

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

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Application of )	
)	
<b>SPACE EXPLORATION HOLDINGS, LLC</b> )	Call Signs: S2983 and S3018
)	
For Modification of Authorization for the )	File No. SAT-MOD-_____
SpaceX NGSO Satellite System )	
_____ )	

**APPLICATION FOR MODIFICATION OF AUTHORIZATION  
FOR THE SPACEX NGSO SATELLITE SYSTEM**

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## SUMMARY

With this application, SpaceX seeks to modify its license to reflect the result of a rigorous, integrated, and iterative process that has unlocked a constellation design that will accelerate the deployment of its satellites and services while reducing the potential for orbital debris through operation of part of the constellation at a lower altitude. Critically, this modest modification to the altitude authorized in SpaceX's license will accomplish these objectives without increasing overall interference. SpaceX will also use this application to address three conditions included in its authorization related to orbital debris mitigation, the protection of fixed services in the Ka-band, and compliance with applicable limits on equivalent power flux-density ("EPFD").

The Commission authorized SpaceX earlier this year to construct, launch, and operate a constellation of 4,425 non-geostationary orbit ("NGSO") satellites. That Commission license marked a major step in SpaceX's efforts to design, develop, and deploy an innovative and spectrum-efficient satellite system to deliver robust broadband service to customers around the world. The authorization came on the heels of SpaceX's successful launch of two experimental satellites to test both operational capabilities and innovative engineering concepts. These satellites demonstrated that SpaceX-developed satellite technology functions well in the harsh environment of space and, importantly, they provided key operational lessons that SpaceX has quickly integrated into the system's design. For instance, with the launch of the prototypes, SpaceX was able to test its communications equipment, better discern its ability to take advantage of the benefits of lower altitude operations, and gain experience coordinating with proximate orbital objects.

SpaceX is now applying its unique approach of swift learning and rapid, iterative development to accelerate the deployment of its next-generation NGSO communications network.

SpaceX will leverage the same American innovation, technical savvy, and integrated, iterative culture that allowed it to develop the most advanced launch and spacecraft systems in history. SpaceX will manufacture the satellites making up the constellation in the United States, where its engineers are designing both the broadband system and the launch vehicles, just as it does with its launch vehicles and Dragon spacecraft. This integrated process of design, development, production, and testing establishes a tight iterative loop that enables SpaceX to learn continuously and apply technical insight and design improvements to refine and advance its technology in real time. In fact, as a result of this approach, SpaceX was able to move from opening its satellite technology development office in Redmond, Washington to building, launching, and operating its own spacecraft in orbit in an unprecedented three-and-a-half years.

Now, SpaceX is poised to take the next step. The company will utilize key elements from its experimental satellites, such as its sophisticated phased-array antennas and its advanced Hall-effect thrusters, as the foundation of a more efficient and cost-effective architecture that can rapidly accelerate deployment for the overall constellation while optimizing space safety. This architecture will support commencement of service as soon as possible, allowing SpaceX to quickly employ valuable spectrum and orbital resources for meaningful services.

*Lower orbit.* Maintaining a clean orbital environment is a foundational concern for SpaceX, and the company will take every opportunity to improve its effect on the orbital environment. In this case, SpaceX proposes a modest modification of its Commission authorization to further enhance the already considerable space safety attributes of the constellation. Specifically, SpaceX proposes to relocate 1,584 satellites previously authorized for operation at an altitude of 1,150 km to a new altitude of 550 km. Given the atmospheric drag at

this lower altitude, this relocation will significantly enhance space safety by ensuring that any orbital debris will quickly re-enter and demise in the atmosphere.

