users in the bands. In this *FNPRM*, we seek comment on various licensing models with these goals in mind and aim to bring regulatory certainty in the marketplace while minimizing administrative burden and duplicative regulations.

78. *Site-Based Licensing.* A number of Part 87 services, including flight test station licenses, and Part 90 radiolocation services are authorized on a site-by-site basis.<sup>184</sup> A site-based licensing model is helpful in a shared use situation as fixed, well-defined areas of operation simplify coordination during the application process for services requiring frequency coordination, and facilitate intensive spectrum sharing. Moreover, this approach enables the Commission and interested stakeholders to identify quickly licensees in the band and their specific areas of operation in the event interference issues arise, which allows parties to resolve such issues in the shortest timeframe practicable.<sup>185</sup> We seek comment on these conclusions and whether to issue space launch licenses on a site-by-site basis. Would site-based licensing meet the needs of space launch operations? Does site-based licensing enable the safe and efficient operation of shared frequencies while providing the certainty and flexibility needed to support the existing and future needs of commercial space launch entities? Are space launch activities centered usually around certain sites? If we were to adopt site-based licensing, how should we define a site?

79. *Other Licensing Options.* We also seek comment on whether there are any other licensing models that may be suitable in the space launch operations context. For example, would it be appropriate to license specific space launch vehicles and list applicable ground stations (including those at the launch sites licensed by FAA) as authorized communications points with those vehicles? Another option would be to adopt a new approach combining various aspects of space-based services and

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<sup>183</sup> 47 CFR § 87.307. Specifically, under section 87.307, the Commission licenses only one flight test land station per airport, but it requires that these stations be made available without discrimination, on a cooperative maintenance basis, to anyone eligible for a flight test station license. Section 87.307 permits additional flight test land stations if an applicant can demonstrate that sharing of an existing flight test land station is not possible and that the addition of another land station will not result in significant degradation of the reliability of the existing station. See 47 CFR § 87.307(d).

<sup>184</sup> See 47 CFR § 1.907 (Covered Site-based Licenses).

<sup>185</sup> See, e.g., *Amendment of Part 90 of the Commission's Rules to Provide for Flexible Use of the 896-901 MHz and 935-940 MHz Band Allotted to the Business and Industrial Land Transportation Pool*, WT Docket No. 05-62, WT Docket No. 02-55, Report and Order, 23 FCC Rcd 15856, 15863, para. 12 (2008) (retaining the site-based licensing approach for the 900 MHz B/ILT spectrum).



aeronautical service licensing rules.<sup>186</sup> If we do so, what are the rules that would be most appropriate for licensing space launch services? Stations on space launch vehicles could be licensed similar to space stations and the communicating ground/earth stations could be licensed on a single or multiple site basis.<sup>187</sup> A ground/earth station's operations also could be conditioned, for example, on filing of a certification before a planned space launch to certify that any required frequency coordination has been satisfactorily completed and the relevant ground/earth stations are in compliance with all applicable legal and technical rules that we might adopt for space launch operations. Or licensing of space launch operations could be similar to licensing models applicable to certain wireless services such as the 3650-3700 MHz band,<sup>188</sup> and the 71-76 GHz, 81-86 GHz, 92.0-94.0 GHz, and 94.1-95.0 GHz bands.<sup>189</sup> Pursuant to these approaches, space launch operators could have access to various spectrum bands on a non-exclusive, yet protected, basis, but would be subject to measures designed to promote shared use of spectrum, such as a registration and frequency coordination requirement prior to each launch. With respect to the terrestrial nationwide, but non-exclusive, licensing approach, which typically has been used for shorter-distance terrestrial wireless services, could such a licensing approach be effective as applied to all phases of operations, including orbital phases? Could such a licensing process streamline the information that would be needed for initial licensing and then registration and coordination prior to a planned launch? We seek comment on the feasibility, costs, benefits, and potential challenges (if any) associated with each of these proposals.

80. Comments should discuss any needed changes that should be made to reduce potential administrative burdens and streamline the site-based licensing process as well as any other alternatives. We also seek comment on service area definitions as well as alternatives and the costs and benefits of proposed alternatives.

**e. Authorized bandwidth**

81. We propose to grant licenses for non-Federal operations in the 2200-2290 MHz band using a 5 megahertz bandwidth, similar to NTIA's limit for transmissions by Federal space-to-Earth and space-to-space operations in the band.<sup>190</sup> We further seek comment on permitting licensees to use larger bandwidths upon adequate justification for why such bandwidth are necessary and in the public interest, on a case-by-case basis. Any requirement for additional bandwidth for use during launches will have to be balanced with the use of the band by Federal systems and coordinated with NTIA. Our review of experimental authorizations requested for the 2200-2290 MHz band indicates that the majority of applications involved requests for bandwidths of less than 5 megahertz.<sup>191</sup> We tentatively conclude that

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<sup>186</sup> See, e.g., 47 CFR part 25 (satellite and earth station licensing); 47 CFR part 87 (aircraft station licensing).

<sup>187</sup> See e.g., 47 CFR §§ 25.114 (applications for space station licenses and market access), 25.122 (applications for small satellites), and 25.115(a) and 25.115(c)(2) (applications for transmitting earth station authorizations and networks of earth stations operating in 3700-4200/5925-6425 MHz).

<sup>188</sup> *Wireless Operations in the 3650-3700 MHz Band*, ET Docket No. 04-151; *Rules for Wireless Broadband Services in the 3650-3700 MHz Band*, WT Docket No. 05-96; *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket No. 02-380; *Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band*, ET Docket No. 98-237, Report and Order and Memorandum Opinion and Order, 20 FCC Rcd 6502 (2005).

<sup>189</sup> *Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318 (2003).

<sup>190</sup> See NTIA Manual § 8.2.4.1. Section 8.2.41 establishes that Federal use of the 2200-2290 MHz band should be limited to necessary bandwidths of no more than 5 megahertz. Necessary bandwidth is defined as follows: "For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions." See NTIA Manual § 6.1.1.

<sup>191</sup> See, e.g., Astra Space, Special Temporary Authorization, OET Experimental Licensing System, File No. 0004-EX-ST-2020; Rocket Lab USA, Inc., Special Temporary Authorization, OET Experimental Licensing System, File No. 0623-EX-ST-2020; Blue Origin Texas, LLC, Special Temporary Authorization, OET Experimental Licensing

(continued....)

licensing the 2200-2290 MHz band in 5 megahertz channel blocks will likely accommodate most non-Federal launch vehicle operations in the band and provide licensees with greater flexibility than authorizations with a smaller bandwidth. This approach is consistent with NTIA's stated preference.<sup>192</sup> We seek comment on this approach as well as other approaches. We note that 2360-2395 MHz band space launch telemetry and telecommand operations may be authorized in bandwidths of 1, 3, and 5 megahertz.<sup>193</sup> Should we similarly authorize the 2200-2290 MHz band in a range of bandwidths?

82. As discussed, we are proposing to allocate the entire 420-430 MHz and 2025-2110 MHz bands for flight termination and telecommand uses, respectively, and are seeking comment regarding the portions of the 5650-5925 MHz band that should be allocated for launch vehicle tracking purposes. We seek comment on the appropriate bandwidth or spectrum blocks for the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations. We note that the bandwidths associated with experimental authorizations granted for frequencies in the 2025-2110 MHz and 5650-5925 MHz bands have varied in size. We seek comment on the typical and/or necessary bandwidths applicable to the space launch uses specified in this proceeding. Consistent with an NTIA recommendation, we further seek comment regarding the 420-430 MHz band, specifically on "the most appropriate frequencies . . . for each designated launch facility based on which frequencies can be supported for sending command destruct/flight termination signals."<sup>194</sup>

#### f. License Term and Renewal

83. The Commission historically has established ten-year terms for wireless radio service licenses, including Part 87 aviation and Part 90 radiolocation licensees. In the satellite licensing context, most satellites are authorized for a 15-year license term.<sup>195</sup> We tentatively conclude that ten-year terms will provide certainty and flexibility for space launch providers and therefore propose to issue commercial space launch licenses for ten-year terms. We recognize, however, that the spectrum and use must be carefully managed and coordinated due to the heavy use of these bands, and we note that the Commission has granted shorter license terms for Part 87 flight test stations pursuant to the frequency coordination process as a means to manage and ensure periodic reevaluation of possible interference issues.<sup>196</sup> Several commenters have suggested a shorter five-year period as an appropriate license term.<sup>197</sup> We seek comment on alternative license terms.

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System, File No. 1791-EX-ST-2019; Orbital ATK, Inc., Special Temporary Authorization, OET Experimental Licensing System, File No. 0008-EX-ST-2018; Space Exploration Technologies Corp., Special Temporary Authorization, OET Experimental Licensing System, File No. 2375-EX-ST-2019.

<sup>192</sup> *NTIA 2016 Letter* at 4-5.

<sup>193</sup> *See* 47 CFR § 87.303(d)(3). Part 87 also permits authorization of wider bandwidths if necessary. *Id.* Applications for greater bandwidths are considered in accordance with the provisions of 47 CFR § 87.135.

<sup>194</sup> *See NTIA 2016 Letter* at 4.

<sup>195</sup> *See* 47 CFR § 25.121(a). There are a few exceptions to the typical 15-year satellite license term, including for small satellites authorized under the streamlined small satellite process, for which the license term is six years. *See id.*

<sup>196</sup> *See, e.g.,* Stratolaunch LLC, Call Sign WRFW314, FCC File No. 0009043027, granted May 14, 2020. For Federal users, NTIA limits the license terms of aeronautical mobile telemetry bands to five years to ensure periodic re-evaluation. *See* NTIA Manual § 8.3.16.

<sup>197</sup> *See* Boeing Reply Comments at 6-7; Letter from Bruce A. Olcott, Counsel to The Boeing Company, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 2 (filed March 15, 2016) (Boeing March 15, 2016 *Ex Parte*); Letter from Monica S. Desai, Counsel to SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 2 (filed Nov. 14, 2013) (SpaceX Nov. 14, 2013 *Ex Parte*); Letter from Monica S. Desai, Counsel to SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 2 (filed July 18, 2014) (SpaceX July 18, 2014 *Ex Parte*).

84. The Wireless Radio Services (WRS) proceeding established the process for renewing a site-based license.<sup>198</sup> Specifically, it provided that a site-based WRS licensee will meet our renewal standard if it can certify that it is continuing to operate consistent with its most recently filed construction notification (or most recent authorization, when no construction notification is required), and make the certifications regarding permanent discontinuance and substantial compliance with Commission rules and policies that are applicable to all renewal applicants seeking to avail themselves of one of the renewal safe harbors.<sup>199</sup> Services subject to this site-based renewal standard include the Part 90 Radiolocation Service.<sup>200</sup> We propose to extend this renewal standard to licensees in the 5650-5925 MHz band to the extent we apply the Part 90 Radiolocation Service rules to this band. We request comment on this proposal.

85. The *WRS Order* does not apply to Wireless Radio Services that are licensed by rule or on a “personal” basis or that have no construction/performance obligation.<sup>201</sup> This includes most Part 87 services.<sup>202</sup> We seek comment on whether to require commercial space launch licensees make a “renewal showing,” for instance, certifying that it is operating consistent with its initial application for authorization or that it has complied with the required coordination. We seek comment on whether this renewal showing is warranted for the bands at issue given the heavy use by Federal agencies. We believe that requiring a renewal showing in these bands would facilitate efficient spectrum use by ensuring that licensees use the spectrum productively, collaboratively, and in compliance with Commission rules during their initial license terms. We seek comment on the costs and benefits of imposing a renewal requirement for commercial space launch operations licensees.

**g. Application Process**

86. We seek comment on the application process to be used to assign commercial space launch licenses. As an initial matter, we seek comment on whether assignment of space launch operations licenses is subject to Section 309(j) of the Communications Act.<sup>203</sup> We note that, while Section 309(j) of the Communications Act requires that the Commission assign spectrum licenses through the use of competitive bidding for mutually exclusive license applications, the shared, non-exclusive licensing we are proposing for the spectrum bands at issue would not result in mutually exclusive applications and thus would not be subject to such competitive bidding requirements.<sup>204</sup> However, where Section 309(j) applies and to the extent that we determine that it is in the public interest to adopt a licensing scheme that would result in mutually exclusive license applications, we propose to use the general competitive bidding rules

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<sup>198</sup> See *Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Services*, WT Docket No. 10-112, Second Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 8874 (2017) (*Wireless Radio Services Renewal Reform 2nd R&O and FNPRM*).

<sup>199</sup> *WRS Renewal Reform 2nd R&O and FNPRM*, 32 FCC Rcd 8874, 8882, para. 19.

<sup>200</sup> *WRS Renewal Reform 2nd R&O and FNPRM*, 32 FCC Rcd 8874, 8962, Appx. G.

<sup>201</sup> *WRS Renewal Reform 2nd R&O and FNPRM*, 32 FCC Rcd 8874, 8880, para. 13.

<sup>202</sup> See 47 CFR § 1.907; *WRS Renewal Reform 2nd R&O and FNPRM*, 32 FCC Rcd 8874, 8922, Appx. A, Final Rules. Part 87 services that are subject to renewal standards are: Aeronautical Advisory Stations (Unicom) and Radiodetermination Service Stations (Radionavigation Land Stations) under subparts G and Q, respectively.

<sup>203</sup> Specifically, Section 309(j) of the Communications Act requires that the Commission assign initial licenses through the use of competitive bidding when mutually exclusive applications for such licenses are accepted for filing, except in the case of certain specific statutory exemptions. See 47 U.S.C. § 309(j)(1), (2). The Section 765(f) of the Communications Act also states that “[n]otwithstanding any other provision of law, the Commission shall not have the authority to assign by competitive bidding orbital locations or spectrum used for the provision of international or global satellite communications services.” 47 U.S.C § 765f.

<sup>204</sup> See *Implementation of Section 309(j) of the Communications Act — Competitive Bidding*, PP Docket No. 93-253, Second Report and Order, 9 FCC Rcd 2348, 2351, para. 13 (1994).

set forth in Part 1, Subpart Q, of the Commission's rules.<sup>205</sup> We seek comment on these conclusions and proposals.

87. With respect to application framework, we are aiming to establish an application framework that would increase the regulatory certainty while reducing the administrative burden. One approach would be to apply the existing licensing framework for Part 87 and Part 90 licensees to commercial space launch operations applications. Currently, applicants for Part 87 flight test stations and Part 90 radiolocation licenses are required to submit FCC Form 601 and associated schedules through the Universal Licensing System (ULS).<sup>206</sup> We seek comment on requiring applicants seeking authorization for 2200-2290 MHz as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz frequencies to file an FCC Form 601 and applicable schedules through ULS under the appropriate rule part designation.<sup>207</sup> We seek comment on the benefits and costs of this approach. Another approach would be to use aspects of Form 312 and Schedule S, with narrative legal and technical information similar to licenses under Part 25 and filing in the International Bureau Filing System (IBFS).<sup>208</sup> We seek comment on these and any alternative approaches.

88. Depending on our licensing scheme, for example, if we adopt site-based licensing, would it be in the public interest to license the bands individually and use separate applications for separate spectrum bands? We recognize that not all operators will seek authorization for all of the bands at issue. Moreover, even where an applicant seeks multiple frequency bands, the applicant may not have the same site or area of operation for each of the bands. Would separate licensing of separate bands be less burdensome and provide more flexibility for applicants than a single multi-band license application process, similar to space station and earth station licensing? Would some of the differences in operational parameters be addressed more efficiently in a nationwide non-exclusive licensing application which would be coupled with a planned launch coordination registration? Are there any coordination issues in any of the frequency bands that would benefit from site licensing? Would it be simpler and less costly for the Commission to incorporate into our existing ULS or IBFS licensing processes and/or forms? What are the most efficient and effective way to license space launch operations that will provide operators with substantial benefits in terms of flexibility and efficiency, and will facilitate rapid implementation of this service?

89. To support the evolving communications needs of space launch entities and to provide flexibility sufficient to support innovation and investment in new technologies, we seek comment on how to allow applicants for space launch licenses to request authorization covering all launches within their license terms. We also seek comment on any measures needed to implement a multi-launch approach. For example, how should we account for any variances in vehicle trajectory or spectrum usage from launch to launch? Should operators be required to file a modification or notification to change certain characteristics of their license, and if so, which characteristics? Which of these variances must be reflected in the license and which ones can be addressed during a planned launch coordination stage on a case-by-case basis? What information should be required to be provided at the licensing application stage and the planned launch stage?

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<sup>205</sup> 47 CFR §§ 1.2101-1.2114.

<sup>206</sup> See 47 CFR §§ 87.25(b) (procedures for filing applications for Part 87 licenses); 1.913(a)(1) (procedures for filing applications in the wireless radio services generally); 1.913(e) (procedures for filing applications that require frequency coordination); 1.923 (content of applications in the wireless radio services). See *Completing the Transition to Electronic Filing, Licenses and Authorizations, and Correspondence in the Wireless Radio Services*, WT Docket No. 19-212, Report and Order, FCC 20-126 (2020) (removing exemptions to mandatory electronic filing).

<sup>207</sup> Applicants seeking authority to operate in these bands would be required to comply with applicable regulatory requirements such as rules relating to the National Environmental Policy Act (NEPA). See 47 CFR §§ 1.1307, 1.1317.

<sup>208</sup> See, e.g., 47 CFR §§ 25.110, 25.114.

90. If we were to adopt a site-based licensing system for commercial space launch operations, under this proposal, applicants may request: (1) fixed stations on the ground, (2) mobile stations on the ground,<sup>209</sup> and/or (3) stations on launch vehicles. For fixed ground site locations, each applicant would include in its application the specific coordinates for its proposed fixed sites. Because most space launch entities conduct launches at specific fixed sites, we do not anticipate that providing this information will be burdensome. For mobile stations on the ground, each applicant would specify a mobile area of operation, as defined by a center point and radius governing their area of operation. Would this definition of mobile area of operation provide licensees the flexibility needed to support the existing and future needs of space launch entities? We seek comment on this proposed definition of mobile area of operation and on alternate definitions that might further our goals of providing flexibility to space launch operators while protecting other uses in the bands. For example, should the mobile area of operation be defined by a specific county or some other metric, such as an option that allows the applicant to describe in text the proposed area of operation? For stations on launch vehicles, these stations can be authorized within a specific area of operation with a center point and radius coordinated and approved by an approved frequency coordinator.<sup>210</sup> We seek comment on these proposals. We further seek comment on whether an applicant's ground stations in the United States should be licensed separately from the launch vehicle stations with which they are communicating, or whether those operations may be encompassed within a single license.

91. Launch vehicle operations can be categorized broadly into two take-off modes: a vertical take-off like a traditional launch vehicle or a horizontal take-off from a runway.<sup>211</sup> In addition, launch vehicles can be either expendable or reusable. Further, an operator may seek to use different launch vehicles from launch to launch. We seek comment on whether the proposed site-based licensing framework and area of operation definitions will adequately accommodate all of these initial launch and reentry scenarios. To the extent that commenters believe that the proposals cannot be applied satisfactorily to all take-off, flight, and landing operations, we request comment on alternate licensing options or definitions. We ask commenters to evaluate the costs and benefits of these proposals as well as alternatives or additional requirements that may be needed to improve the application process and to address the specific needs of the commercial space launch industry.

92. *ITU Process.* We note that the International Telecommunication Union (ITU) Radio Regulations are treaty provisions binding on the United States, and require that no transmitting station may be established or operated by a private person or by any enterprise without a license by or on behalf of the government of the country to which the station in question is subject.<sup>212</sup> The Communications Act of 1934, as amended, provides the FCC with authority to take actions to implement the ITU Radio Regulations.<sup>213</sup> The operations of the radio facilities on launch vehicles therefore must be authorized consistent with the ITU Radio Regulations. Because these operations could cause harmful interference in other countries, we propose to require applicants to submit appropriate draft documentation for submission to the ITU.<sup>214</sup> We seek comment on this proposal and whether there are other alternatives,

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<sup>209</sup> Ground-based mobile or temporary operations authorized within an approved area of operation for communication with a launch vehicle.