*No change in spectral interference.* Significantly, the ability to accelerate deployment while enhancing space safety will not come at the cost of increased interference. To the contrary, through the benefits of the lower altitude and following specific technological efforts, SpaceX's proposed modification will not degrade the interference environment for other NGSOs, GSOs, or terrestrial spectrum users. Its satellites will, as originally proposed and like the rest of the SpaceX constellation, use advanced beam-forming and digital processing technologies to make highly efficient use of spectrum resources while achieving the flexibility to share that spectrum with other licensed satellite and terrestrial users. Moreover, with its satellites closer to Earth, SpaceX will be able to decrease the power levels of its transmissions from and to these spacecraft. This decrease will also facilitate compliance with applicable EPFD limits designed to promote harmonious operations with GSO satellite systems, while further enhancing SpaceX's ability to protect terrestrial wireless systems. As a result, this modification will not increase interference to any other authorized spectrum user.

*Faster deployment.* This modification will enable SpaceX to accelerate the manufacture of its new spacecraft and begin populating this lower orbital shell with a first-generation of the new architecture. Because of its ability to fully integrate its development, manufacturing, and launch capabilities, SpaceX is capable of continuously populating this orbital shell even as the company adds features to the remainder of its previously authorized system. Accordingly, grant of the requested modification would serve the public interest by enabling SpaceX to make efficient use of valuable spectrum resources more safely, quickly, and cost-effectively as it initiates a new generation of NGSO satellites without any adverse effect on other spectrum users. SpaceX

therefore asks the Commission to grant the proposed modification expeditiously so that SpaceX can proceed with its ambitious deployment schedule.

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**APPLICATION FOR MODIFICATION OF AUTHORIZATION  
FOR THE SPACEX NGSO SATELLITE SYSTEM**

Space Exploration Holdings, LLC, a wholly owned subsidiary of Space Exploration Technologies Corp. (collectively, “SpaceX”), files this Application for Modification to accelerate deployment of its satellite constellation and increase space safety by operating part of its system at a lower altitude without increasing overall interference. This application identifies all changes that SpaceX requests for its Authorization. SpaceX is also filing an FCC Form 312, Schedule S, and updated Technical Attachment to account for the changes proposed. SpaceX certifies that all other information provided in its original Ku/Ka-band applications remains unchanged.<sup>1</sup> In addition, SpaceX takes this opportunity to address three conditions included in its Authorization, related to orbital debris mitigation, compliance with applicable limits on equivalent power flux-density (“EPFD”), and protection of fixed services in the Ka-band.<sup>2</sup>

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<sup>1</sup> See 47 C.F.R. § 25.117(c). See also Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (Nov. 15, 2016); Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System Supplement, IBFS File No. SAT-LOA-20170726-00110 (July 26, 2017).

<sup>2</sup> See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 148, ¶¶ 15, 35, 40n, 40p, and 40q (2018) (“SpaceX Authorization”).

## DISCUSSION

The Commission authorized SpaceX earlier this year to construct, deploy, and operate a constellation in non-geostationary orbit (“NGSO”), consisting of 4,425 satellites operating in 83 orbital planes at five different altitudes, using Ku- and Ka-band spectrum.<sup>3</sup> Both before and after that grant, SpaceX dedicated substantial resources to refining its plans to design and deploy an innovative, cost-effective and spectrum-efficient satellite system capable of delivering robust broadband service to customers around the world, especially for those in areas that find themselves on the wrong side of the digital divide. SpaceX plans to surpass the deployment milestones laid out in its license and in the Commission’s rules that require it to begin operation of at least half of its authorized satellites no later than March 29, 2024.<sup>4</sup> In fact, SpaceX intends to launch its first batch of satellites to begin populating a new orbital shell before the end of 2019.<sup>5</sup>

To accelerate this overall deployment schedule, SpaceX proposes to decrease its number of satellites and relocate 1,584 satellites previously authorized to operate at an altitude of 1,150 km to an altitude of 550 km.<sup>6</sup> As discussed below, this move will help simplify the spacecraft design and enhance the considerable space safety attributes of SpaceX’s constellation by ensuring that any orbital debris will undergo rapid atmospheric re-entry and demise, even in the unlikely event that a spacecraft fails in orbit. And because of its commitment to remaining a good steward of

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

<sup>4</sup> *See id.*, ¶ 42(b); 47 C.F.R. § 25.164(b).