<sup>210</sup> See *infra* Frequency Coordination discussion.

<sup>211</sup> See e.g., Federal Aviation Administration, *The U.S. Commercial Suborbital Industry: A Space Renaissance in the Making*, [http://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/media/111460.pdf](http://www.faa.gov/about/office_org/headquarters_offices/ast/media/111460.pdf) (last visited Mar. 31, 2021).

<sup>212</sup> International Telecommunication Union (ITU) Radio Regulations, No. 18.1 (2015)

<sup>213</sup> 47 USC § 303(r).

<sup>214</sup> The draft "Appendix 4" document can be prepared using the ITU software "SpaceCap," which can be downloaded from the following link: <http://www.itu.int/en/ITU-R/software/Pages/spacecap.aspx>. Such filing would include information about down-range earth stations with which the launch vehicle will operate. We currently request launch operators to provide all appropriate documentation for submission to the ITU.

including bi-lateral coordination with affected countries, to coordinate and minimize harmful interference from any FCC authorized space launch operation.

93. We seek comment more generally on the ITU process as it relates to space launch vehicle licensing and operations. In the space station context, operators provide information to the Commission for submission to the ITU as part of the space station application or authorization process. If we were to decide to apply this process, we seek comment on how and when launch vehicle operators should provide the Commission with information for submission to the ITU. One possibility would be an approach where launch vehicle applicants or licensees submit information to the Commission for an ITU submission regarding an upcoming planned launch a certain number of days prior to the planned launch.<sup>215</sup> We seek comment on this approach and on alternatives. We note that this process is likely to vary depending on the licensing regime adopted, in particular on the scope of the license, such as whether a license covers multiple launches, including multiple launch trajectories. We seek comment on how the scope of the license should affect the applicant's submission of information for the ITU process.

94. *Space Launch Vehicle Operations Outside the United States.* We observe that launch vehicle flight paths will commonly extend downrange beyond the U.S. territories, requiring the space launch vehicle to communicate with ground-based telemetry, tracking, and telecommand stations located outside of the United States, particularly in the 2025-2110 MHz and 2200-2290 MHz frequency bands. Such communications could be considered within the scope of a Part 87 authorization, for example, or be addressed by a licensing approach covering launch vehicles that would allow operations of such vehicles with ground stations both within and outside the U.S. territories, similar to a space station license under Part 25. We seek comment on these observations and the best way to authorize the use of the relevant spectrum bands to cover these operations.

95. We seek comment on whether we should view such launch vehicle operations as being authorized under the applicable site-based license subject to the requirement that such use is identified in the application and ITU coordination is completed. Or should such use be separately authorized? Would an alternative type of license better address operations with ground/earth stations outside the United States? We note that the ability of a launch vehicle operator to obtain ground station authorizations outside the United States may be dependent upon U.S. launch vehicle licensing and/or ITU coordination and/or notification procedures, as needed. We seek comment on the various licensing approaches, given the need for down-range communications, and on the role that ITU coordination should have in the particular licensing approach.

96. *Operations Inside the United States with non-United States Space Launch Vehicles.* We seek comment on how the Commission should authorize ground station operations in the United States with space launch vehicles that are not authorized by the United States. For example, a space launch vehicle originating from a non-U.S. launch site and not otherwise authorized by the United States may seek to communicate with ground stations in the United States. Should we adopt a process for ground station operators to request communications with these launch vehicles? For example, in the context of Part 25 satellite licensing, ground/earth station operators in the United States can apply for authority to communicate with non-U.S.-licensed space stations.<sup>216</sup> In the space launch context, should applications be filed by the U.S. ground/earth station operators? And, if so, what information should be required?

97. *Alternative Approach.* We also seek comment on whether an authorization should be

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<sup>215</sup> Under Part 97 of the Commission's rules, for example, an amateur-satellite control operator seeking to operate an amateur satellite must submit a pre-launch notification to the Commission's International Bureau not later than 30 days after the date of launch vehicle determination, but no later than 90 days before integration of the satellite into the launch vehicle. 47 CFR § 97.207(g). This submission must include, among other things, notification information required for submission to the ITU. *Id.*

<sup>216</sup> See, e.g., 47 CFR § 25.137. See also *Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, IB Docket No. 96-111, Report and Order, 12 FCC Rcd 24094 (1997).

structured to cover all the bands allocated for commercial launch services, including operations outside the United States, discussed above.<sup>217</sup> In other words, a single license application would be used to request multiple spectrum bands and associated uses on a single launch vehicle. For example, if a launch vehicle receives a flight termination signal in one frequency band and operates TT&C in a different frequency band, what are the costs and benefits to those operations being covered under a single space launch operations license? Would such an approach streamline our licensing processes or complicate them? What are the procedural and legal challenges that the Commission needs to consider with such a licensing approach? This approach also could be combined with the site-based or nationwide non-exclusive licensing approaches discussed above. Would such an approach serve the public interest? If we were to adopt such an approach how can we implement it? What licensing information should be required at the licensing application stage and the planned launch coordination stage? We request comment on these alternatives and seek input on any other alternatives we should consider. We ask that commenters discuss the impacts of a proposal, including associated administrative burdens or benefits.

#### **h. Frequency Coordination**

98. Frequency coordination minimizes the likelihood of interference between operations and facilitates the efficient use of spectrum. We seek comment on the appropriate coordination process between Federal and non-Federal users to be used prior to the grant of an application for space launch frequencies as well as a coordination process for the ongoing use of these frequencies by operators during their license terms.

99. As discussed in the *Report and Order*, the Commission shares licensing authority with NTIA.<sup>218</sup> Section 301 establishes the Commission’s licensing authority over non-Federal stations, and section 303 grants the Commission authority to “[m]ake such rules and regulations and prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out the provisions of this [Act.]”.<sup>219</sup> NTIA maintains licensing authority over Federal stations pursuant to section 305(a).<sup>220</sup> The Commission and NTIA’s shared licensing authority is guided by an established set of procedures for developing regulations for radio services in the shared bands and for authorizing frequency use by Federal agencies and Commission licensees.<sup>221</sup>

100. These procedures, set forth under the Memorandum of Understanding (MOU) between NTIA and the Commission, require the agencies to endeavor to give notice to each other of “all proposed actions that could potentially cause interference” to non-Federal and Federal operations respectively. NTIA coordinates with Federal spectrum users through the Interdepartment Radio Advisory Council

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<sup>217</sup> For example, a satellite (space station) license granted under Part 25 of the Commission’s rules, 47 CFR part 25, can authorize the space station’s communications both within and outside the United States, across multiple frequency bands, for both the provision of service and for space safety operations such as TT&C. In some instances, the authorization for a space station covers communications similar to those of a launch vehicle—*e.g.*, communications with a limited number of earth stations, for limited periods of time.

<sup>218</sup> See 47 U.S.C. §§ 301, 305(a). Section 301 of the Communications Act gives the Commission licensing authority over non-Federal stations. Section 305(a) authorizes the President to assign frequencies to Federal stations. This authority has been delegated to the Assistant Secretary of Commerce for Communications and Information, who also serves as the Administrator of the NTIA.

<sup>219</sup> 47 U.S.C. § 303(r). See also 47 U.S.C. § 154(i) (authorizing the Commission to “perform any and all acts, make such rules and regulations, and issue such orders, not inconsistent with this chapter, as may be necessary in the execution of its functions”).

<sup>220</sup> See 47 U.S.C. §§ 301, 305(a).

<sup>221</sup> *Space NPRM*, 28 FCC Rcd at 6702, para. 11.

(IRAC), a committee that includes representation from different government agencies, and typically includes a review period of 15 business days.<sup>222</sup>

101. Until the Commission adopts licensing and technical rules, we will continue to coordinate STAs issued to commercial operators for space launch purposes with NTIA, pursuant to the MOU. Even after licensing and technical rules go into effect, we will continue to have to pre-coordinate licenses with NTIA.<sup>223</sup> Although we are adopting one and proposing three other permanent non-Federal allocations for these bands, coordination is still required for use of these frequencies, given the potential for impacts to and from Federal users in these bands, as well as the potential for harmful interference among non-Federal users.<sup>224</sup> We therefore seek input on a coordination procedure that will adequately minimize the potential for harmful interference, while also minimizing burdens on launch operators to the extent possible.

102. *Pre-grant coordination.* To help ensure that users in a band are protected from harmful interference, the Commission has incorporated various coordination requirements in its service rules, particularly in bands with shared use, in addition to the standard IRAC process.<sup>225</sup> For example, applicants for flight test station licenses under Part 87, Subpart J are required to meet all applicable frequency coordination requirements.<sup>226</sup> Section 87.305 requires that, prior to submission of an application to the Commission, a frequency advisory committee must coordinate all frequency requests with applicable Federal government area frequency coordinators and provide recommendations regarding operating parameters.<sup>227</sup> A flight test station application must include a frequency coordination statement from the frequency advisory committee, which includes a technical evaluation and recommendations to

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<sup>222</sup> Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration, at 1 (Jan. 31, 2003), <https://docs.fcc.gov/public/attachments/DOC-230835A2.pdf> (MOU).

<sup>223</sup> The 5650-5935 MHz band was allocated on a primary basis for Federal use only except for a portion that had non-Federal FSS and mobile service allocations.

<sup>224</sup> See, e.g., *NTIA 2016 Letter* at 4-5 (stating that the 2200-2290 MHz band is “heavily used by the Department of Defense and other agencies for vital, mission-critical systems and, if allocated for use during commercial space launches, must continue to be carefully coordinated,” and that frequency assignments in the 420-430 MHz and 5650-5925 MHz bands will also require coordination); Letter from Audrey Power, Vice President, Blue Origin, *et al.*, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 3 (filed Nov. 2, 2020) (*Launch Spectrum Principles Letter*) (“coordination is necessary to ensure both that other uses of the spectrum do not disrupt mission critical operations during launch/reentry, but also that launches and reentries do not interfere with other essential uses of shared bands.”). We note that the 2200-2290 MHz allocation adopted above expressly requires coordination of assignments with NTIA.

<sup>225</sup> See, e.g., 47 CFR §§ 87.305, 90.175, 90.173(f), 90.173(j), 101.103.

<sup>226</sup> See 47 CFR §§ 1.913(e), 87.305.

<sup>227</sup> 47 CFR § 87.305(a)(1). See *Amendment of Part 87 of the Commission's Rules to Make Provision for the Establishment of an Indus. Frequency Advisory Comm. for Coordination of Frequencies in the 1435-1535 Mc/s Band.*, 15 FCC 2d 831, 831 (1969); *Amendment of the Rules Regarding Aeronautical Flight Test Telemetry; Petition for Rulemaking Filed by Aerospace and Flight Test Radio Coordinating Council (AFTRCC)*, GN Docket No. 84-186, Report and Order, 49 FR 39330, FCC 84-446 (1984) (amending Part 87 rules governing flight test telemetry stations by requiring the frequency advisory committee to coordinate frequency assignment requests with the responsible Government Area Frequency Coordinator). The Aerospace and Flight Test Radio Coordinating Council (AFTRCC) is the frequency coordinating committee for non-government flight test telemetry station assignments. *Amendment of Part 87 of the Commission's Rules to Make Provision for the Establishment of an Indus. Frequency Advisory Comm. for Coordination of Frequencies in the 1435-1535 MC/S Band*, Docket No. 18-234, Report and Order, 15 FCC 2d 831 (1969). In 1984, the Commission extended AFTRCC's frequency coordinating authority to the 2310-2320 MHz and 2345-2390 MHz bands. See *Aeronautical Flight Test Telemetry Operations*, 49 FR 39330-01 (1984).



minimize interference. Once the application is submitted to the Commission, the request is then also submitted to NTIA for coordination, pursuant to the FCC and NTIA's MOU.

103. We seek comment on whether we should require applicants for a license in space launch frequencies to undergo a pre-application coordination requirement similar to that specified in section 87.305. This pre-application coordination requirement historically has been successful in minimizing the risk of harmful interference between flight test stations and other users of the band. Adopting a similar process may be helpful in the space launch context given the heavy usage of these bands by Federal entities as well as other space launch operators and the potential of interference to these operations. While it may, on first glance, seem that there is duplicative review, the pre-application coordination helps to narrow down the acceptable operating parameters of the use, thereby reducing administrative burdens and expediting review once the application is submitted. We seek comment on whether to apply this pre-application coordination process, or whether, in the alternative, the Commission should impose a different coordination process.

104. In this regard, we observe that Federal entities seeking to use the 2025-2110 MHz band for TT&C uplink purposes must complete a similar coordination process prior to submitting an application for authorization to NTIA. A Federal entity must coordinate with all BAS and other non-Federal incumbents that may be affected by the Federal operation prior to submitting an application, and must engage the local BAS frequency coordinator(s), where available, in support of achieving such coordination.<sup>228</sup> To the extent that the Commission adopts a non-Federal allocation in the 2025-2110 MHz band for TT&C uplink purposes, we seek comment on whether to require commercial space launch operators seeking to use the band to follow the same pre-application coordination process to help ensure that launch operations will not cause harmful interference to applicable non-Federal and Federal incumbents in the band.<sup>229</sup> Alternatively, we seek comment as to whether we should apply a different pre-application coordination, such as the process identified in section 87.305.<sup>230</sup>

105. If the Commission determines it would be in the public interest to adopt a pre-application coordination requirement, should the Commission appoint a designated frequency coordinator to streamline the coordination process? The Commission designated the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) as the frequency coordinating committee for non-Government flight test telemetry station assignments in the 1435-1535 MHz band and extended authority to the 2310-2320 MHz and 2345-2390 MHz bands.<sup>231</sup> If the Commission decides to appoint a specific frequency

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<sup>228</sup> See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, 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*, ET Docket No. 00-258, WT Docket No. 02-8, Seventh Report and Order, 19 FCC Rcd 21350, 21363, para. 27 (2004); 47 CFR § 2.106, footnote US346. Federal entities must coordinate with BAS, CARS, and LTTS licensees within the coordination contour of the federal station, consistent with Appx. 7 of the ITU Radio Regulations.

<sup>229</sup> See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, ET Docket No. 00-258, 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, ET Docket No. 00-258, WT Docket No. 02-8, Seventh Report and Order, 19 FCC Rcd 21350, 21363, para. 27 (2004).

<sup>230</sup> New BAS, CARS, and LTTS stations may coordinate using coordination procedures applicable to their services. See 47 CFR §§ 74.638(c)-(d), 78.36(c)-(d), and 101.103. We could similarly apply a service-specific coordination process to the 2025-2110 MHz band rather than follow the Federal process.

<sup>231</sup> *Amendment of Part 87 of the Commission's Rules to Make Provision for the Establishment of an Indus. Frequency Advisory Comm. For Coordination of Frequencies in the 1435-1535 MC/S Band*, Docket No. 18234, Report and Order, 15 FCC 2d 831 (1969); Aeronautical Flight Test Telemetry Operations, 49 FR 39330-01

coordinator, would it be in the public interest to extend AFTRCC's authority, or should the Commission appoint a different entity?

106. *Post-grant coordination.* Given that the license terms associated with permanent authorizations may span several years, we seek comment on coordination between space launch licensees and other users of the respective bands for separate launch operations. We note that experimental STAs are approved, and thereby coordinated, on a per launch basis. By contrast, the Part 87 flight test rules do not require additional formal coordination once an application has been granted.<sup>232</sup> Given the complicated logistics entailed in a space launch operation, as well as changes in the operational environment on and around Federal ranges and other sites that are likely to occur over time, we do not believe that a one-time coordination would be effective to cover all launches that occur during the term of an operator's license. At the same time, we also wish to avoid a coordination process that is overly burdensome for launch operators or that injects uncertainty as to spectrum access. We request that commenters propose solutions for this issue in their comments.

107. We seek comment on other coordination processes that are streamlined and efficient for space launch entities yet are also adequately protective of Federal operations and consistent with the provisions of the Commission and NTIA's MOU. We ask that commenters include detailed coordination procedures in their proposals, as well as the cost and benefits of the proposed process. We note that, given the importance in minimizing the potential for harmful interference to Federal and non-Federal uses alike in these bands, we do not anticipate that coordination procedures would include a "shot clock"—*i.e.*, a provision that permits launch operators to move forward if review has not been completed by a certain date. We seek comment, however, on whether notification procedures could, under some circumstances or conditions, be sufficient to meet coordination requirements.<sup>233</sup>

## 2. Technical Rules for Space Launch Operations

108. We seek comment on a proposed technical framework and on additional technical requirements for operations in the non-Federal allocations in the 2200-2290 MHz band and for operations in the proposed non-Federal allocations in the 420-430 MHz, 2025-2110, and 5650-5925 MHz bands. We seek to develop a technical framework and requirements that can address the unique needs of the commercial space sector.

109. Our goal in establishing a technical framework for commercial space launch operations is to develop rules that support the evolving interests and requirements of commercial space entities while minimizing harmful interference between Federal and non-Federal operations. We find that the current framework that applies to Federal operators offers a predictable and tested model that promotes the efficient use of spectrum while minimizing interference among users in these bands. We therefore propose to adopt a similar set of technical rules to non-Federal space launch operations in the newly allocated 2200-2290 MHz band as well as in the proposed allocations. We find that adopting a technical framework similar to that which currently applies to Federal operations will promote interoperability and allow commercial launch providers to benefit from the economies of scale inherent from using the same radio systems for both Federal agencies and commercial customers.<sup>234</sup>

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(1984) (amending Part 87 rules governing flight test telemetry stations by requiring the frequency advisory committee to coordinate frequency assignment requests with the responsible Government Area Frequency Coordinator).

<sup>232</sup> Many of the Part 87 flight test/aeronautical mobile telemetry licenses, however, have shorter, five-year or less license terms. *See License Term* discussion.

<sup>233</sup> *See Launch Spectrum Principles Letter* at 3.

<sup>234</sup> *See supra* para. 28; *cf. Amendment of the Frequency Allocation and Aviation Services Rules (Parts 2 and 87) to provide frequencies for use by commercial space launch vehicles*, GN Docket No. 89-16, Report and Order, 5 FCC Rcd 493, 494, para. 10 (1990) (noting comments that "launch vehicles that are used now by Government and non-

(continued....)

110. In the 2013 *Notice of Proposed Rulemaking*, the Commission sought comment generally on how to support the anticipated growth of the commercial space launch industry.<sup>235</sup> The Commission asked whether providing non-Federal access to this spectrum would allow commercial space launch operators to incur lower development costs because they would be able to use the same communications systems for both Federal and non-Federal launches.<sup>236</sup>

111. Several commenters support allocations and service rules that promote interoperability between Federal and commercial systems.<sup>237</sup> For example, New Mexico Spaceport Authority (NMSA) maintains that interoperability between ranges avoids increased costs for development, hardware acquisition, operations, and testing; saves on opportunity costs; increases competition among launch providers and launch sites; and promotes the industry overall.<sup>238</sup>

112. We seek comment on our proposal to model a technical framework on rules applicable to Federal launch operations. We discuss below, as examples of this approach, certain technical requirements set forth in NTIA rules or ITU Radio Regulations and seek comment on whether to apply similar rules to the 2200-2290 MHz band, as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations.<sup>239</sup> We seek comment on other technical requirements that apply to Federal space launch operations in the relevant bands, such as any requirements regarding frequency tolerance, emissions classifications, or emissions levels, the benefits and costs of such requirements, whether we should apply these requirements to non-Federal operations, and any additional technical rules needed to achieve our goals. For example, Table 5.2.1 of the NTIA Manual specifies frequency tolerance standards for aeronautical, space, and radiolocation stations in the frequencies at issue in this proceeding among others.<sup>240</sup> We seek comment on adopting these or alternative frequency tolerance standards.