<sup>5</sup> In order to meet this ambitious timeline, SpaceX intends to begin satellite construction at its own risk. *See* 47 C.F.R. § 25.113(f).

<sup>6</sup> The facilities comprising the SpaceX system, as modified under this proposal, are described below and in more detail in the Schedule S and Technical Attachment (Attachment A) accompanying this application.

spectrum, SpaceX ensured that its proposed modification will not diminish SpaceX's ability to share spectrum resources fairly and efficiently with other licensed satellite and terrestrial users.

SpaceX's unique ability to design, build, launch, and operate its NGSO system from end to end means that the company can learn continuously throughout deployment. In contrast to other would-be NGSO systems, SpaceX's integrated approach to designing, building, and operating uniquely enables the company to leverage the experience gained through ongoing efforts into technological and operational improvements that will make its constellation safer, more capable, more efficient, and better able to deliver the broadband services its customers demand. SpaceX has applied this philosophy and approach to its Falcon launch vehicle systems and Dragon spacecraft to great effect—iterating on technologies never thought possible (*e.g.*, reusable rockets) to continuously improve these space systems for performance, reliability, and affordability. Accordingly, grant of the requested modification would serve the public interest by enabling SpaceX to make efficient use of valuable spectrum resources more safely, quickly, and cost-effectively as it initiates a new generation of NGSO broadband services available to customers worldwide, including those in areas previously underserved or even totally unserved by other broadband solutions.

#### **I. SPACEX'S UNIQUE INTEGRATED AND ITERATIVE APPROACH DRIVES THE SYSTEM IMPROVEMENTS DESCRIBED IN THE PROPOSED MODIFICATION**

SpaceX took a major step forward in February of this year when it successfully launched and operated two experimental satellites, Microsats 2A and 2B.<sup>7</sup> This experiment demonstrated

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<sup>7</sup> See Call Sign WI2XTA, ELS File No. 0298-EX-CN-2016 (granted Nov. 16, 2017). Both of these satellites were deployed on February 22, 2018 in the same launch mission aboard a SpaceX Falcon 9 rocket, and are currently engaged in the test regimen previously authorized.

the performance of SpaceX-built technology, such as its phased-array antennas and its powerful Hall-effect thruster propulsion system. These experimental satellites also provided key operational lessons, such as the benefits of operating at different altitudes and practical experience coordinating with and avoiding neighboring orbital objects. Even as operations continue with these two experimental satellites, SpaceX is already poised to leverage this successful demonstration to take the next step in its satellite development. SpaceX will use elements from the Microsat spacecraft as the foundation of an efficient and economic architecture that will enable the rapid acceleration of deployment of the overall constellation.

This kind of swift learning and rapid innovation is foundational to SpaceX and is one of the company's core competencies. Since its inception, SpaceX has leveraged American innovation, technical savvy, and its integrated, iterative culture to provide the most advanced launch and spacecraft systems in history. Through these efforts, SpaceX's Falcon family of launch vehicles has provided dependable and affordable rides to space for NASA, the Department of Defense, and the world's most sophisticated commercial satellite manufacturers and operators. SpaceX also regularly conducts cargo resupply missions to and from the International Space Station ("ISS") with its Dragon spacecraft, which requires proximity operations at the ISS. SpaceX achieved the world's first re-flight of an orbital class rocket in March 2017 and, since then, has successfully recovered 30 Falcon 9 boosters on land or at sea, and re-flown 16 Falcon 9 first stages. To date, SpaceX has successfully launched its Falcon rockets 62 times; since 2017 SpaceX has launched more than 65 percent of all launches from U.S. soil and the company's launch manifest represents well more than 60 percent of the worldwide commercial satellite launches. SpaceX is now set to reuse a Falcon 9 booster for an unprecedented third time. Earlier this year, SpaceX launched the most powerful operational rocket in the world by a factor two, the Falcon

Heavy, and landed the two side boosters of that vehicle simultaneously, a feat never accomplished—nor even attempted—in history. Looking forward, NASA has selected SpaceX to launch next year the first American astronauts from U.S. soil on an American rocket since the Space Shuttle was retired in 2011. Each of these considerable breakthroughs were the product of SpaceX’s approach of rapid design, manufacturing, and test iteration.