**a. 2200-2290 MHz**

113. The 2200-2290 MHz band typically is used, in non-Federal space launch operations, for sending telemetry data from the launch vehicle to ground controllers. NTIA explains that Federal operations in the band primarily consist of tracking, telemetry, and control data communications for control of spacecraft.<sup>241</sup> The band is used by Federal agencies in space operation, space research and Earth exploration-satellite service (space-to-Earth) for communications with earth stations and return links via TDRSS (space-to-space), which provides links between low earth orbiting spacecraft and earth stations. Federal agencies and the military also use this band for terrestrial telemetry operations for

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Government entities are cost efficient because they have identical requirements, and thus are built in the same assembly line, stored without customer discrimination before they are sold and use the same launch facilities”).

<sup>235</sup> *Space NPRM*, 28 FCC Rcd at 6726-27, paras. 74-75.

<sup>236</sup> *Space NPRM*, 28 FCC Rcd at 6727, para. 75.

<sup>237</sup> NMSA Comments at 4-5.

<sup>238</sup> NMSA Comments at 4.

<sup>239</sup> The ITU is the specialized agency of the United Nations responsible for information and communications technologies. ITU's Radiocommunication Sector (ITU-R) develops global technical and operational standards for radio-based telecommunication systems and services. NTIA frequently adopts these recommendations in the NTIA Manual. If spectrum standards are not set forth in the NTIA Manual, provisions of the ITU Radio Regulations typically apply. If spectrum standards are neither specified in the NTIA Manual nor the ITU Radio Regulations, provisions of the ITU-R Recommendations are used as guidelines. *See* NTIA Manual § 8.2.26.

<sup>240</sup> *See, e.g.*, NTIA Manual, Table 5.2.1 (providing frequency tolerance standards of 20 parts-per-million (ppm) for aeronautical and space stations in the 2025-2110 MHz and 2200-2290 MHz bands, 2.5-5 ppm (depending on mean power) for land stations in the 420-430 MHz band, and 1250 ppm for radiodetermination stations in the 5650-5925 MHz band).

<sup>241</sup> National Telecommunications and Information Administration, *2200-2290 MHz* (March 1, 2014), <https://www.ntia.doc.gov/files/ntia/publications/compendium/2200.00-2290.00-01MAR14.pdf>.

aircraft, missile flight testing, land and maritime mobile communications, and fixed point-to-point microwave relay communications.

114. As discussed above, we have adopted a Space Operation allocation for the 2200-2290 MHz band and are also seeking comment on adopting a Mobile allocation in this band.<sup>242</sup> As space launch operations in this band may potentially operate under this dual regulatory approach, we seek comment on technical requirements under both a space operations and aeronautical mobile allocation, including whether these technical rules align with NTIA's requirements for both Federal and non-Federal space operations and how we might promote consistency between and among the various, similarly situated services authorized in the band.

115. *Emission mask.* Under NTIA's space operations requirements, earth and space stations in the space operations service above 470 MHz must comply with the emissions mask standard established in section 5.6.2 of the NTIA Manual.<sup>243</sup> Section 5.6.2 provides that for frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required.<sup>244</sup> At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required.<sup>245</sup> Frequencies offset more than 50 percent of the necessary bandwidth should be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.<sup>246</sup>

116. Section 5.3.9 of the NTIA Manual provides that aeronautical telemetry operation in the 2200-2290 MHz band must meet the emissions limits from Chapter 2 of the Inter-Range Instrumentation Group (IRIG) Standard 106-15, Part 1.<sup>247</sup> Chapter 2 of IRIG Standard 106-15, Part 1 (hereinafter IRIG Standard 106-15), in turn, includes the following aeronautical telemetry spectral mask: all spectral components larger than  $-[55 + 10 \times \log(P)]$  dBc (*i.e.*, larger than  $-25$  dBm) at the transmitter output must be within the spectral mask calculated using the following equation:

$$M(f) = K + 90 \log(R) - 100 \log |f-f_c|; |f-f_c| \geq R/m$$

where  $M(f)$  = power (dBc) at frequency  $f$  (MHz)

$K = -20$  for analog signals

$K = -28$  for binary signals

$K = -61$  for FQPSK-B, FQPSK-JR, SOQPSK-TG

$K = -73$  for ARTM CPM

$f_c$  = transmitter center frequency (MHz)

$R$  = bit rate (Mbps) for digital signals or  $(\Delta f + f_{max})$ (MHz) for analog FM signals

$M$  = number of states in modulating signal ( $m = 2$  for binary signals,  $m = 4$  for quaternary signals)

<sup>242</sup> See *supra* para. 49.

<sup>243</sup> See NTIA Manual § 5.2.2.1.

<sup>244</sup> See NTIA Manual § 5.6.2 (“Unwanted Emission Mask”). Necessary bandwidth is defined as follows: “For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.” See NTIA Manual § 6.1.1. Methods of calculating necessary bandwidth are provided in Annex J. See NTIA Manual, Annex J.

<sup>245</sup> See *id.*

<sup>246</sup> See *id.*

<sup>247</sup> See NTIA Manual, §§ 5.2.2.1, 5.3.9. See also Telemetry Standards, “Transmitter and Receiver Systems,” IRIG Standard 106-15 (Part 1), Chapter 2, (July 2015) (IRIG Standard 106-15), available at <http://www.irig106.org/docs/106-15/>. The NTIA Manual states that “aeronautical telemetering” in the 2200-2290 MHz band includes “telemetry associated with launch vehicles[.]” NTIA Manual, § 4.3.4(2).

and analog signals)

$\Delta f$  = peak deviation

$f_{\max}$  = maximum modulation frequency<sup>248</sup>

117. While we seek to align the technical parameters used by Federal and non-Federal operations to facilitate interoperability, we also seek to introduce measures that will help licensees to simplify or streamline operations, while ensuring that other users in the band are protected. To that end, we request comment on the utility of using one specific mask for all non-Federal operations in the band as an alternative to NTIA's dual emissions mask approach.<sup>249</sup> For example, we seek comment on applying the space operations emissions mask described above at all stages of flight, or whether alternatively the emission limits for space stations found in Part 25 should be applied.<sup>250</sup> As another alternative, we seek comment on the use of the emission mask described in Part 87 of the Commission's rules:<sup>251</sup> (1) on any frequency removed from the assigned frequency by more than 50 percent, up to and including 100 percent of the authorized bandwidth, at least 25 decibels attenuation; (2) on any frequency removed from the assigned frequency by more than 100 percent, up to and including 250 percent of the authorized bandwidth, at least 35 decibels attenuation; and (3) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth, at least  $43 + 10 \log(pY)$  decibels or 80 decibels, whichever is the lesser attenuation. We seek comment on these emission masks and whether such masks are appropriate notwithstanding our goal of promoting interoperability. Alternatively, we seek comment on whether to follow the NTIA approach of applying the aeronautical telemetry and space operations emission masks referenced by the NTIA Manual to first-stage and subsequent telemetry operations in the band, respectively, or any other alternatives.

118. *Power limits.* The RCC's IRIG Standard 106-15 that NTIA applies to aeronautical telemetry in the 2200-2290 MHz band provides that the EIRP of a transmitter shall not exceed 25 watts and that the output power shall not exceed 25 watts.<sup>252</sup> NTIA's space operations requirements, in contrast, do not impose a power limit, and instead rely on a power flux-density limit.<sup>253</sup> Consistent with the Federal requirements, we seek comment on whether to limit first-stage operations to an effective radiated power of 25 watts and a transmitter output power of up to 25 watts, and below, we seek comment on whether to apply a power flux-density limit on operations after the first stage. Alternatively, if we adopt a power flux-density limit in the band, we seek comment on whether no further limit on power is necessary, or whether we should adopt an alternative to the power limit in IRIG Standard 106-15.

119. *Power flux-density limits applicable to second-stage operations.* The ITU Radio Regulations establish power flux-density limits at the surface of the Earth from space research, space operation and Earth exploration-satellite services in the 2025-2110 MHz and 2200-2290 MHz bands in

<sup>248</sup> See IRIG Standard 106-15, § 2.4.6.

<sup>249</sup> We note that similar launch telemetry services in other bands have been subject to a single aeronautical standard at all stages. For example, the NTIA Manual provides that the 1435-1525 MHz band's terrestrial mobile service includes launch telemetry at all stages, including all "telemetry associated with launching and reentry into the Earth's atmosphere as well as any incidental orbiting prior to reentry of manned objects[.]" See NTIA Manual, § 4.3.4(1). Similarly, the Commission has previously regulated launch telemetry at all stages as an aeronautical mobile service. See U.S. Table, US343; 47 CFR § 87.303(d)(1) (providing that frequencies in the 1435-1525 MHz and 2360-2395 MHz bands, with non-Federal allocations of Mobile (aeronautical telemetry) and Mobile, respectively, are assigned in the mobile service primarily for aeronautical telemetry including "telemetry and associated telecommand operations associated with the launching and reentry into the Earth's atmosphere, as well as any incidental orbiting prior to reentry, of objects undergoing flight tests").

<sup>250</sup> See 47 CFR § 25.202(f).

<sup>251</sup> See 47 CFR § 87.139.

<sup>252</sup> See IRIG Standard 106-15, Ch. 2 § 2.4.2.

<sup>253</sup> See NTIA Manual, § 8.2.36.

order to protect the fixed and mobile services in those bands.<sup>254</sup> These limits are reflected in section 8.2.36 of the NTIA Manual.<sup>255</sup> We seek comment above on potentially treating commercial space operations in the band under both a mobile service and space operation service allocation framework.<sup>256</sup> If we adopt this approach, what should be the boundary between these regulatory frameworks for purposes of applying the ITU power-flux density limits? Should the ITU power flux-density limits apply when the launch vehicle is above a specified altitude, at a certain time after launch, at a particular stage of operation, or based on some other fashion on launch operations in the band? For example, the power flux-density limits could apply after 15 minutes of flight, or alternatively, could apply to either the second or subsequent stage of the launch vehicles operation. Would applying the power-flux density limit above a certain altitude better accommodate reentry operations as well? To the extent NTIA requires space launch operations to meet the PFD limit, at what stage of the launch (or at what demarcation point) does NTIA require compliance with the limit? Should we adopt a parallel requirement in our technical rules? We further seek comment on whether, aside from the interest in harmonization, we should impose the power flux-density limit on operations in the 2200-2290 MHz band in a reference bandwidth of 1 megahertz instead of 4 kilohertz, consistent with Recommendation ITU-R SA.1273.<sup>257</sup>

**b. 420-430 MHz**

120. As noted, the 420-430 MHz band typically is used for sending flight termination commands from ground control to the launch vehicle, if necessary, during launch. Non-Federal entities may obtain access to this band through STAs. NTIA explains that the band is also used by the military and other Federal agencies for a number of important radar applications, multi-function position-location communications systems, and test range telecommand and flight termination systems, making the band essential to national security.<sup>258</sup>

121. We recognize that several commercial space launch entities have migrated or are in the process of migrating the flight termination signal from transmission of a signal from the ground station to launch vehicle to an automated function within the launch vehicles via onboard systems (*i.e.*, the flight termination sequence is now initiated from onboard the launch vehicle). Moreover, launches to date have occurred at Federal ranges, so access to this band by commercial launch providers has not been necessary. However, we expect this to change as companies transition towards using commercial launch sites in the future. Therefore, adopting technical rules for commercial flight termination functions in the 420-430 MHz band is critical for ensuring the public is protected during space launches.<sup>259</sup> To facilitate seamless operation with respect to Federal and non-Federal operations, we seek comment on whether to apply the same technical specifications for flight termination used by Federal space launches to non-Federal operations. For example, below, we seek comment on applying NTIA rules regarding emission mask and power limits.

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<sup>254</sup> See No. 21.16 of Article 21 of the ITU Radio Regulations. No. 21.17 of the ITU Radio Regulations provides that these limits may be exceeded on the territory of any administration who has so agreed, thus providing individual administrations with some flexibility in how these limits are implemented. See also Recommendation ITU-R SA.1273, [https://www.itu.int/dms\\_pubrec/itu-r/rec/sa/R-REC-SA.1273-0-199710-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/sa/R-REC-SA.1273-0-199710-I!!PDF-E.pdf). Recommendation ITU-R SA.1273 recommends similar levels as in Article 21, except that the reference bandwidth is 1 megahertz instead of 4 kilohertz and the level for space-to-space links in the Space Operations Service is 3 dB higher.

<sup>255</sup> NTIA Manual, § 8.2.36; see also NTIA Manual, Annex B, § B.1.3 (establishing procedures for assessing compliance with power flux-density limits).

<sup>256</sup> See *supra* para. 49.

<sup>257</sup> See Recommendation ITU-R SA.1273, [https://www.itu.int/dms\\_pubrec/itu-r/rec/sa/R-REC-SA.1273-0-199710-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/sa/R-REC-SA.1273-0-199710-I!!PDF-E.pdf).

<sup>258</sup> National Telecommunications and Information Administration, *420-450 MHz* (Feb. 1, 2017), [https://www.ntia.doc.gov/files/ntia/publications/compendium/0420.00-0450.00\\_01Feb17.pdf](https://www.ntia.doc.gov/files/ntia/publications/compendium/0420.00-0450.00_01Feb17.pdf).

<sup>259</sup> See Commercial Spaceflight Federation Comments at 1; SpaceX Comments at 8.

122. *Emission mask.* NTIA requires land/mobile stations in the 420-430 MHz band to meet the standard established in section 5.2.2.2.<sup>260</sup> This section requires that the mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, must be in accordance with the following: (a) on any frequency removed from the assigned frequency by more than 75 percent, up to and including 150 percent, of the authorized bandwidth, at least 25 decibels attenuation; (b) on any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent, of the authorized bandwidth, at least 35 decibels attenuation; and (c) on any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, two levels of attenuation depending on whether the transmitter operates with mean power of (1) less than 5 kilowatts or (2) 5 kilowatts or greater.<sup>261</sup>

123. To facilitate similar treatment among non-Federal and Federal launches, we propose to apply an emission mask similar to section 5.2.2.2 to commercial launch operators using the 420-430 MHz band for flight termination purposes. We seek comment on the proposed emission mask. We request comment on alternative limits, and on the need for an emission mask generally for the transmission of this singular function.

124. *Power limits.* NTIA permits a maximum power limit of 1 kW of transmit power for range safety operations in the 420-450 MHz bands, which include flight termination operations such as self-destruct commands.<sup>262</sup> Requests for additional power must be coordinated with and agreed to by the Commission.<sup>263</sup> Range safety operations at three specific locations—Vandenberg AFB, CA; White Sands Missile Range, NM; and Cape Canaveral AFS, FL—may be authorized up to 10 kW transmit power without Commission coordination.<sup>264</sup>

125. We aim to provide flexibility to space launch operators using this band, but we recognize that limits are particularly necessary in this band, given that the intended use of this band is for safety-of-life applications. Consistent with the NTIA requirements, and with NTIA's stated preference for non-Federal launch operations in the band, we propose to permit an effective radiated power of up to 1000 watts by non-Federal launch providers.<sup>265</sup> We seek comment on whether our proposed limits are sufficient to provide both the flexibility and the protection necessary to this safety-of-life application. We also seek comment on whether to consider alternative limits.

### **c. 2025-2110 MHz**

126. The 2025-2110 MHz band supports fixed and mobile services on a primary basis for non-Federal terrestrial use. The band is allocated to BAS and LTTS for fixed and mobile use and to CARS for mobile use only. Federal operations include communications with satellites or other space stations, as

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<sup>260</sup> See NTIA Manual § 5.2.2.1. An "earth station" is defined as a station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication with one or more space stations or with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. See NTIA Manual § 6.1.1. A "space station" is a station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere. See *id.*

<sup>261</sup> See NTIA Manual § 5.2.2.2. Specifically, on any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, section 5.2.2.2 requires, in relevant part, that: (1) for transmitters with mean power of 5 kilowatts or greater, attenuation shall be at least 80 decibels; and (2) for transmitters with mean power less than 5 kilowatts, spurious output shall not exceed 50 microwatts (*i.e.*,  $43+10 \log(pY)$ ) decibels attenuation.

<sup>262</sup> See NTIA Manual § 8.2.54.

<sup>263</sup> See NTIA Manual § 8.2.54.

<sup>264</sup> See NTIA Manual § 8.2.54.

<sup>265</sup> See *NTIA 2016 Letter* at 4 ("When developing the proposed service rules for [the 420-430 MHz] band, the FCC should consider the restriction currently contained in Section 8.2.54 of the *NTIA Manual*, which limits frequency assignments in this band to 1 kW of transmit power at most locations.").

well as between satellites or spacecraft, occurring under primary allocations for space operations (Earth-to-space) (space-to-space), space research (Earth-to-space) (space-to-space), or Earth exploration-satellite service (Earth-to-space) (space-to-space).<sup>266</sup> Federal agencies operate earth stations in this band for tracking and command of manned and unmanned Earth-orbiting satellites and space vehicles either for Earth-to-space links for satellites in all types of orbits or through space-to-space links using TDRSS. In addition, the National Oceanic and Atmospheric Administration (NOAA) operates earth stations in this band to control the Geostationary Operational Environmental Satellite (GOES) and Polar Operational Environmental Satellite (POES) meteorological satellite systems.<sup>267</sup> To facilitate the relocation of military operations from the 2155-2180 MHz band, the 2025-2110 MHz band also includes a primary Federal allocation for fixed and mobile services, restricted to use by the military services and subject to certain provisions codified in footnote US92 of the U.S. Table.<sup>268</sup>

127. *Emission mask.* The most analogous authorized Federal operation in the 2025-2110 MHz band is earth station telecommand transmissions to spacecraft, which operate under space operations rules. As discussed above, NTIA requires that earth and space stations in the space operations service above 470 MHz comply with the emissions mask standards established in section 5.6.2 of the NTIA Manual.<sup>269</sup> Section 5.6.2 provides that for frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required.<sup>270</sup> At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required.<sup>271</sup> Frequencies offset more than 50 percent of the necessary bandwidth should be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.<sup>272</sup>

128. Consistent with our general approach, we propose to adopt the NTIA's emissions mask described above for commercial space launch transmissions in the 2025-2110 MHz band, except that we propose to apply attenuation requirements to the licensee's assigned frequencies rather than requiring a separate calculation of necessary bandwidth. We seek comment on this proposal, and on whether we should adopt an alternative emissions mask.

129. *Power limits.* NTIA requires that the EIRP transmitted in any direction towards the horizon by a Federal earth station in bands between 1 GHz and 15 GHz that are shared with stations in the

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<sup>266</sup> See National Telecommunications and Information Administration, *2025-2110 MHz* (March 1, 2014), [https://www.ntia.doc.gov/files/ntia/publications/compendium/2025.00-2110.00\\_01MAR14.pdf](https://www.ntia.doc.gov/files/ntia/publications/compendium/2025.00-2110.00_01MAR14.pdf), at section 3, Federal Agency Use (listing types of applications and the number of assignments by agency).

<sup>267</sup> See *id.* at 1.

<sup>268</sup> See 47 CFR § 2.106, footnote US92; *Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, GN Docket No. 13-185, Report and Order, 29 FCC Rcd 4610, 4689, para. 211 (2014). Footnote US92 includes, among other provisions, a requirement that military fixed and mobile operations in the 2025-2110 MHz band may not cause harmful interference to or constrain the deployment and use of the band by BAS, CARS, or LTTS, a requirement of coordination in accordance with a Memorandum of Understanding between Federal and non-Federal fixed and mobile operations, and a provision that Non-Federal licensees in the band shall make all reasonable efforts to accommodate military mobile and fixed operations but that the use of the band by the non-Federal fixed and mobile services has priority over military fixed and mobile operations. See 47 CFR § 2.106, footnote US92.

<sup>269</sup> See NTIA Manual § 5.2.2.1.

<sup>270</sup> See NTIA Manual § 5.6.2 ("Unwanted Emission Mask"). Necessary bandwidth is defined as follows: "For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions." See NTIA Manual § 6.1.1. Methods of calculating necessary bandwidth are provided in Annex J. See NTIA Manual, Annex J.

<sup>271</sup> See *id.*

<sup>272</sup> See *id.*



fixed or mobile service, which includes the 2025-2110 MHz band, shall not (with limited exceptions) exceed the following limits:

- +40 dBW in any 4 kHz band for  $\theta \leq 0^\circ$
- +40+3 $\theta$  dBW in any 4 kHz band for  $0^\circ < \theta \leq 5^\circ$

where  $\theta$  is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.<sup>273</sup>

130. Consistent with our general approach, we propose to adopt the NTIA's limit on maximum transmitted EIRP for commercial space launch transmissions in the 2025-2110 MHz band. We seek comment on this proposal, and on whether we should adopt an alternative maximum power limit.

**d. 5650-5925 MHz**

131. The 5650-5925 MHz band supports launch vehicle radar tracking. As noted, tracking of a launch vehicle typically involves use of a transponder that is placed on the launch vehicle. The transponder transmits a radar signal that is received at a ground-based tracking station. The radar signal provides ground controllers with more precise and accurate tracking information for the launch vehicle. NTIA explains that the Department of Defense (DoD) uses this band for a wide variety of radar applications, including anti-air warfare radars, which are part of an advanced ground-based air defense missile system. DoD and NASA also use this band for a variety of land-based and shipborne radars.<sup>274</sup> The 5650-5925 MHz band also supports daily DoD and Department of Homeland Security (DHS) unmanned aircraft systems (UAS) missions.

132. Section 5.5 of the NTIA Manual contains the technical rules for Federal radar operations in the 5650-5925 MHz band. Section 5.5 provides five classifications of radar (Criteria A through E) incorporating NTIA's Radar Spectrum Engineering Criteria (RSEC). The RSEC establishes the technical standards for Federal radar use. Operations in the 5650-5925 MHz band are governed by RSEC Criteria A, RSEC Criteria B, or RSEC Criteria C, depending on the system characteristics and peak operating power of the radar system. RSEC Criteria A radars include radars with the following system characteristics: (1) non-pulsed radars of 40 watts or less rated average power; (2) pulsed radars of 1 kW or less rated peak power; (3) radars with an operating frequency above 40 GHz; and (4) expendable, non-recoverable radars on missiles.<sup>275</sup> Criteria B applies if the radar system operates with a peak power over 1000 Watts and less than 100 kW.<sup>276</sup> Criteria C applies if the system operates with less than 1000 Watts.<sup>277</sup> The NTIA Manual also includes receiver standards.<sup>278</sup>

133. *Emission mask.* To facilitate the interoperable use of tracking radar equipment, we propose that Commission licensees that plan to utilize the 5650-5925 MHz band for launch vehicle

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<sup>273</sup> NTIA Manual § 8.2.35; see also *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, ET Docket No. 00-258, Seventh Report and Order, 19 FCC Rcd 21350, para. 33 (2004) (noting that this provision of the NTIA Manual applies to Defense Department earth stations for tracking, telemetry, and commanding that operate in the 2025-2110 MHz band). We note that, under this standard, there is no power limit for angles of elevation above five degrees.

<sup>274</sup> National Telecommunications and Information Administration, *5650-5925 MHz* (Feb. 1, 2017), [https://www.ntia.doc.gov/files/ntia/publications/compendium/5650.00-5925.00\\_1Feb2017.pdf](https://www.ntia.doc.gov/files/ntia/publications/compendium/5650.00-5925.00_1Feb2017.pdf).

<sup>275</sup> See NTIA Manual § 5.5.2. See also NTIA Manual § 5.5.7.1 (RSEC Criteria A).

<sup>276</sup> See NTIA Manual § 5.5.2. See also NTIA Manual § 5.5.7.2 (RSEC Criteria B).

<sup>277</sup> See NTIA Manual § 5.5.2. See also NTIA Manual § 5.5.7.3 (RSEC Criteria C).

<sup>278</sup> The Commission does not establish receiver standards.

tracking will need to comply with the applicable RSEC requirements in the NTIA Manual.<sup>279</sup> The NTIA Manual provides emission masks for RSEC Criteria A, RSEC Criteria B, and RSEC Criteria C. We propose to incorporate the emission masks listed in the NTIA Manual.<sup>280</sup> We seek comment on this proposal and also request the submission of any alternative emission masks that may be applicable for operations in the band.

134. *Power limits.* While NTIA requires radar operations to meet RSEC technical requirements, neither the RSEC requirements nor ITU Radio Regulations establish a specific power limitation for emissions inside the assigned bandwidth for radar operations in the 5650-5925 MHz band. However, we note that an ITU Recommendation, ITU-R M.1638-1, provides characteristics and sharing studies for certain radiolocation uses in the 5250-5850 MHz band that may be of use in helping to establish appropriate technical standards for radar tracking operations in the 5650-5925 MHz band.<sup>281</sup> We seek comment on whether it is appropriate to derive power limits for operations in the 5650-5925 MHz band using parameters described in Recommendation ITU-R M.1638-1, specifically those found in Annex 1, Table 2, of the recommendation. We seek comment on appropriate limit(s) identified in the recommendation as well as alternative power levels.

135. *Accommodation of other services.* We sought comment above on potential restrictions to the non-Federal radiolocation allocation in the 5650-5925 MHz band to enable coexistence with other operations in portions of this band.<sup>282</sup> These other operations include the Intelligent Transportation Systems that operate in 5895-5925 MHz, U-NII devices that operate in 5650-5895 MHz, and fixed-satellite service uplinks that operate in 5850-5925 MHz.<sup>283</sup> We seek comment on whether to adopt requirements or restrictions in the service rules for the radiolocation service to facilitate coexistence with these other operations. These may include, for example, limiting the portions of the band and/or locations where radiolocation operations may be conducted, restricting use of the radiolocation service only to transponders attached to launch vehicles, requiring coordination with these other operations, or limiting the power that radiolocation stations may transmit in the direction of the geostationary arc.

**e. 2360-2395 MHz**

136. As noted in the NPRM, three frequencies in the 2360-2395 MHz band are available for both Federal and non-Federal telemetry and telecommand use for launch and reentry vehicles.<sup>284</sup> This

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<sup>279</sup> See NTIA Manual § 5.5.7.2 at pages 5-37 and 5-38. See also NTIA Manual § 5.5.7.3 at pages 5-38 through 5-41.

<sup>280</sup> See NTIA Manual § 5.5.7.1 for RSEC Criteria A, NTIA Manual § 5.5.7.2 for RSEC Criteria B, and NTIA Manual § 5.5.7.3 for RSEC Criteria C.

<sup>281</sup> See ITU Recommendation ITU-R M.1638-1, Characteristics of and protection criteria for sharing studies for radiolocation (except ground based meteorological radars) and aeronautical radionavigation radars operating in the frequency bands between 5-250 and 5-850 MHz (Jan. 2015).

<sup>282</sup> See *supra* paras. 58, 59.

<sup>283</sup> 47 CFR § 2.106 Footnote NG160; 47 CFR § 15.407.

<sup>284</sup> *Space NPRM*, 28 FCC Rcd at 6729-30, para. 83; 47 CFR §§ 2.106 US276, 87.303(d)(1); *Amendment of the Frequency Allocation and Aviation Services Rules (Parts 2 and 87) to Provide Frequencies for Use by Commercial Space Launch Vehicles*, Report and Order, 5 FCC Rcd at 495, para. 15 (1990); *Establishment of Rules and Policies for the Digital Audio Radio Service in the 2310-2360 MHz Frequency Band*, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, 12 FCC Rcd at 5805-06, paras. 124-26 (1997); *Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range*, Report and Order, 18 FCC Rcd at 23441-43, paras. 37-40 (2003); *Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 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*, Notice of Proposed Rulemaking and Order, 27 FCC Rcd at 14623, para. 57 (2012); 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*

(continued....)

band is currently regulated under Subpart J of the Commission's Part 87 rules. As discussed in Section IV.B, one proposal is to create a separate subpart under the Part 87 rules for the commercial space launch operations under the non-Federal space operations allocation we adopt today for the 2200-2290 MHz band. We seek comment on whether to administer the 2360-2395 MHz space launch use under this new subpart or whether to retain the Subpart J designation. If we administer the 2360-2395 MHz space launch use under the new subpart, should we apply the licensing scheme set forth under the new subpart or the existing licensing framework provided under the current Subpart J flight testing rules? In that event, should we continue to apply the technical rules currently applicable to these services? Moreover, if we continue to apply the Subpart J rules to the 2360-2395 MHz frequencies that may be used for space launch operations, should we eliminate or amend any requirements under that subpart, including technical requirements such as power and emission limits, in light of other rule changes we propose to adopt today? We also note that space launch telemetry and telecommand operations in the 2360-2395 MHz band occur under a Mobile allocation.<sup>285</sup> In contrast, we have adopted a Space Operation allocation for space launch telemetry operations in the 2200-2290 MHz band, while seeking comment on whether to add a Mobile allocation, and we propose to adopt a Space Operation allocation for space launch telecommand operations in the 2025-2110 MHz band. We seek comment on whether, to facilitate any changes we should make to the 2360-2395 MHz band space launch rules, we should add a primary Space Operation allocation to the band, limited to launch vehicle telemetry and associated telecommand operations, subject to the same restrictions as apply to such operations under the Mobile allocation as specified in footnote US276 of the U.S. Table.<sup>286</sup>

137. While there has been substantial development of equipment for commercial space launches operating in the 2200-2290 MHz band, we have very limited information on the state of commercial space launch equipment operating in the 2360-2395 MHz band. Accordingly, we seek comment on the current state of equipment development for commercial space launch purposes in the band. We seek comment on whether any such equipment that has equipment authorization now or is currently in development should be grandfathered from any rule changes we adopt for the 2360-2395 MHz band.

#### **f. Equipment Authorization**

138. Radio Frequency (RF) devices are required to be properly authorized under 47 CFR part 2 prior to being marketed or imported into the United States. Equipment that contains an RF device must be authorized in accordance with the appropriate procedures specified in 47 CFR part 2, subpart J, with certain limited exceptions.<sup>287</sup> These requirements not only minimize the potential for harmful interference, but also ensure that the equipment complies with the rules that address other policy objectives—such as human RF exposure limits. The Commission has two different approval procedures for equipment authorization—Certification and Supplier's Declaration of Conformity (SDoC). The rule part governing the service under which the equipment operates may require that such equipment be authorized under SDoC or receive a grant of certification from a Telecommunication Certification Body. In some instances, a device may perform different functions under multiple rule parts, resulting in the

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*the World Radiocommunication Conference*, ET Docket Nos. 12-338, 15-99, IB Docket No. 06-123, *Report and Order, Order, and Notice of Proposed Rulemaking*, 30 FCC Rcd at 4211, para. 65 (2015). These frequencies have been available since 1990.

<sup>285</sup> See U.S. Table, footnote US276.

<sup>286</sup> Footnote US276 provides: "Except as otherwise provided for herein, use of the band 2360-2395 MHz by the mobile service is limited to aeronautical telemetering and associated telecommand operations for flight testing of aircraft, missiles or major components thereof. The following three frequencies are shared on a co-equal basis by Federal and non-Federal stations for telemetering and associated telecommand operations of expendable and reusable launch vehicles, whether or not such operations involve flight testing: 2364.5 MHz, 2370.5 MHz, and 2382.5 MHz. All other mobile telemetering uses shall not cause harmful interference to, or claim protection from interference from, the above uses."

<sup>287</sup> See 47 CFR Part 2, Subpart J.

device being subject to more than one type of approval procedure. Part 25, for example, requires equipment authorization for portable earth-station transceivers, *e.g.*, handsets, body-worn devices, antenna-in-keyboard notebook computers, as well as satellite digital audio radio service (SDARS) terrestrial repeaters and mobile-satellite service (MSS) ancillary terrestrial component (ATC) base stations and mobile transceivers.<sup>288</sup> Part 87 generally requires certification for aviation services equipment, with limited exceptions such as flight test station transmitters for limited time periods.<sup>289</sup> In the context of space launch operations, should we require Part 2 equipment authorization for the radio frequencies devices that are being used to provide space launch operations and if so, which procedure is appropriate? Are there any additional or alternative compliance requirements or authorization processes specified in any of our rule parts, including Part 25, Part 87, or Part 90, that may be appropriate for space launch radio frequency devices or would provide analogous models for authorizing such equipment? What should such rules, if any, look like? Commenters should discuss cost and benefits of any proposed equipment authorization process and how such a process would serve the public interest while ensuring the equipment complies with the technical rules applicable to space launch operations.

### C. Licensing and Operating Rules for Payload Activities

139. Although the primary focus of this proceeding is on radio-frequency use by space launch vehicles, space launch operations include launches of satellites and other commercial payloads. Accordingly, we also seek comment on whether there are improvements to the licensing process that could facilitate more routine licensing for certain payload activities currently addressed through experimental licensing. Launch payloads vary, from traditional geostationary and small satellites, to cargo capsules destined for the ISS, including the SpaceX Crew Dragon capsule transporting human crew to the ISS. Although most commercial payload needs for radiofrequency are addressed through the satellite licensing provisions in Part 25 of the Commission's rules, there are some types of activities that are currently addressed through experimental licensing.

140. For example, involving some of the same frequency bands that are used for space launch activities, SpaceX's cargo and crew capsules utilize S-band frequencies. For links between the capsule and ground stations, SpaceX uses 2106 MHz (earth-to-space) and 2216 MHz (space-to-earth); SpaceX also uses 2203.2 MHz for links between the capsule and the ISS, 2028.78 MHz for links between the ISS and the capsule, 2287.5 MHz for links between the capsule and TDRSS, and 2106.4 MHz for TDRSS to the Capsule.<sup>290</sup> In addition to SpaceX, another example is the Orbital Sciences Corporation, a Northrop Grumman Systems Corporation Affiliate, and its operations of the Cygnus spacecraft for transporting cargo to ISS, and deploying satellites. The Cygnus spacecraft has used 2287.5 (space-to-Earth) as well as 2287.5 MHz for links between the Cygnus spacecraft and TDRSS, and 2203.2 MHz for links between the Cygnus spacecraft and the ISS.<sup>291</sup> We seek comment on how to establish frequency allocations and license processes to facilitate commercial space launch operations involving operations of payloads.

141. We seek comment on whether any changes to the Table of Frequency Allocations we are adopting or proposing herein for the 2025-2110 MHz and 2200-2290 MHz frequency bands are needed to provide for these payload communications. What are the spectrum requirements for such operations?

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<sup>288</sup> See 47 CFR §§ 25.129, 25.144(e)(7)(iii) and 25.149(c). Other earth stations are subject to verification and certification processes within Part 25 to ensure compliance with applicable technical standards. Section 25.133 requires earth-station licensees to certify that their transmitters have been tested and found to be within emission limits and/or gain patterns specified in other sections. Unlike the certification rules in Part 2, however, Section 25.133 does not require submission of test data and does not require any equipment authorization to be obtained prior to importation, distribution, sale, or offer for sale. Transmitting FSS earth stations are subject to a test-based verification and certification requirement established by Section 25.132(a). See 47 CFR §§ 25.132(a) and 25.133.

<sup>289</sup> See 47 CFR §§ 87.145 and 87.147.

<sup>290</sup> Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-115, at 2 (filed July 6, 2020) (SpaceX July 6, 2020 *Ex Parte*).

<sup>291</sup> See, *e.g.*, Experimental Licensing System File No. 0927-EX-ST-2020.

Are there other frequency bands that the Commission should also consider for such uses? Recognizing that this use would also be subject to coordination with NTIA, are there additional technical provisions that would facilitate compatibility with existing Federal and other Non-Federal operations in these frequency bands?

142. In addition, we seek comment on whether such payload operations should be addressed in Part 25 of the Commission's rules. If so, as these newer commercial operations were not considered when many of our rules were first adopted, are there any modifications to the current Part 25 rules (e.g., default rules, bond requirements, fees, etc.) that may facilitate licensing?<sup>292</sup> Would a streamlined process along the lines of the recently adopted process for small satellites be appropriate for such operations?<sup>293</sup> Are there other licensing models that can be better suited for the needs of these payload operations?

143. We are also aware of at least one launch operator, Rocket Lab, which intends to operate a spacecraft, derived from a launch vehicle upper stage, which will remain in orbit and function as a payload, equipped with various radios and sensors designed for longer-term operations.<sup>294</sup> One option to license such operation is to require the applicant to apply for both a launch operation license to cover the launch vehicle and a separate license for orbital insertion activities to cover subsequent payload activities, assuming we decide to separate these activities and govern them under separate rule parts (e.g., Part 87 for the launch activities and Part 25 for the payload activities). To that end, we seek comment on this proposal and on the point at which operations should be considered to have switched from launch vehicle operations to payload operations (*i.e.*, which operations should be covered by the Part 87 license and which by the Part 25 license). In addition, reentry operations may be necessary for certain payload vehicles, especially those transporting human crew. We seek comment on whether there should be distinct regulatory framework for such commercial payload transportation as well as the appropriate authorization approach for such reentry operations. Finally, are there other approaches we should consider for licensing the radiofrequency operations of such objects?

144. In this *FNPRM*, we separate issues associated with the licensing of commercial space launch operations into space launch vehicle communications operations (including space launch vehicle reentry) and payload communications operations—due to their distinct communications operations and underlying missions. We believe that the telemetry, tracking, and command functions associated with the vehicle launch phase of a space launch are more akin to terrestrial aeronautical mobile and radiolocation operations under Parts 87 and 90, respectively, while the payload stage and associated communications may be more aptly viewed as space operations. Further, we anticipate that operators may have different spectrum needs or seek to address them in different ways. Given these differences, are there any advantages of establishing separate licensing for these activities? Would such an approach provide space launch operators with greater flexibility to seek spectrum tailored to their operations? That said, we seek comment on other alternatives, including whether it would be appropriate and serve the public interest to license all phases of a commercial space operation under one authorization. We seek comment on the costs and benefits of such an authorization, including the possible consequences of issuing a single license to cover all aspects of a commercial launch operation and the associated administrative burdens and benefits. For example, would consigning all necessary information under one authorization inadvertently complicate the application and licensing process given the disparate operations involved rather than streamlining or simplifying it? What are the procedural and legal challenges that the Commission needs to consider with such a licensing approach?

#### **D. Launch Vehicle-Satellite Communications**

145. While the new proposed licensing rules for space launch operations would support transmissions for TT&C between commercial space launch vehicles and ground stations, we also seek

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<sup>292</sup> See 47 CFR §§ 25.110, 25.164, 25.165, and 25.217.

<sup>293</sup> See 47 CFR § 25.122.

<sup>294</sup> Rocket Lab, *Satellite Solutions*, <https://www.rocketlabusa.com/satellites/> (last visited Mar. 31, 2021).

comment on authorizing communications between space launch vehicles and other space stations, including satellites. In some instances, we observe that radios designed for communications with the Globalstar or Iridium satellite systems, for example, have been used on space launch vehicles in order to utilize those systems for data relay, including for TT&C purposes. We seek comment on whether such operations should continue to be licensed on an experimental or otherwise case-by-case basis, or whether these types of operations could be authorized as part of one of the approaches to space launch vehicle licensing discussed in this *FNPRM*. If commenters support authorization for such uses on a regular basis, are any changes needed to the Table of Frequency Allocations to provide for such operations? Are there existing frameworks from which the Commission could draw to authorize space launch vehicle to satellite communications through a footnote to the domestic Table of Frequency Allocations and appropriate additions or revisions to Part 25? What additional technical provisions would be needed to ensure compatibility with existing systems and services? Commenters proposing any licensing approaches should also discuss costs and benefits of such approaches, including associated administrative burdens or benefits, and how their proposals would ensure the most efficient and effective use of the spectrum in the public interest. For example, we seek comment on whether any proposed licensing approach for such operations would streamline our licensing processes or complicate them, and on the procedural and legal challenges that the Commission needs to consider with such an approach.

#### **E. Expanded Federal Use of the non-Federal FSS and MSS Bands**

146. Over the past few years, U.S. space policies have evolved to encourage the Federal government to use commercial space-related systems to meet its satellite communications needs through commercial leasing, which can include investment in Federal earth stations. However, current rules do not protect Federal earth station investments when they are built to connect to commercial satellites. The FCC has collaborated with NTIA over many years on opportunities to provide greater parity between Federal and analogous non-Federal earth stations, recognizing that reliable satellite communications are vital for Federal agencies to accomplish their missions.

147. Nearly eight years ago, the *NPRM* sought comment on this issue.<sup>295</sup> Specifically, the *NPRM* sought comment on a proposal to add a co-primary Federal FSS or MSS allocation to several bands together with a footnote that limits primary Federal use of the bands to earth stations communicating with non-Federal space stations.<sup>296</sup> Alternatively, and in lieu of adding the new Federal allocations, the *NPRM* also sought comment on a proposal to add a footnote to the Table of Allocations outlining certain circumstances under which Federal earth stations operating with non-Federal space stations would be entitled to interference protection.<sup>297</sup> The bands under consideration at that time included a wide range of non-Federal FSS and MSS allocations.<sup>298</sup> The *NPRM* also proposed that for either approach, Federal agencies could operate earth stations in motion (ESIMs) on an interference protected basis to the same extent as non-Federal licensees. Under those proposals, Federal agencies would be expected to comply with all of the Part 25 rules pertaining to ESIMs and with the footnotes to the Allocation Table regarding ESIMs.<sup>299</sup>

148. In the *NPRM*, we noted that reliable access to spectrum for commercial launch operations and for federal earth stations were “two separate, but closely related portions of the commercial space sector.”<sup>300</sup> Moreover, the National Space Policy has long recognized both of these issues as vital to

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<sup>295</sup> See *Space NPRM*, 28 FCC Rcd at 6706-20, paras. 19-58.

<sup>296</sup> See *Space NPRM*, 28 FCC Rcd at 6712-17, paras. 36-46.

<sup>297</sup> See *Space NPRM*, 28 FCC Rcd at 6717-20, paras. 47-58.

<sup>298</sup> See *Space NPRM*, 28 FCC Rcd at 6707-12, paras. 25-34.

<sup>299</sup> See *Space NPRM*, 28 FCC Rcd at 6715-16, 6720, paras. 42, 57.

<sup>300</sup> See *Space NPRM*, 28 FCC Rcd at 6699, para. 1.

continued progress in space.<sup>301</sup> However, while we advance our proposals regarding commercial launch operations in the *Order*, we note that the spectrum landscape in non-Federal FSS and MSS allocations has changed significantly in the time since the *NPRM* was adopted. Our *Spectrum Frontiers, 3.7 GHz Service, 6 GHz* proceedings, among others, have altered the underlying assumptions about current and expected future uses of many of the frequency bands that were discussed in the *NPRM* and the subsequent record.<sup>302</sup> Some of the bands under consideration in the *NPRM* may no longer be appropriate candidates for expanded Federal FSS or MSS use given recent changes in the FCC's licensing or technical rules for the band. Other bands, however, may support greater Federal use.

149. We recognize again the need for greater parity and certainty in the protections granted to communications between commercial satellites and Federal users.<sup>303</sup> However, we must give careful consideration to the *NPRM*'s proposals based on the current state of the commercial satellite marketplace. Accordingly, we seek to refresh the record with respect to the *NPRM*, which sought comment on expanded Federal use of the 4.0-4.2 GHz, 5.925-6.425 GHz, 11.7-12.2 GHz, 13.75-14.5 GHz, 18.3-19.3 GHz, 19.7-20.2 GHz, 28.35-29.1 GHz, and 29.25-30 GHz frequency bands, among others. We plan to move expeditiously in reviewing and acting on this new record.

150. Some of the bands raised in the *NPRM* may no longer be suitable for expanded federal use. In the *3.7 GHz Report and Order* the Commission established a new 3.7 GHz Service for terrestrial operations in the 3.7-3.98 GHz band and established a transition process for existing non-federal operators in the 3.7-4.2 GHz band. The transition process included protection criteria for existing registered incumbent operators that would continue to operate FSS earth stations in the 4.0-4.2 GHz portion of the band after the transition. At that time, the Commission also found that it would not be in the public interest to allow non-federal operators to register new protected earth stations in the 4.0-4.2 GHz band.<sup>304</sup> Since that time, the Commission completed Auction 107 and announced winning bids totaling a record \$81.1 billion in gross bids.<sup>305</sup> Similarly, the Commission recently adopted rules to permit greater use by unlicensed devices of the 5.925-6.425 GHz band, which is the uplink band paired with the 3.7-4.2 GHz downlink band.<sup>306</sup> The Commission has proposed to further expand unlicensed use

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<sup>301</sup> See National Space Policy of the United States of America, at 5, 9 (June 28, 2010), available at [https://obamawhitehouse.archives.gov/sites/default/files/national\\_space\\_policy\\_6-28-10.pdf](https://obamawhitehouse.archives.gov/sites/default/files/national_space_policy_6-28-10.pdf); National Space Policy of the United States of America, at 8-9, 18 (Dec. 9, 2020), available at <https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf>.

<sup>302</sup> See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016); Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988 (2017); *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 (2020) (*3.7 GHz Report and Order*); *Unlicensed Use of the 6 GHz Band*, ET Docket No. 18-295, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852 (2020) (*6 GHz Report and Order*).

<sup>303</sup> See *Space NPRM*, 28 FCC Rcd at 6707, para. 23.

<sup>304</sup> *3.7 GHz Report and Order*, 35 FCC Rcd at 2407-2408, paras. 151-153.

<sup>305</sup> See *Auction of Flexible-Use Service Licenses in the 3.7-3.98 GHz Band Closes: Winner Bidders Announced for Auction 107*, Public Notice, DA 21-207 (OEA/WTB rel. Feb. 24, 2021). The *3.7 GHz Report and Order* set out a Relocation Deadline of December 5, 2025, as well as two Accelerated Relocation Deadlines—a Phase I deadline and a Phase II—for incumbent space station operators that voluntarily relocate on an accelerated schedule. Incumbent operators that clear the spectrum early are for relocation payments. To be eligible for Phase I payments, operators must clear 120 megahertz of spectrum (3.7-3.82 GHz) in 46 Partial Economic Areas by December 5, 2021. To be eligible for Phase II payments, they must clear the remaining 180 megahertz of spectrum (3.82-4.0 GHz) by December 5, 2023. *3.7 GHz Report and Order*, 35 FCC Rcd at 2408-2415, paras. 154-177.

<sup>306</sup> *Unlicensed Use of the 6 GHz Band, Report and Order and Further Notice of Proposed Rulemaking*, 35 FCC Rcd 3852, 3860, paras. 17-18 (2020). Petitions for reconsideration of these rules filed by Verizon, CTIA, and the Fixed Wireless Communications Coalition are currently pending. Verizon Petition for Reconsideration, ET Docket 18-295

(continued....)

of this band.<sup>307</sup> Do commenters agree with our observation that, given the current status of these bands, they may not be suitable candidates for expanded federal use?

151. In the *NPRM*, the Commission noted that terrestrial services heavily use several segments of the extended Ku-band, including the 10.7-11.7 GHz and 12.7-12.25 GHz bands, and therefore the Commission, at the time, “[did] not anticipate that the [extended Ku-] band will be heavily used by Federal agencies.”<sup>308</sup> Does this remain the case? Does the complexity of coordination between terrestrial and satellite users in these bands outweigh the benefits of expanding Federal users’ access to these frequencies? Are there other frequency bands included in the *NPRM* that should be considered further? Which of the two alternative *NPRM* proposals for providing Federal access to these bands—adopting a Federal allocation or providing Federal earth stations interference protection through a footnote—is preferable?<sup>309</sup> Are any additional modifications required to either set of proposals with respect to any relevant frequency bands, including whether to include a secondary allocation instead of a co-primary allocation or provide some other means of providing interference protection to Federal earth stations, communicating with non-Federal satellites? What process should the Commission, NTIA, and Federal agencies follow when coordinating Federal earth stations in the relevant bands to receive protection?<sup>310</sup> Should the fact that the Commission has licensed non-geostationary satellite systems with large numbers of satellites in some of these bands since the *NPRM* was issued impact our decision?<sup>311</sup> Is there a need for us to address Federal access to satellite bands where our rules permit blanket licensing of earth stations, such as the Ku-band and Ka-band, as blanket licensing permits Federal agencies to access commercial satellite systems on what effectively amounts to an equal basis with Commission licensees?<sup>312</sup> Finally, to the extent that certain parties may be concerned about how such proposals, if implemented, might inhibit future repurposing of these bands for other non-federal services, we seek comment on those concerns and ways to address them.

#### F. Federal Space Stations in the 399.9-400.05 MHz MSS Band

152. Currently, U.S. Table footnote US319 prevents Federal space stations from operating in the 399.9-400.05 MHz band even though there is a primary Federal MSS allocation for this band.<sup>313</sup> At the request of NTIA, the *NPRM* proposed to permit Federal space stations (*i.e.*, satellites) to operate in

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(filed June 25, 2020); Petition for Partial Reconsideration, CTIA, ET Docket 18-295 (filed June 25, 2020); Petition for Reconsideration of the Fixed Wireless Communications Coalition, ET Docket No. 18- 295, GN Docket No. 17-183 (filed June 25, 2020)

<sup>307</sup> *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852, 3938-45, paras. 231-55 (2020).

<sup>308</sup> *See Space NPRM*, 28 FCC Rcd at 6709-10, para. 30.

<sup>309</sup> *Space NPRM*, 28 FCC Rcd at 6712, 6717, paras. 36, 47-48.

<sup>310</sup> *Space NPRM*, 28 FCC Rcd at 6712-14, 6718, paras. 37-39, 49.

<sup>311</sup> *Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017); *Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System*, Memorandum Opinion, Order, and Authorization, 33 FCC Rcd 3391 (2018); *Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System*, Order and Declaratory Ruling, 33 FCC Rcd 11486 (2018); *Kuiper Systems, LLC, Application for Authority to Deploy and Operate a Ka-Band Non-Geostationary Satellite Orbit System*, Order and Authorization, 35 FCC Rcd 8324 (2020).

<sup>312</sup> *Space NPRM*, 28 FCC Rcd at 6708-09, 6710-11, paras. 28, 31.

<sup>313</sup> 47 CFR § 2.106 footnote US319.



this band.<sup>314</sup> We take this opportunity to invite further comment on the *NPRM*'s proposal to modify footnote US319 to permit Federal space stations to operate in the 399.9-400.05 MHz band.

153. NTIA made this request to allow the 399.9-400.05 MHz band be used for a new satellite system that will assume some of the traffic currently handled by the Argos satellite system. Argos is a satellite system that was established by the French Space Agency, NASA, and the National Oceanic and Atmospheric Administration (NOAA).<sup>315</sup> Argos is used for a large number of applications, such as monitoring the oceans at thousands of fixed and drifting buoys, tracking the movements of wildlife, relaying information by humanitarian agencies from remote areas, monitoring water resources, and tracking the locations of ships.<sup>316</sup> According to NTIA, establishing a new satellite system in the 399.9-400.05 MHz band would allow non-environmental applications to be removed from the Argos system which will result in lower interference, higher capacity, and improved reliability and service for both the environmental applications remaining on Argos and the non-environmental applications moved to the new system.<sup>317</sup>

154. The Commission first made the 399.9-400.05 MHz band along with three other frequency bands available for MSS in 1993 to allow deployment of non-geosynchronous low Earth orbit (LEO) satellite systems, called "Little LEO" systems, to provide non-voice services such as data messaging and position determination.<sup>318</sup> Although a Little LEO system had been deployed in other nearby frequency bands, at the time that the *NPRM* was adopted in 2013 no MSS applicants had requested access to the band.<sup>319</sup> In 2019, the Commission's International Bureau initiated a processing round for non-voice non-geostationary systems in this band as well as the 400.15-401 MHz band.<sup>320</sup> Five applications were

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<sup>314</sup> Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, U.S. Department of Commerce, to Julius P. Knapp, Chief, Office of Engineering and Technology, July 10, 2012, ET Docket 13-115 (*NTIA US319 Letter*); *Space NPRM*, 28 FCC Rcd at 6722 paras. 63-64.

<sup>315</sup> Argos, The Argos System, an International Cooperation, <http://www.argos-system.org/web/en/349-international-cooperation.php> (last visited Mar. 31, 2021).

<sup>316</sup> Argos, Argos Applications, <http://www.argos-system.org/web/en/283-argos-applications.php> (last visited Mar. 31, 2021).

<sup>317</sup> See *NTIA US319 Letter*.

<sup>318</sup> *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed-Satellite Service and the Mobile-Satellite service for Low-Earth Orbit Satellites*, ET Docket No. 91-280, Report and Order, 8 FCC Rcd 1812, 1813 paras. 7, 12 (1993). The Little LEO MSS is officially known as the non-voice, non-geostationary (NVNG) mobile-satellite service.

<sup>319</sup> A spectrum sharing plan proposed by five Little LEO applicants did not include use of the 399.9-400.05 MHz band, and, consequently, the Commission did not assign this band to any of the Little LEO licensees. *Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service*, IB Docket No. 96-220, Report and Order, 13 FCC Rcd 9111, 9120-21 para 22 (1997). Prior to 2019 only Orbcomm had constructed a Little LEO system and Orbcomm did not include the 399.9-400.05 MHz band when later requesting additional spectrum for use by a second generation Little LEO system. Orbcomm did state that it may seek authority to operate in the 399.9-401 MHz band at a later date. *Applications by Orbcomm License Corp. for Authority to Modify its Non-Voice, Non-Geostationary Satellite System*, IBFS File No. SAT-MOD-20070531-00076, SAT-AMD-20071116-00161, Order and Authorization, 23 FCC Rcd 4804, 4807-08 para. 10 (IB 2008); Modification Application of Orbcomm License Corp., Narrative Description, IBFS File No. SAT-MOD-20070531-00076, filed May 30, 2007 at 1, 11.

<sup>320</sup> *Satellite Policy Branch Information, Myriota Pty. Ltd. Petition Accepted for Filing, IBFS File No. SAT-PDR-20190328-00020, Cut-Off Established for Additional NVNG MSS Applications or Petitions for Operations in the 399.9-400.05 MHz and 400.15-401 MHz Bands*, Public Notice, DA 19-779, 34 FCC Rcd 7185 (Aug. 15, 2019).

included in this processing round.<sup>321</sup> The Commission’s International Bureau has granted market access for the 399.9-400.05 MHz band to two of these applicants while the other applications remain pending.<sup>322</sup>

155. The only commenter to address the 399.9-400.05 MHz band in response to the *NPRM* was Bigelow Aerospace. Bigelow Aerospace suggested that the 399.9-400.05 MHz band be allocated for emergency audio/data and backup communications links for communications between manned space stations or spacecraft and earth stations.<sup>323</sup> Bigelow Aerospace made this suggestion as part of a discussion of the future bandwidth needs of crewed space stations and spacecraft that included suggestions that numerous other bands be used for different communication purposes.<sup>324</sup> Bigelow Aerospace did not address the merits of NTIA’s request to open up this band to Federal space stations.

156. We seek additional comment on the *NPRM*’s proposal to amend footnote US319 to permit Federal space stations in the 399.9-400.05 MHz band.<sup>325</sup> As indicated by the number of applications the Commission has received to use the band for NVNG MSS operations, the interest in use of the band has significantly changed since the record was developed in response the *NPRM*. Considering these changes, we seek to update the record on this issue and on whether modifying footnote US319 to permit Federal space stations to operate in the 399.9-400.05 MHz band would serve the public interest. Allocating spectrum for a new satellite system to supplement Argos may further the reliable provision of important services. However, any Federal satellites in this band will need to coexist with the non-Federal systems to also be deployed in the band. We seek comment on how this spectrum band can be shared by Federal systems without causing harmful interference to non-Federal systems, including those in the adjacent bands, and if coordination between the relevant systems can resolve any potential interference issues.

## V. PROCEDURAL MATTERS

157. *Ex Parte Presentations.* The proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.<sup>326</sup> Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting

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<sup>321</sup> Hiber, Myriota, and Spire Global were included in the initial processing round public notice. *Id.* at 1. Kinéis filed an application in response to the public notice. Kinéis, IBFS File No. SAT-PDR-20191011-00113. The processing round also includes Astro Digital, which was subject to a separate accepted for filing public notice that did not initiate a processing round. Astro Digital’s application was granted in part and deferred in part. Astro Digital, IBFS File No. SAT-LOA-20170508-00071 (grant stamped Aug. 1, 2018). Within the frequency ranges included in the processing round, Astro Digital was authorized to use a telemetry carrier (space-to-Earth) centered at 400.5 MHz. Its request to use other portions of the 399.9-400.05 MHz and 400.15-401 MHz bands remains pending. *Satellite Policy Branch Information*, Public Notice, DA 20-184, 35 FCC Rcd 1507, 1508 (Feb. 21, 2020). In addition, Swarm Technologies, Inc. filed a petition to serve the U.S. market using the 399.9-400.05 MHz and 400.5-401 MHz bands, and requested a waiver of 47 CFR § 25.155 to be included in this processing round. No determination has yet been made regarding Swarm’s petition or waiver request. *See* Swarm Technologies, Inc., IBFS File No. SAT-PDR-20200228-00021.

<sup>322</sup> *Hiber, Inc.*, Order and Declaratory Ruling, 35 FCC Rcd 4619 (Int’l Bur. 2020); *Myriota Pty. Ltd.*, Order and Declaratory Ruling, 5 FCC Rcd 5475 (Int’l Bur. 2020).

<sup>323</sup> Bigelow Aerospace, LLC Comments, ET Docket No. 13-115, filed Aug. 30, 2013, at 7 (Bigelow Comments). In addition to the 399.9-400.05 MHz band, Bigelow has suggested the 400.15-401 MHz, 401-402 MHz, 420-430 MHz, 148-149.9 MHz, or 149.9-150.05 MHz bands as other possible bands that could be used for this purpose.

<sup>324</sup> *Id.* at 7.

<sup>325</sup> Consistent with this proposal, the reference to US319 in the 399.9-400.05 MHz band of the U.S. Table would be removed.

<sup>326</sup> *Id.* §§ 1.1200 *et seq.*

at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

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

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing.
  - Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
  - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
  - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street, NE, Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See *FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy*, Public Notice, DA 20-304 (March 19, 2020), <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.
  - During the time the Commission's building is closed to the general public and until further notice, if more than one docket or rulemaking number appears in the caption of a proceeding, paper filers need not submit two additional copies for each additional docket or rulemaking number; an original and one copy are sufficient.
  - After COVID-19 restrictions are lifted, the Commission has established that hand-carried documents are to be filed at the Commission's office located at 9050 Junction Drive, Annapolis Junction, MD 20701. This will be the only location where hand-carried paper filings for the Commission will be accepted.<sup>327</sup>

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<sup>327</sup> See *Amendment of the Commission's Rules of Practice and Procedure*, Order, DA 20-562 (OMD 2020).

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

160. *Final Regulatory Flexibility Analysis.* The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.” Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the potential impact of rule and policy changes adopted in the Report and Order on small entities. The FRFA is set forth in Appendix B.

161. *Initial Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act,<sup>328</sup> the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities of the proposals addressed in this *Notice of Proposed Rulemaking*. The IRFA is set forth in Appendix E. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines for comments on the *Further Notice of Proposed Rulemaking*, and should have a separate and distinct heading designating them as responses to the IRFA. The Commission’s Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this *Further Notice of Proposed Rulemaking*, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with the Regulatory Flexibility Act.<sup>329</sup>

162. *Paperwork Reduction Act Analysis.* This *Report and Order* does not contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4).

163. In addition, this *Further Notice of Proposed Rulemaking* contains proposed modified information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4)), we seek specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

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

165. *Further Information.* For additional information on this proceeding, contact Nicholas Oros, Office of Engineering and Technology; at [Nicholas.Oros@fcc.gov](mailto:Nicholas.Oros@fcc.gov) or 202-418-0636; Peter Trachtenberg, Wireless Telecommunications Bureau, at [Peter.Trachtenberg@fcc.gov](mailto:Peter.Trachtenberg@fcc.gov) or 202-418-7369; or Kimberly Baum, International Bureau, at [Kimberly.Baum@fcc.gov](mailto:Kimberly.Baum@fcc.gov) or 202-418-2752.

## VI. ORDERING CLAUSES

166. Accordingly, IT IS ORDERED that, pursuant to sections 1, 2, 4(i), 5(c), 301, 303(c), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i),

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<sup>328</sup> 5 U.S.C. § 603.

<sup>329</sup> *See id.* § 603(a).

155(c), 301, 303(c), 303(f), and 303(r), and section 1.411 of the Commission's rules, 47 CFR § 1.411, this *Report and Order and Further Notice of Proposed Rulemaking* IS HEREBY ADOPTED.

167. IT IS FURTHER ORDERED that the amendments of Part 2 of the Commission's rules, as set forth in Appendix A, ARE ADOPTED, effective thirty (30) days after publication in the Federal Register.

168. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Report and Order and Further Notice of Proposed Rulemaking*, including the Final and Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

169. 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**

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR Part 2 as follows:

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

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

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

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Revise page 37.

b. In the list of United States (US) Footnotes, add footnote US96.

The revisions and additions read as follows:

**§ 2.106 Table of Frequency Allocations.**

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International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
2110-2120 FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388			2110-2120	2110-2120 FIXED MOBILE	Public Mobile (22) Wireless Communications (27) Fixed Microwave (101)
2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2160 FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2200	2120-2180 FIXED MOBILE	
	2160-2170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.388 5.389C 5.389E	5.388			
2170-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F				NG41 2180-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25) Wireless Communications (27)
2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)			2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) US96 EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED (line-of-sight only) MOBILE (line-of-sight only including aeronautical telemetry, but excluding flight testing of manned aircraft) 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)	2200-2290	
5.392			5.392 US303	US96 US303	
2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)			2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	
2300-2450 FIXED MOBILE 5.384A Amateur Radiolocation	2300-2450 FIXED MOBILE 5.384A RADIOLOCATION Amateur		2300-2305 G122 2305-2310	2300-2305 Amateur 2305-2310 FIXED MOBILE except aeronautical mobile RADIOLOCATION Amateur	Amateur Radio (97) Wireless Communications (27) Amateur Radio (97)
			US97 G122	US97	

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UNITED STATES (US) FOOTNOTES

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US96 The band 2200-2290 MHz is allocated to the space operation service (space-to-Earth) on a secondary basis for non-Federal use subject to the following conditions. Non-Federal stations shall be:

(a) restricted to transmissions from the launch vehicle in the sub-bands 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz (necessary bandwidth shall be contained within these ranges);

(b) restricted to use for pre-launch testing and space launch operations, except as provided under US303; and

(c) subject to coordination with NTIA prior to each launch.

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**APPENDIX B****Final Regulatory Flexibility Analysis**

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rulemaking (NPRM)* released in May 2013.<sup>2</sup> The Commission sought written public comment on the proposals in the *NPRM*, including comments on the IRFA.<sup>3</sup> No comments were filed addressing the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.<sup>4</sup>

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

2. The *Report and Order (Report and Order)* adopted by the Commission today continues the Commission's efforts to reform and streamline regulation of U.S. space commerce in order to ensure that commercial companies can continue to drive U.S. space leadership. It adopts a secondary allocation for the 2200-2290 MHz band to support the current level of commercial launches and enable continued growth of a vibrant commercial space industry. This allocation is limited to use for pre-launch testing and space launch operations; restricted to transmissions in the sub-bands 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz; and requires coordination with NTIA prior to each launch. This action is the first step in a process that will allow the Commission to adopt service rules to govern commercial launch operations which, in turn, will give operators more certainty by providing them a pathway to obtain spectrum use licenses in these bands.

3. Adopting this new allocation will provide access to spectrum under a more predictable, collaborative, and transparent regulatory process. This action is important to the fledgling commercial space launch industry because of the large monetary investment required for each launch. The need for such licenses is becoming even more important as commercial launch operators shift beyond cargo supply activities into manned space missions. The current process of obtaining an STA for each launch places burdens on launch providers. As the U.S. commercial space industry continues to expand, we expect the burdens and uncertainties associated with continuing the current STA process would only increase. Adopting a non-Federal secondary allocation for the 2200-2290 MHz band will allow us to develop rules that meet the specific needs of the commercial space industry, rather than stretch the experimental rules to meet these unique needs.

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

4. 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**

5. 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.<sup>5</sup>

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

<sup>2</sup> *Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations*, ET Docket No. 13-115, Notice of Proposed Rulemaking and Notice of Inquiry, 28 FCC Rcd 6698, 6755, Appendix B (2013).

<sup>3</sup> See 5 U.S.C. § 603(a).

<sup>4</sup> See 5 U.S.C. § 603(a).

<sup>5</sup> 5 U.S.C. § 604(a)(3).

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

8. *Satellite Telecommunications and All Other Telecommunications.* Two economic census categories address the satellite industry. The "Satellite Telecommunications" category 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."<sup>10</sup> Satellite telecommunications service providers include satellite and earth station operators. The category has a small business size standard of \$35 million or less in average annual receipts, under SBA rules.<sup>11</sup> For this category, U.S. Census Bureau data for 2012 show that there were a total of 333 firms that operated for the entire year.<sup>12</sup> Of this total, 299 firms had annual receipts of less than \$25 million.<sup>13</sup> Consequently, we estimate that the majority of satellite telecommunications providers are small entities.

9. The "All Other Telecommunications" category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.<sup>14</sup> 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.<sup>15</sup> Establishments providing Internet services or voice over Internet protocol (VoIP)

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<sup>6</sup> 5 U.S.C. § 603(b)(3).

<sup>7</sup> 5 U.S.C. § 601(6).

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

<sup>9</sup> Small Business Act, 15 U.S.C. § 632 (1996).

<sup>10</sup> See U.S. Census Bureau, *2017 NAICS Definition, "517410 Satellite Telecommunications"*, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517410&search=2017+NAICS+Search&search=2017>.

<sup>11</sup> See 13 CFR § 121.201, NAICS Code 517410.

<sup>12</sup> See U.S. Census Bureau, *2012 Economic Census of the United States, Table ID: EC1251SSSZ4, Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the U.S.: 2012*, NAICS Code 517410, <https://data.census.gov/cedsci/table?text=EC1251SSSZ4&n=517410&tid=ECNSIZE2012.EC1251SSSZ4&hidePreview=false&vintage=2012>.

<sup>13</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>14</sup> See U.S. Census Bureau, *2017 NAICS Definition, "517919 All Other Telecommunications"*, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517919&search=2017+NAICS+Search&search=2017>.

<sup>15</sup> *Id.*

services via client-supplied telecommunications connections are also included in this industry.<sup>16</sup> The SBA has developed a small business size standard for “All Other Telecommunications”, which consists of all such firms with annual receipts of \$35 million or less.<sup>17</sup> For this category, U.S. Census Bureau data for 2012 show that there were 1,442 firms that operated for the entire year.<sup>18</sup> Of those firms, a total of 1,400 had annual receipts less than \$25 million and 15 firms had annual receipts of \$25 million to \$49,999,999.<sup>19</sup> Thus, the Commission estimates that the majority of “All Other Telecommunications” firms potentially affected by our action can be considered small.

10. *Commercial Space Transportation.* Neither the Commission nor the Small Business Administration (SBA) has developed a small business size standard for commercial space transport. The closest applicable industry in the U.S. Census Bureau’s North American Industry Classification System (NAICS) is Nonscheduled Charter Passenger Air Transportation.<sup>20</sup> This U.S. industry comprises establishments primarily engaged in providing air transportation of passengers or passengers and cargo with no regular routes and regular schedules. This industry also includes air taxi services, aircraft charter passenger services and charter air passenger services which would encompass air space transportation. The SBA small business size standard for this NAICS industry is that such a business is small if it has 1,500 employees or less.<sup>21</sup> U.S. Census Bureau data for 2012 indicates there were 1,303 firms that operated for the entire year.<sup>22</sup> Of this number 1,300 firms had less than 1,000 employees.<sup>23</sup> We note that this category encompasses various types of commercial air transportation firms and does not exclusively represent the number of firms engaged in passenger space transport.

11. The FCC believes that the following business entities are the principal entities currently comprising the commercial space transportation launch operator industry in the United States: The Boeing Company, Lockheed Martin Corporation, Space Exploration Technologies, Northrop Grumman, Rocket Lab, Blue Origin, Relativity Space, and Astra. In addition, Virgin Galactic and Blue Origin have announced plans for suborbital manned space flights.<sup>24</sup> NASA has agreements with two companies to design and develop human space flight capabilities: Space Exploration Technologies, and The Boeing

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<sup>16</sup> *Id.*

<sup>17</sup> See 13 CFR § 121.201, NAICS Code 517919.

<sup>18</sup> See U.S. Census Bureau, *2012 Economic Census of the United States*, Table ID: EC1251SSSZ4, *Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the U.S.: 2012*, NAICS Code 517919, <https://data.census.gov/cedsci/table?text=EC1251SSSZ4&n=517919&tid=ECNSIZE2012.EC1251SSSZ4&hidePreview=false>.

<sup>19</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>20</sup> See U.S. Census Bureau, *2017 NAICS Definition*, “481211 Nonscheduled Charter Passenger Air Transportation”, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=481211&search=2017>.

<sup>21</sup> See 13 CFR § 121.201, NAICS Code 481211.

<sup>22</sup> See U.S. Census Bureau, *2012 Economic Census of the United States*, Table ID: EC1248SSSZ5, *Transportation and Warehousing: Subject Series - Estab and Firm Size: Summary Statistics by Employment Size of Firms for the U.S.: 2012*, NAICS Code 481211, <https://data.census.gov/cedsci/table?y=2012&n=481211&tid=ECNSIZE2012.EC1248SSSZ5&hidePreview=false>.

<sup>23</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>24</sup> Mike Wall, *Virgin Galactic Gearing up to Start Selling Suborbital Spaceflight Tickets Again*, Space.com (Feb. 26, 2020) <https://www.space.com/virgin-galactic-spaceshiptwo-reservations-one-small-step.html>; Blue Origin, *Unparalleled Views of the Earth from Space*, <https://www.blueorigin.com/new-shepard/become-an-astronaut/> (last visited Mar. 31, 2021).

Company.<sup>25</sup> Because the commercial space industry is a nascent industry, it is difficult to state whether additional entities will enter the industry and how many and which entities will succeed. We do not have data on the size of these entities, and consequently, cannot classify them as large or small entities. We therefore cannot reach definite conclusions as to the number of small entities that will be affected by our actions in this proceeding, but we shall assume that a significant number of small entities will be affected.

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

12. The Report and Order adopted no reporting and recordkeeping requirements.

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

13. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.<sup>26</sup>

14. The *Report and Order* adds a non-Federal allocation to the 2200-2290 MHz band for use during commercial space launches. This band does not currently have a non-Federal allocation for this purpose. Consequently, the Commission has granted special temporary authority under the Part 5 experimental licensing rules for each individual launch rather than providing launch providers with longer term licenses. Adopting this allocation is only a first step towards the Commission issuing licenses for this band; the Commission will later have to adopt service and technical rules for the band. However, once the Commission is able to issue licenses for the 2200-2290 MHz band, small entities who manufacture and/or develop launch vehicles and spacecraft will benefit because they will be able to obtain licenses for spectrum. Consequently, we expect that adopting these allocations will provide only a benefit to small entities and will have no significant harmful economic impact on any small entity.

**G. Report to Congress**

15. 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.<sup>27</sup> 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.<sup>28</sup>

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<sup>25</sup> NASA, NASA Astronauts Launch from America in Historic Test Flight of SpaceX Crew Dragon (May 30, 2020), <https://www.nasa.gov/press-release/nasa-astronauts-launch-from-america-in-historic-test-flight-of-spacex-crew-dragon>; Boeing, *CST-1000 Starliner*, <https://www.boeing.com/space/starliner/> (last visited Mar. 31, 2021).

<sup>26</sup> See 5 U.S.C. § 603(c).

<sup>27</sup> See 5 U.S.C. § 801(a)(1)(A).

<sup>28</sup> See *id.* § 604(b).

**APPENDIX C**  
**List of Commenters**

NPRM/NOI Comments

Aerospace and Flight Test Coordinating Radio Council (AFTRCC)  
Bigelow Aerospace, LLC (Bigelow)  
The Boeing Company (Boeing)  
The Commercial Spaceflight Federation (CSF)  
Comsearch  
EchoStar Satellite Operating Corporation and Hughes Network Services, LLC (EchoStar)  
Fixed Wireless Communications Coalition, Inc. (FWCC)  
Lockheed Martin Corporation (Lockheed)  
Marcus Spectrum Solutions LLC (Marcus)  
National Telecommunications and Information Administration (NTIA)  
New Mexico Spaceport Authority (NMSA)  
Orbital Sciences Corporation (Orbital Sciences)  
Satellite Industry Association  
Space Exploration Technologies Corp. (SpaceX)  
XCOR Aerospace (XCOR)

NPRM/NOI Reply Comments

The Boeing Company (Boeing)  
Engineers for the Integrity of Broadcast Auxiliary Services Spectrum (EIBASS)  
Fixed Wireless Communications Coalition, Inc. (FWCC)  
Satellite Industry Association

**APPENDIX D****Proposed Rules**

The Federal Communications Commission proposes to amend 47 CFR parts 2, 87, and 90 as follows:

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

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

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

2. Amend Section 2.106, the Table of Frequency Allocations, as follows:

- a. Revise pages 26, 28, 36, 43, and 44.

- b. In the list of United States (US) Footnotes, add footnotes US68 and US121 and revise footnotes US96 and US319.

The revisions and additions read as follows:

**§ 2.106 Table of Frequency Allocations.**

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272-273 SPACE OPERATION (space-to-Earth) FIXED MOBILE			
5.254			
273-312 FIXED MOBILE			
5.254			
312-315 FIXED MOBILE Mobile-satellite (Earth-to-space) 5.254 5.255			
315-322 FIXED MOBILE			
5.254			
322-328.6 FIXED MOBILE RADIO ASTRONOMY	G27 G100 322-328.6 FIXED MOBILE	322-328.6	
5.149	US342 G27	US342	
328.6-335.4 AERONAUTICAL RADIONAVIGATION 5.258	328.6-335.4 AERONAUTICAL RADIONAVIGATION 5.258		Aviation (87)
5.259			
335.4-387 FIXED MOBILE	335.4-399.9 FIXED MOBILE	335.4-399.9	
5.254			
387-390 FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255			
390-399.9 FIXED MOBILE			
5.254	G27 G100		
399.9-400.05 MOBILE-SATELLITE (Earth-to-space) 5.209 5.220	399.9-400.05 MOBILE-SATELLITE (Earth-to-space) US320 RADIONAVIGATION-SATELLITE		Satellite Communications (25)
400.05-400.15 STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz)	400.05-400.15 STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz)		
5.261 5.262	5.261		

420-430 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271			420-450 RADIOLOCATION G2 G129	420-430 Amateur US270  US64 US68 US230 US269		Private Land Mobile (90) MedRadio (95I) Amateur Radio (97)		
430-432 AMATEUR RADIOLOCATION  5.271 5.274 5.275 5.276 5.277		430-432 RADIOLOCATION Amateur 5.271 5.276 5.277 5.278 5.279		430-450 Amateur US270			MedRadio (95I) Amateur Radio (97)	
432-438 AMATEUR RADIOLOCATION Earth exploration-satellite (active) 5.279A 5.138 5.271 5.276 5.277 5.280 5.281 5.282		432-438 RADIOLOCATION Amateur Earth exploration-satellite (active) 5.279A 5.271 5.276 5.277 5.278 5.279 5.281 5.282						
438-440 AMATEUR RADIOLOCATION 5.271 5.274 5.275 5.276 5.277 5.283		438-440 RADIOLOCATION Amateur 5.271 5.276 5.277 5.278 5.279						
440-450 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286				5.286 US64 US68 US87 US230 US269 US270 US397 G8		5.282 5.286 US64 US87 US269 US397		
450-455 FIXED MOBILE 5.286AA				450-454		450-454 LAND MOBILE		Remote Pickup (74D) Low Power Auxiliary (74H) Private Land Mobile (90) MedRadio (95I)
5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E				5.286 US64 US87		5.286 US64 US87 NG112 NG124		
455-456 FIXED MOBILE 5.286AA  5.209 5.271 5.286A 5.286B 5.286C 5.286E		455-456 FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to- space) 5.286A 5.286B 5.286C 5.209		454-456		454-455 FIXED LAND MOBILE US64 NG32 NG112 NG148		Public Mobile (22) Maritime (80) MedRadio (95I)
		455-456 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E		US64		455-456 LAND MOBILE  US64		



1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			
5.289 5.341	5.289 5.341 5.384	5.341	5.341 US88	
1710-1930 FIXED MOBILE 5.384A 5.388A 5.388B		1710-1761	1710-1780 FIXED MOBILE	
		5.341 US91 US378 US385		
		1761-1780 SPACE OPERATION (Earth-to-space) G42		
		US91	5.341 US91 US378 US385	
		1780-1850 FIXED MOBILE SPACE OPERATION (Earth-to-space) G42	1780-1850	
5.149 5.341 5.385 5.386 5.387 5.388		1850-2025	1850-2000 FIXED MOBILE	RF Devices (15) Personal Communications (24) Wireless Communications (27) Fixed Microwave (101)
1930-1970 FIXED MOBILE 5.388A 5.388B	1930-1970 FIXED MOBILE 5.388A 5.388B Mobile-satellite (Earth-to-space)	1930-1970 FIXED MOBILE 5.388A 5.388B		
5.388	5.388	5.388		
1970-1980 FIXED MOBILE 5.388A 5.388B				
5.388				
1980-2010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A				
5.388 5.389A 5.389B 5.389F				
2010-2025 FIXED MOBILE 5.388A 5.388B	2010-2025 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	2010-2025 FIXED MOBILE 5.388A 5.388B	2000-2020 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	Satellite Communications (25) Wireless Communications (27)
5.388	5.388 5.389C 5.389E	5.388	2020-2025 FIXED MOBILE	
2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space)			2025-2110 SPACE OPERATION (Earth- to-space) (space-to-space) FIXED NG118 MOBILE 5.391	Satellite Communications (25) TV Auxiliary Broadcasting (74F) Cable TV Relay (78) Local TV Transmission (101J)
5.392		5.392 US90 US92 US222 US346 US347	5.392 US90 US92 US222 US346 US347	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
2110-2120 FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388			2110-2120	2110-2120 FIXED MOBILE	Public Mobile (22) Wireless Communications (27) Fixed Microwave (101)
2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2160 FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2200	2120-2180 FIXED MOBILE	
5.388	2160-2170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)				
2170-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F	5.388 5.389C 5.389E	5.388		NG41 2180-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25) Wireless Communications (27)
2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)			2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED (line-of-sight only) MOBILE (line-of-sight only including aeronautical telemetry, but excluding flight testing of manned aircraft) 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)	2200-2290	
5.392			5.392 US303 US96	US96 US303	
2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)			2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	
2300-2450 FIXED MOBILE 5.384A Amateur Radiolocation	2300-2450 FIXED MOBILE 5.384A RADIOLOCATION Amateur		2300-2305 G122 2305-2310	2300-2305 Amateur 2305-2310 FIXED MOBILE except aeronautical mobile RADIOLOCATION Amateur	Amateur Radio (97) Wireless Communications (27) Amateur Radio (97)
			US97 G122	US97	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
5460-5470 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION 5.448D RADIONAVIGATION 5.449 SPACE RESEARCH (active)			5460-5470 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION 5.449 US65 SPACE RESEARCH (active)	5460-5470 RADIONAVIGATION 5.449 US65 Earth exploration-satellite (active) Radiolocation Space research (active)	Maritime (80) Aviation (87) Private Land Mobile (90)
5.448B			5.448B US49 G130	5.448B US49	
5470-5570 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION SPACE RESEARCH (active)			5470-5570 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 MARITIME RADIONAVIGATION US65 SPACE RESEARCH (active)	5470-5570 RADIOLOCATION MARITIME RADIONAVIGATION US65 Earth exploration-satellite (active) Space research (active)	RF Devices (15) Maritime (80) Private Land Mobile (90)
5.448B 5.450 5.451			5.448B US50 G131	US50	
5570-5650 MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION			5570-5600 RADIOLOCATION G56 MARITIME RADIONAVIGATION US65	5570-5600 RADIOLOCATION MARITIME RADIONAVIGATION US65	
			US50 G131	US50	
5.450 5.451 5.452			5.452 US50 G131	5.452 US50	
5650-5725 MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION Amateur Space research (deep space)			5650-5925 RADIOLOCATION US121 G2	5650-5830 Amateur	RF Devices (15) ISM Equipment (18) Amateur Radio (97)
5.282 5.451 5.453 5.454 5.455					
5725-5830 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur		5725-5830 RADIOLOCATION Amateur			
5.150 5.451 5.453 5.455		5.150 5.453 5.455		5.150 5.282 US121	
5830-5850 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)		5830-5850 RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)		5830-5850 Amateur Amateur-satellite (space-to-Earth)	
5.150 5.451 5.453 5.455		5.150 5.453 5.455		5.150 US121	

5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation		5850-5925 FIXED-SATELLITE (Earth-to-space) US245 MOBILE NG160 Amateur	RF Devices (15) ISM Equipment (18) Private Land Mobile (90) Personal Radio (95) Amateur Radio (97)
5.150	5.150	5.150	5.150 US245	5.150 US121	
5925-6700 FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C			5925-6425	5925-6425 FIXED FIXED-SATELLITE (Earth-to-space) NG457A	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
			6425-6525	6425-6525 FIXED-SATELLITE (Earth-to-space) MOBILE	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			5.440 5.458	5.440 5.458	
			6525-6700	6525-6700 FIXED FIXED-SATELLITE (Earth-to-space)	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
5.149 5.440 5.458			5.458 US342	5.458 US342	
6700-7075 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE			6700-7125	6700-6875 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441  5.458 5.458A 5.458B	
				6875-7025 FIXED NG118 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE NG171  5.458 5.458A 5.458B	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
5.458 5.458A 5.458B				7025-7075 FIXED NG118 FIXED-SATELLITE (Earth-to-space) NG172 MOBILE NG171  5.458 5.458A 5.458B	RF Devices (15) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
7075-7145 FIXED MOBILE				7075-7125 FIXED NG118 MOBILE NG171	
			5.458	5.458	
			7125-7145 FIXED	7125-7145	RF Devices (15)
5.458 5.459			5.458 G116	5.458	

\* \* \* \* \*

UNITED STATES (US) FOOTNOTES

\* \* \* \* \*

US68 The band 420-430 MHz is allocated to the aeronautical mobile service on a primary basis for non-Federal use. Non-Federal stations in the aeronautical mobile service shall be:

(a) restricted to use for pre-launch testing of launch vehicles and sending flight termination signals to launch vehicles during launches; and

(b) subject to coordination with NTIA prior to each launch.

\* \* \* \* \*

US96 The band 2200-2290 MHz is allocated to the space operation (space-to-Earth) and the mobile services on a secondary basis for non-Federal use. Non-Federal stations in the space operation and mobile services shall be:

(a) restricted to use for pre-launch testing and space launch operations except as provided under US303; and

(b) subject to coordination with NTIA prior to each launch.

\* \* \* \* \*

US121 The band 5650-5925 MHz is allocated to the radiolocation service on a primary basis for non-Federal use. Non-Federal stations in the radiolocation service shall be:

(a) restricted to use for pre-launch testing and tracking launch vehicles; and

(b) subject to coordination with NTIA prior to each launch.

\* \* \* \* \*

US319 In the bands 137-138 MHz, 148-149.9 MHz, 149.9-150.05 MHz, 400.15-401 MHz, 1610-1626.5 MHz, and 2483.5-2500 MHz, Federal stations in the mobile-satellite service shall be limited to earth stations operating with non-Federal space stations.

\* \* \* \* \*

**PART 87 – AVIATION SERVICES**

3. The authority citation for Part 87 continues to read as follows:

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

4. Part 87 is revised by adding new subpart U to read as follows:

**Subpart U—Commercial Space Launch Stations**

87.601 Scope of service.

87.602 Supplemental eligibility.

87.603 Frequencies.

**TECHNICAL REGULATIONS GOVERNING THE USE OF 420-430 MHz, 2025-2110 MHz, AND 2200-2290 MHz BANDS**

87.604 Frequency coordination.

- 87.605 Emission Masks.  
87.606 Power Limits.

**§ 87.601 Scope of service.**

Commercial space launch stations are restricted to the following uses:

- (a) 420-430 MHz band. The use of commercial space launch licenses in the 420-430 MHz band is restricted to the transmission of flight termination signals during pre-launch testing and launch operations.
- (b) 2025-2110 MHz band. The use of commercial space launch licenses in the 2025-2110 MHz band is restricted to telecommand uplink transmissions from the controllers on the ground to the launch vehicle.
- (c) 2200-2290 MHz band. The use of commercial space launch licenses in the 2200-2290 MHz band is restricted to the transmission of telemetry data from the launch vehicle to controllers on the ground.

**§ 87.602 Supplemental eligibility.**

(a) The following entities are eligible for commercial space launch licenses:

- (1) An operator or manufacturer of commercial spacecraft or spacecraft components;
  - (2) A parent corporation or its subsidiary if either corporation is an operator or manufacturer of spacecraft or spacecraft components; or
  - (3) An educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of spacecraft or spacecraft components.
- (b) Each application must include a certification sufficient to establish the applicant's eligibility under the criteria in paragraph (a) of this section.

**§ 87.603 Frequencies.**

(a) Commercial space launch operations are conducted in the 420-430 MHz, 2025-2110 MHz, and 2200-2290 MHz bands on a co-equal basis with U.S. Government stations. Frequencies in the 420-430 MHz, 2025-2110 MHz, and 2200-2290 MHz bands are assigned for telemetry and telecommand operations of expendable and re-usable launch vehicles:

- (1) 420-430 MHz. Frequencies in the 420-430 MHz band are assigned on a shared basis for the transmission of flight termination signals during pre-launch testing and launch operations.
- (2) 2025-2110 MHz. Frequencies in the 2025-2110 MHz band are assigned on a shared basis for telecommand uplink transmissions from the controllers on the ground to the launch vehicle.
- (3) 2200-2290 MHz. Frequencies in the 2200-2290 MHz band are assigned on a shared basis for the transmission of telemetry data from the launch vehicle to controllers on the ground.

**§ 87.604 Frequency coordination.**

(a)

(1) Each application for a new station license, renewal, or modification of an existing license concerning commercial space launch frequencies, except as provided in paragraph (b) of this section, must be accompanied by a statement from a frequency advisory committee. The committee must comment on the frequencies requested or the proposed changes in the authorized station and the probable interference to existing stations. The committee must consider all stations operating on the frequencies requested or assigned within 320 km (200 mi) of the proposed area of operation and all prior coordinations and assignments on the proposed frequency(ies). The committee must also recommend frequencies resulting in the minimum interference. The committee must coordinate in writing all requests for frequencies or proposed operating changes with the responsible Government Area Frequency Coordinators listed in the

NTIA “Manual of Regulations and Procedures for Federal Radio Frequency Management.” In addition, committee recommendations may include comments on other technical factors and may contain recommended restrictions which it believes should appear on the license.

(2) The frequency advisory committee must be organized to represent all persons who are eligible for non-Government space launch stations. A statement of the organization service area and composition of the committee must be submitted to the Commission for approval. The functions of any advisory committee are purely advisory to the applicant and the Commission, and its recommendations are not binding upon either the applicant or the Commission.

(b) These applications need not be accompanied by evidence of frequency coordination:

(1) Any application for modification not involving change in frequency(ies), power, emission, antenna height, antenna location, or area of operation.

### § 87.605 Emission Masks.

(a) 420-430 MHz. The mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, in the 420-430 MHz band of the Commercial Space Launch Service must be in accordance with the following:

(1) on any frequency removed from the assigned frequency by more than 75 percent, up to and including 150 percent, of the authorized bandwidth, at least 25 decibels attenuation;

(2) on any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent, of the authorized bandwidth, at least 35 decibels attenuation; and

(3) on any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, two levels of attenuation depending on whether the transmitter operates with mean power of (i) less than 5 kilowatts or (ii) 5 kilowatts or greater.

(b) 2025-2110 MHz. For frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required. At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required. Frequencies offset more than 50 percent of the necessary bandwidth shall be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.

(c) 2200-2290 MHz. All spectral components larger than  $-[55 + 10 \log(P)]$  dBc (*i.e.*, larger than  $-25$  dBm) at the transmitter output must be within the spectral mask calculated using the following equation:

$$M(f) = K + 90 \log(R) - 100 \log |f-f_c| \text{ Eqn. A-9}$$

where  $M(f)$  = power (dBc) at frequency  $f$  (MHz)

$K = -20$  for analog signals

$K = -28$  for binary signals

$K = -61$  for FQPSK-B, FQPSK-JR, SOQPSK-TG

$K = -73$  for ARTM CPM

$f_c$  = transmitter center frequency (MHz)

$R$  = bit rate (Mbps) for digital signals or  $(\Delta f + f_{max})$ (MHz) for analog FM signals

$M$  = number of states in modulating signal ( $m = 2$  for binary signals,  $m = 4$  for quaternary signals and analog signals)

$f$  = peak deviation

$f_{max}$  = maximum modulation frequency

**§ 87.606 Power Limits.**

(a) 420-430 MHz. The effective radiated power of a transmitter in the 420-430 MHz band of the Space Operation Service shall not exceed 1000 Watts.

(b) 2025-2110 MHz. The effective radiated power of a transmitter in the 2025-2110 MHz band of the Space Operation Service shall not (with limited exceptions) exceed the following limits:

- +40 dBW in any 4 kHz band for  $\theta \leq 0^\circ$
- +40+3 $\theta$  dBW in any 4 kHz band for  $0^\circ < \theta \leq 5^\circ$

where  $\theta$  is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

(c) 2200-2290 MHz. The effective radiated power of a transmitter in the 2200-2290 MHz band of the Space Operation Service shall not exceed 25 Watts and the transmitter output power shall not exceed 25 Watts. In addition, the power flux-density at the Earth’s surface produced by emissions from a transmitter operating after the first stage for all conditions and for all methods of modulation shall not exceed the following limits:

- 154 dB(W/m<sup>2</sup>) in any 4 kHz for angles of arrival less than 5° above the horizontal plane;
- 154 + 0.5 ( $\delta - 5$ ) dB(W/m<sup>2</sup>) in any 4 kHz for angles of arrival  $\delta$  (degrees) between 5° and 25° above the horizontal plane;
- 144 dB(W/m<sup>2</sup>) in any 4 kHz for angles of arrival between 25° and 90° above the horizontal plane;

**PART 90 – PRIVATE LAND MOBILE RADIO SERVICES**

5. The authority citation for Part 90 continues to read as follows:

AUTHORITY: 47 U.S.C. 154i, 161, 303g, 332c7, 1401-1473, unless otherwise noted.

6. Section 90.103 is amended by adding paragraph (a)(4), by revising the table in paragraph (b), and by adding paragraph (c)(31) to read as follows:

**§ 90.103 Radiolocation Service.**

\* \* \* \* \*

(a) \* \* \*

(4) An operator or manufacturer of commercial spacecraft or spacecraft components; a parent corporation or its subsidiary if either corporation is an operator or manufacturer of spacecraft or spacecraft components; or an educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of spacecraft or spacecraft components.

(b) \* \* \*

**RADIOLOCATION SERVICE FREQUENCY TABLE**

Frequency or band	Class of station(s)	Limitation
* * *	* * *	* * *
Megahertz		
* * *	* * *	* * *



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5650 to 5925	Radiolocation land or mobile	31
* * *	* * *	* * *

\* \* \* \* \*

(c) \* \* \*

(31) This frequency band is shared on a co-primary basis to Government Radiolocation Service. The use of commercial space launch licenses in the 5650-5925 MHz band is restricted to launch vehicle tracking operations with signals originating from the launch vehicle\* \* \* \* \*

## APPENDIX E

## Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in the *Further Notice of Proposed Rulemaking (FNPRM)*. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the *FNPRM*. The Commission will send a copy of the *FNPRM*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).<sup>2</sup> In addition, the *FNPRM* and IRFA (or summaries thereof) will be published in the Federal Register.<sup>3</sup>

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

2. In the *FNPRM*, the Commission seeks comment on non-Federal allocations in the 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands and proposes to adopt a licensing framework that governs such services in these bands and enables space launch companies to obtain and use licenses in these bands, to the extent they are allocated for commercial space launch purposes. While the *Report and Order* accompanying the *FNPRM* adopts a non-Federal Space Operations allocation in the 2200-2290 MHz band for use during commercial space launches, the *FNPRM* also seeks comment on whether, consistent with NTIA policies in the band, the Commission should add a non-Federal secondary Mobile allocation to the 2200-2290 MHz band.

3. Due to the lack of an appropriate non-Federal allocation, the Commission grants space launch companies approval to use frequencies in these bands during launches only through special temporary authorizations (STAs) under the Part 5 experimental licensing rules. This mechanism may not be ideal for commercial space launch activities because experimental STAs offer no interference rights and expire after six months. Moreover, an STA includes the condition that any future launches by the grantees would be considered on a case-by-case basis, without expectation of approval. Adopting non-Federal allocations may be the best way to support commercial launches in the future and meet the future needs of the growing commercial space launch industry, as they would allow the Commission to establish rules that will enable the Commission to issue long-term licenses to commercial launch operators to permit their use of this spectrum band on an interference-protected basis.

4. The establishment of allocations is only the first step, however, to enable commercial launch operators to use these spectrum bands on an interference-protected basis. The Commission must also establish the licensing and technical rules that will allow for issuing licenses for this purpose. Accordingly, the *FNPRM* proposes to establish licensing and technical rules for space launch, including for the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz band. Specifically, the *FNPRM* seeks comment on various licensing frameworks for commercial launch vehicle radio-frequency operations. In addition, it seeks comment on technical rules that will meet the future needs of the commercial space launch industry, while protecting critical Federal operations from harmful interference. As we expect the number of launches to continue to increase in the future, we seek to adopt a suitable regulatory approach which will provide more certainty than continued reliance on the current STA process.

5. While the focus of the *FNPRM* is on the licensing of communications for commercial

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

<sup>2</sup> See 5 U.S.C. § 603(a).

<sup>3</sup> See *id.*

space launch operations, it additionally seeks comment on whether there are improvements to the licensing process that could facilitate more routine licensing for certain payload activities currently addressed through experimental licensing. The *FNPRM* also seeks comment on permitting Federal space stations in the 399.9-400.05 MHz band, noting that the Commission has received several applications to use the band for non-voice, non-geostationary mobile-satellite service (MSS) operations. Allowing Federal space stations would allow deployment of a new satellite in the Argos Federal MSS system, thereby resulting in less interference and improved service and reliability for users of both the existing Argos and the new Federal MSS system. The *FNPRM* seeks comment on how this spectrum band can be shared by Federal systems without causing harmful interference to non-Federal systems, including those in the adjacent bands. Finally, the *FNPRM* seeks to refresh the record on the matter of expanding Federal use of certain non-Federal FSS and MSS bands.

## **B. Legal Basis**

6. The proposed action is authorized pursuant to sections 1, 2, 4(i), 5(c), 301, 303(c), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 155(c), 301, 303(c), 303(f), and 303(r), and section 1.411 of the Commission's rules, 47 CFR § 1.411.

## **C. Description and Estimate of the Number of Small Entities to Which 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 proposed rules, if adopted.<sup>4</sup> The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."<sup>5</sup> In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.<sup>6</sup> 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.<sup>7</sup>

8. *Satellite Telecommunications and All Other Telecommunications.* Two economic census categories address the satellite industry. The "Satellite Telecommunications" category 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."<sup>8</sup> Satellite telecommunications service providers include satellite and earth station operators. The category has a small business size standard of \$35 million or less in average annual receipts, under SBA rules.<sup>9</sup> For this category, U.S. Census Bureau data for 2012 show that there were a total of 333 firms that operated for the entire year.<sup>10</sup> Of this total,

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<sup>4</sup> 5 U.S.C. § 603(b)(3).

<sup>5</sup> 5 U.S.C. § 601(6).

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

<sup>7</sup> 15 U.S.C. § 632.

<sup>8</sup> See U.S. Census Bureau, *2017 NAICS Definition, "517410 Satellite Telecommunications"*, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517410&search=2017+NAICS+Search&search=2017>.

<sup>9</sup> See 13 CFR § 121.201, NAICS Code 517410.

<sup>10</sup> See U.S. Census Bureau, *2012 Economic Census of the United States*, Table ID: EC1251SSSZ4, *Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the U.S.: 2012*, NAICS Code 517410,

(continued....)

299 firms had annual receipts of less than \$25 million.<sup>11</sup> Consequently, we estimate that the majority of satellite telecommunications providers are small entities.

9. The “All Other Telecommunications” category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.<sup>12</sup> 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.<sup>13</sup> Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.<sup>14</sup> The SBA has developed a small business size standard for “All Other Telecommunications”, which consists of all such firms with annual receipts of \$35 million or less.<sup>15</sup> For this category, U.S. Census Bureau data for 2012 show that there were 1,442 firms that operated for the entire year.<sup>16</sup> Of those firms, a total of 1,400 had annual receipts less than \$25 million and 15 firms had annual receipts of \$25 million to \$49,999,999.<sup>17</sup> Thus, the Commission estimates that the majority of “All Other Telecommunications” firms potentially affected by our action can be considered small.

10. *Commercial Space Transportation.* Neither the Commission nor the Small Business Administration (SBA) has developed a small business size standard for commercial space transport. The closest applicable industry in the U.S. Census Bureau’s North American Industry Classification System (NAICS) is Nonscheduled Charter Passenger Air Transportation.<sup>18</sup> This U.S. industry comprises establishments primarily engaged in providing air transportation of passengers or passengers and cargo with no regular routes and regular schedules. This industry also includes air taxi services, aircraft charter passenger services and charter air passenger services which would encompass air space transportation. The SBA small business size standard for this NAICS industry is that such a business is small if it has 1,500 employees or less.<sup>19</sup> U.S. Census Bureau data for 2012 indicates there were 1,303 firms that

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<https://data.census.gov/cedsci/table?text=EC1251SSSZ4&n=517410&tid=ECNSIZE2012.EC1251SSSZ4&hidePreview=false&vintage=2012>.

<sup>11</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>12</sup> See U.S. Census Bureau, *2017 NAICS Definition*, “517919 All Other Telecommunications”, <https://www.census.gov/naics/?input=517919&year=2017&details=517919>.

<sup>13</sup> *Id.*

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

<sup>15</sup> See 13 CFR § 121.201, NAICS Code 517919.

<sup>16</sup> See U.S. Census Bureau, *2012 Economic Census of the United States*, Table ID: EC1251SSSZ4, *Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the U.S.: 2012*, NAICS Code 517919, <https://data.census.gov/cedsci/table?text=EC1251SSSZ4&n=517919&tid=ECNSIZE2012.EC1251SSSZ4&hidePreview=false>.

<sup>17</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>18</sup> See U.S. Census Bureau, *2017 NAICS Definition*, “481211 Nonscheduled Charter Passenger Air Transportation,” <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=481211&search=2017>.

<sup>19</sup> See 13 CFR § 121.201, NAICS Code 481211.

operated for the entire year.<sup>20</sup> Of this number 1,300 firms had less than 1,000 employees.<sup>21</sup> We note that this category encompasses various types of commercial air transportation firms and does not exclusively represent the number of firms engaged in passenger space transport.

11. The Commission believes that the following business entities are the principal entities currently comprising the commercial space transportation launch operator industry in the United States: The Boeing Company, Lockheed Martin Corporation, Space Exploration Technologies, Northrop Grumman, Rocket Lab, Blue Origin, Relativity Space, and Astra. In addition, Virgin Galactic and Blue Origin have announced plans for suborbital manned space flights,<sup>22</sup> and Bigelow Aerospace plans to deploy a manned space station.<sup>23</sup> NASA has agreements with two companies to design and develop human space flight capabilities: Space Exploration Technologies, and The Boeing Company.<sup>24</sup> Because the commercial space industry is a nascent industry, it is difficult to state whether additional entities will enter the industry and how many and which entities will succeed. We do not have data on the size of these entities, and consequently, cannot classify them as large or small entities. We therefore cannot reach definite conclusions as to the number of small entities that will be affected by our actions in this proceeding, but we shall assume that a significant number of small entities will be affected.

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

12. The rule changes proposed in this *FNPRM*, if adopted, could impose new reporting, recordkeeping, or other compliance requirements on some small entities as well as other applicants and licensees. The proposed rule changes involve several new compliance obligations. The reporting, recordkeeping, and other compliance obligations proposed for small entities and other licensees are described below.

13. In the *FNPRM*, we seek comment on the appropriate licensing framework for non-Federal space launch applicants and licensees, including for the 2200-2290 MHz band and the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands. These applicants and licensees would be required to comply with certain licensing and operating rules, and we seek comment on whether entities operating or seeking to operate space launch vehicles would be required to comply with licensing frameworks within or similar to those in parts 87, 90, and/or 25 of the Commission's rules. We seek comment on rules for eligibility, shared frequency use, site-based licensing and other licensing options, authorized bandwidth, license term and renewal, the application process, the International Telecommunication Union (ITU) process as it relates to space launch vehicle licensing and operations, frequency coordination, and technical requirements.

14. *Eligibility.* An eligibility standard has been proposed for licensing in the 2200-2290

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<sup>20</sup> See U.S. Census Bureau, *2012 Economic Census of the United States*, Table ID: EC1248SSSZ5, *Transportation and Warehousing: Subject Series - Estab and Firm Size: Summary Statistics by Employment Size of Firms for the U.S.: 2012*, NAICS Code 481211, <https://data.census.gov/cedsci/table?y=2012&n=481211&tid=ECNSIZE2012.EC1248SSSZ5&hidePreview=false>.

<sup>21</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

<sup>22</sup> Mike Wall, Virgin Galactic Gearing up to Start Selling Suborbital Spaceflight Tickets Again, Space.com (Feb. 26, 2020) <https://www.space.com/virgin-galactic-spaceshiptwo-reservations-one-small-step.html>; Blue Origin, Unparalleled Views of the Earth from Space, <https://www.blueorigin.com/new-shepard/become-an-astronaut/> (last visited Mar. 31, 2021).

<sup>23</sup> Adam Higginbotham, *Robert Bigelow Plans a Real Estate Empire in Space*, Bloomberg Businessweek (May 2, 2013), <http://www.bloomberg.com/bw/articles/2013-05-02/robert-bigelow-plans-a-real-estate-empire-in-space#p1>.

<sup>24</sup> NASA, NASA Astronauts Launch from America in Historic Test Flight of SpaceX Crew Dragon (May 30, 2020), <https://www.nasa.gov/press-release/nasa-astronauts-launch-from-america-in-historic-test-flight-of-spacex-crew-dragon>; Boeing, CST-1000 Starliner, <https://www.boeing.com/space/starliner/> (last visited Mar. 31, 2021).

MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands. We propose that, to be eligible for a new commercial space launch license, the applicant must qualify as one of the following: (1) an operator or manufacturer of a commercial launch or reentry vehicle or launch or reentry vehicle components; (2) a parent corporation or its subsidiary if either corporation is an operator or manufacturer of a launch or reentry vehicle or launch or reentry vehicle components; or (3) an educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of a launch or reentry vehicle or launch or reentry vehicle components. We also propose to require an applicant for any commercial space launch frequencies to certify the eligibility criteria proposed above.

15. *Shared Frequency Use and Cooperative Use of Facilities.* In the *FNPRM*, we propose to provide non-Federal space launch operators access to the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands on a shared, non-exclusive basis. We note that, in the context of flight test operations, Part 87 generally limits authorizations of flight test land stations to only one per airport, but it requires that these stations be made available without discrimination to anyone eligible for a flight test station license. This rule has enabled the shared use of facilities, which has reduced costs to licensees and promoted efficient use and competition in the aviation industry. We seek comment on whether to adopt a similar non-discrimination policy for all operations in the bands at issue in the space launch context.

16. *Site-Based and Other Licensing.* We seek comment on adopting a site-based licensing model, which would enable the safe and efficient operation of shared frequencies while providing the certainty and flexibility needed to support the existing and future needs of commercial space launch entities. We seek comment on this approach, as well as changes that should be made to improve potential administrative burdens and streamline the site-based licensing process. Alternatively, we seek comment on whether there are any other licensing models that may be suitable in the space launch context.

17. *Authorized Bandwidth.* The *FNPRM* proposes to grant licenses for non-Federal operations in the 2200-2290 MHz band using a 5 megahertz bandwidth. We seek comment on this approach as well as other approaches. We also seek comment on the appropriate bandwidth or spectrum blocks for the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations.

18. *License Term and Renewal.* We propose to establish 10-year terms for commercial space launch licenses and seek comment on alternative license terms. We also propose to apply the renewal standard set forth in the Wireless Radio Services (WRS) proceeding to licensees in the 5650-5925 MHz band. We seek comment on whether to require that commercial space launch licensees to make a “renewal showing,” for instance, certifying that it is operating consistent with its initial application for authorization or that it has complied with required coordination.

19. *Application Process.* We seek comment on the application process to be used to assign commercial space launch licenses. We are aiming to establish an application framework that would increase the regulatory certainty while reducing the administrative burden, and seek comment on various approaches, including applying the existing licensing framework for Part 87 and Part 90 licenses to commercial space operations. We seek comments on the benefits and costs of requiring applicants seeking authorization for 2200-2290 MHz as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz frequencies to file an FCC Form 601 and applicable schedules through ULS under the appropriate Part 87 or Part 90 designation. We also seek comment on requiring applicants to file information consistent with certain aspects of Part 25 Form 312 and Schedule S, with additional narrative legal and technical information, and filing in the International Bureau Filing System (IBFS).

20. We seek comment on whether a proposed site-based licensing framework, including area of operation definitions, would accommodate various initial launch and re-entry scenarios. We also seek comment on whether a single license application could be used to request multiple spectrum bands and associated uses on a single launch vehicle, potentially in combination with site-based or non-exclusive licensing.

21. *ITU Process and Other Matters.* We seek comment on the ITU process as it relates to space launch vehicle licensing and operations, including on when and how launch vehicle operators should provide the Commission with information for submission to the ITU. We also seek comment on how to authorize operations of launch vehicles with ground stations outside of U.S. territories. Additionally, we seek comment on how the Commission should authorize ground station operations in the United States with space launch vehicles that are not authorized by the United States, including whether we should adopt a process for ground station operators to request communications with these launch vehicles.

22. *Frequency Coordination.* To minimize the likelihood of interference between operations and facilitate the efficient use of spectrum, we seek comment on the appropriate coordination process between Federal and non-Federal users to be used for space launch frequencies during the application process as well as the ongoing use of these frequencies by operators during their license terms.

23. *Technical Rules.* Small entities and other licensees would also be subject to certain technical rules that support the evolving interests and requirements of commercial space entities while minimizing harmful interference between Federal and non-Federal operations. We propose to adopt a similar set of technical rules to non-Federal space launch operations in the newly allocated 2200-2290 MHz band as well as in the proposed allocations. We find that adopting a technical framework similar to that which currently applies to Federal operations will promote interoperability and allows commercial launch providers to benefit from the economies of scale inherent from using the same radio systems for both Federal agencies and commercial customers. We propose and seek comment on technical rules regarding emission mask, power limits, and other technical rules that will maximize use of the band while protecting new, non-federal licensees and federal incumbents in the bands.

24. *Federal space station use of 399.9-400.05 MHz.* Small entities licensed to use 399.9-400.05 MHz would have requirements to coordinate with new Federal space stations in this frequency band to avoid harmful interference. Currently, we are aware of one such Federal space station. The limited number of space stations and intermittent use should facilitate this coordination.

25. *Protected Federal earth station operations in certain non-Federal FSS and MSS frequency bands.* The *FNPRM* refreshes the record regarding two alternative proposals from the *NPRM* to provide protection and formal recognition to Federal earth stations communicating with non-Federal space stations in certain frequency bands.

26. To comply with the proposed rules in the *FNPRM*, small entities may be required to hire attorneys, engineers, consultants, or other professionals. In particular, for small entities that are not existing operators and do not have existing staffing dedicated to regulatory compliance, engineering, and legal expertise may be necessary to make the requisite filings and to demonstrate compliance with the proposed performance obligations. At this time, while the Commission cannot quantify the cost of compliance with the proposed rule changes, we note that several of the proposed changes we seek comment on are consistent with and/or mirror existing policies and requirements used as part of other licensing frameworks, whether Part 87, Part 90, or Part 25. Therefore, small entities with existing licenses under these rule parts may already be familiar with some of the policies and requirements and have the processes and procedures in place to facilitate compliance resulting in minimal incremental costs to comply if similar requirements are adopted. We also note that for most of the proposals and requests for comments in the *FNPRM*, the Commission also requests cost and benefit analysis. The Commission expects that the information it receives in comments will help it identify and evaluate all relevant associated with the proposed reallocation and the relocation of public safety operations out of the band, including compliance costs and other burdens on small entities.

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

27. The RFA requires an agency to describe any significant, specifically small business,

alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof for small entities.”<sup>25</sup>

28. In this proceeding, the Commission seeks to provide the space launch industry with a more efficient, predictable, collaborative, and transparent regulatory process for obtaining access to spectrum than the process of obtaining experimental Special Temporary Authorizations on which the industry currently relies. Accordingly, we anticipate that the steps we propose or on which we seek comment will in fact help reduce burdens on small entities engaged in space launch operations by reducing the cost, effort, and uncertainty involved in obtaining spectrum authorization for such operations. Further, the Commission has taken steps to enable it to minimize the economic burden on small entities that could occur if some of the proposed rule changes and approaches upon which we seek comment upon in the *FNPRM* are adopted. More specifically, in many of the proposals for the 2200-2290 MHz and proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations, we propose applying existing requirements applicable in other spectrum bands. This could minimize the compliance costs for small entities that are already subject to these requirements and have processes and procedures in place for compliance. These entities may only incur incremental costs to scale their operations for compliance should our proposals be adopted. Below we describe areas where we have made proposals to minimize the compliance costs for small entities. We seek comment on the economic impact of our proposals on small entities and invite commenters addressing these proposals to discuss alternatives that could further lessen the burden on small businesses.

29. *Proposed Non-Federal Allocations for the 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz Bands.* Adopting allocations in the 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands will provide commercial space operators, including small entities, greater certainty as to which frequency bands they can use, which will promote the advance planning and investment necessary for future space launch activities. The current process of obtaining an STA for each launch places burdens on launch providers, including small entities, which must prepare numerous applications but nevertheless face the uncertainty of whether they will be permitted to access the spectrum they require in a timely fashion – or even from one launch to the next. As the U.S. commercial space industry continues to expand, the burdens and uncertainties associate with continuing the current STA process would only increase. The proposed allocations would minimize the economic and administrative burdens on small entities by providing greater certainty to access to the spectrum it needs to support business ventures and encourage further investment.

30. *Scope of Service.* We propose to add provisions restricting use of the 2200-2290 MHz band and the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands, which will support the current level of commercial launches and enable the continued growth of the commercial space launch industry. The proposed rules are designed to provide sufficient flexibility for existing and future needs of non-Federal launch activities and we seek comment on whether additional uses should be accommodated if technically feasible.

31. *Eligibility.* To encourage entrepreneurial efforts in the commercial space launch industry, we propose to limit eligibility to hold authorizations for the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands to space launch entities. We propose to require an applicant for any commercial space launch frequencies to certify the eligibility criteria, which would impose minimal burden on eligible entities.

32. *Shared Frequency Use and Cooperative Use of Facilities.* We propose to provide non-

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<sup>25</sup> 5 U.S.C. § 603(c)(1)-(4).



Federal space launch operators access to the 2200-2290 MHz band, as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands on a shared, non-exclusive basis. The Commission traditionally has issued Part 87 licenses on a shared basis, and certain Part 90 radiolocation uses are also authorized on a similar shared basis. Many entities may therefore already be familiar with shared frequency use policies that the Commission applies for other services, including those under Parts 87 and 90. We also seek comment on whether to adopt a non-discrimination shared use of facilities policy for all operations in the bands at issue in the space launch context, which has reduced costs and promoted efficient use of spectrum and competition in other contexts, such as for Part 87 flight test operations.

33. *Site-Based and Other Licensing.* Consistent with our approach for other wireless radio services, including Part 87 flight test station licenses and Part 90 radiolocation services, we seek comment on whether to issue commercial space launch licenses on a site-by-site basis. Licensees, including small entities, may already be familiar with the site-based licensing model and its requirements from other bands and have the processes and procedures in place to facilitate compliance resulting in minimal incremental costs to comply if a similar framework is adopted for 2200-2290 MHz, 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz band spectrum. We also seek comment on whether there are any other licensing models that may be suitable in the space launch context, and whether any alternatives would facilitate compliance or further streamline the licensing process.

34. *Authorized Bandwidth.* We propose to grant licenses for non-Federal operations in the 2200-2290 MHz band using a 5 megahertz bandwidth. The majority of applications for experimental authorizations requested for the 2200-2290 MHz band involved requests for bandwidths less than 5 megahertz. Accordingly, we believe that licensing this band in 5 megahertz channel blocks will accommodate most non-Federal launch vehicle operations in the band. We seek comment on the appropriate bandwidth or spectrum blocks for the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands.

35. *License Term and Renewal.* In order to provide certainty and flexibility for space launch providers, we propose to issue commercial space launch licenses for ten-year terms. We are cognizant that small entities must allocate resources carefully over the length of their license term and we believe that our proposal to apply a ten-year license term will provide the certainty of a longer license term which would give small entities sufficient incentive to make the long-term investments necessary for compliance. We seek comment on alternative license terms. The Wireless Radio Services (WRS) proceeding established the process for renewing a site-based license, which applies to Part 90 Radiolocation services. We propose to extend this renewal standard to licensees in the 5650-5925 MHz band, which involves a certification process and imposes minimal burden on operators, including small entities. The *WRS Order* does not apply to wireless radio services that are licensed by rule or on a “personal” basis or that have no construction/performance obligations, which includes most Part 87 services. We seek comment on whether to require that commercial space launch licensees make a “renewal showing,” for instance, certifying that it is operating consistent with its initial application for authorization or that it has complied with required coordination. The renewal requirements and procedures proposed are based on or would apply existing renewal requirements applicable to other services and with which small entities may already be familiar.

36. *Application Process.* The application requirements and procedures proposed or on which we seek comment in the *FNPRM* may be based on or would apply existing requirements in Part 87, Part 90, or Part 25. We seek comment on the impacts of various aspects of these application processes, including associated administrative burdens or benefits.

37. *Frequency Coordination.* To minimize the likelihood of interference between operations and facilitate the efficient use of spectrum, we propose to require frequency coordination between space launch licensees and other users of the respective bands for separate launch operations. We wish to avoid a coordination process that is overly burdensome for launch operators or that injects uncertainty as to spectrum use. The Commission has adopted coordination requirements for other services and applicants

may be familiar with these policies and requirements, resulting in minimal incremental compliance costs if a similar policy is adopted in the space launch context.

38. *Technical Rules.* Many of the technical rules proposed in the *FNPRM* are based on the rules adopted by the NTIA and the ITU. The proposed technical rules would promote interoperability between Federal and commercial systems, which would avoid increased costs for development, hardware acquisition, operations, and testing; reduce opportunity costs; increase competition among launch providers and launch sites; and promote the industry overall.

39. *Licensing and Operating Rules for Payload Operations.* Although the primary focus of the *FNPRM* is on the radio-frequency use by launch vehicles, we seek comment on ways to improve the licensing process to facilitate more routine licensing for several other types of activities currently addressed through experimental licensing, which would reduce the administrative and economic burdens on commercial space operators, which includes small entities.

40. *Federal space station use of 399.9-400.05 MHz.* The *FNPRM* also proposes to amend a footnote to the Allocation Table to permit Federal MSS systems to operate in the 399.9-400.05 MHz band. There is a possibility that a Federal MSS system deployed in the band may cause harmful interference to Commission licensees in the same or nearby spectrum. The *FNPRM* asks whether such interference could be an issue and if it could be successfully mitigated through coordination. Coordination would give small entities the greatest flexibility in mitigation techniques to achieve compatibility with Federal users, and given the limited number of Federal space stations (we are aware of one planned satellite), we expect that this proposal would not have a significant economic impact on any small entity.

41. *Protected Federal earth station operations in certain non-Federal FSS and MSS frequency bands.* The *FNPRM* seeks to refresh the record regarding two alternative proposals from the *NPRM*. In the first option, the *FNPRM* proposes to add a co-primary Federal FSS or Federal MSS allocation in the Table of Frequency Allocations in section 2.106 of our rules (Allocation Table) for a number of spectrum bands used for commercial satellite services. In conjunction with this modification of the Allocation Table, we will add a footnote to the Allocation Table restricting primary use of Federal earth stations in these bands to communication with non-Federal satellites. This will not directly change the regulatory burdens on Commission licensees. Commission licensees will continue to follow the same licensing procedures and be subject to the existing technical rules when operating in these bands. Because the bands will have a co-primary Federal allocation, under existing coordination procedures the Commission would be expected to coordinate license applications in these bands with NTIA. This will result in increased processing time for applications for Commission licenses for these bands. We are not able to quantify the economic impact this increased processing time will have on small entities applying for Commission licenses.

42. In the second option, the *FNPRM* proposes to modify the Allocation Table by adding a footnote that gives Federal earth stations communicating with non-Federal satellites in a number of bands used for commercial satellite service interference protection equivalent to that afforded to non-Federal earth stations. The Federal earth stations will receive interference protection only if they operate in accordance with the Commission's rules. This proposal does not change the regulatory burdens on Commission licensees. Commission licensees will continue to follow the same licensing procedures and be subject to the existing technical rules when operating in these bands. Unlike the first proposal, a Federal allocation will not be added to these bands and there will be no new requirement to coordinate Commission licenses with NTIA. This alternate proposal should have no significant economic impact on small entities.

43. The Commission seeks comment on its proposals and the questions it raises which can help to identify whether small entities face any special or unique issues with respect to the buildout and other requirements that would require certain accommodations or additional time to comply. The Commission also seeks comment on modifications that could be made to our rules regarding

administrative processes in order to reduce the economic impacts of the proposed rule changes on small entities. By specifically targeting small entities, the Commission hopes to obtain the requisite data to allow it to evaluate the most cost-effective approach to minimize the economic impact for such entities, while achieving its statutory objectives.

44. Additionally, to assist with the Commission's evaluation of the economic impact on small entities that may result from the actions and alternatives that have been proposed in this proceeding, the *FNPRM* seeks alternative proposals and requests information on the potential costs of such alternatives to licensees. The Commission expects to consider more fully the economic impact on small entities following its review of comments filed in response to the *FNPRM*, including costs and benefits information. Alternative proposals and approaches from commenters could help the Commission further minimize the economic impact on small entities. The Commission's evaluation of the comments filed in this proceeding will shape the final conclusions it reaches, the final alternatives it considers, and the actions it ultimately takes in this proceeding to minimize any significant economic impact that may occur on small entities from the final rules that are ultimately adopted.

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

45. None.