SpaceX is now taking its nearly two decades of experience in cost-effectively deploying large, complex space systems for other operators to develop its own broadband satellite constellation from the ground up. With a tightly integrated approach—linking design, development, production, test, launch, and operations—SpaceX is pursuing a more efficient and cost effective path to leverage low-Earth orbit to address the challenges that have plagued past NGSO constellations. Because SpaceX will design, build, test, launch, and operate its own satellite constellation, it can update technology at the speed of the market rather than maintaining outdated technology in orbit many years after launch. SpaceX has the unique ability to improve its architecture and services to address changes in consumer demand, and then refresh the technology of the satellite system through iterative spacecraft design changes and phased, continuous deployment. SpaceX’s indigenous launch capability leveraging the reusable Falcon 9 system provides the company with nearly unfettered access to space, further enabling continuous technology enhancements in the spacecraft. SpaceX anticipates that this approach will enable its satellite system to remain adaptable to existing and future broadband customer opportunities.

Moreover, as its own launch provider, SpaceX is fully integrating its satellite design with the launch vehicle—the groundbreaking Falcon 9 rocket. This integration allows SpaceX to optimize the satellites’ specifications to the capacity and thrust available with Falcon 9 to plan for highly efficient launches that maximize the speed of deployment. In addition, SpaceX can take

advantage of its continuing innovation in its launch reusability to support an even faster tempo of satellite launches. For instance, the most recent iteration of the Falcon 9 rocket—Block 5—is designed to be launched, landed, and relaunched at least 10 times with mere inspection, with a goal of cycling the booster for relaunch within just days. Falcon 9’s reusability, operational cadence, and affordability fundamentally alter the dynamics of deploying large satellite constellations.

But the integration with launch is more than just technical—it is rooted in the culture of the company. For example, SpaceX can take advantage of the engineering and manufacturing expertise used to develop the Falcon 9 and the Cargo and Crew Dragon spacecraft to drive other projects like its satellite system. SpaceX has applied this expertise to study the success of its experimental satellites and help accelerate the process of refining SpaceX’s plans for its NGSO constellation. The same technical know-how behind Falcon 9 and Dragon can be applied to assess the experimental satellite bus and related subsystems, the operation of space-based and ground-based phased array technologies, and the operational environment at lower altitudes in space. SpaceX learned how to initiate the move towards mass production by beginning with a single-band antenna using Ku-band spectrum and how to operate a portion of the system at a lower orbital altitude to capture a variety of operational and service-related benefits described below. Now, SpaceX is poised to build upon the lessons learned from these satellites to advance into the next stage in development.

## **II. OPERATING AT LOWER ALTITUDE YIELDS MANY BENEFITS, INCLUDING ENHANCING THE SYSTEM’S ALREADY SIGNIFICANT SPACE SAFETY PROFILE**

Maintaining a clean orbital environment is a fundamental concern for SpaceX’s business. SpaceX is planning to launch its vehicles into orbital altitudes at least 22 times this year alone for its commercial and government customers. For its commercial satellite customers, SpaceX must

safely deliver satellite payloads to their proper orbital altitudes. For other missions, SpaceX must reliably deliver cargo—and soon astronauts—to the ISS, a more than \$100 billion multinational facility with human beings onboard. SpaceX is privileged to be trusted by NASA and its International Partners to approach and berth or dock with the ISS—a highly complex operation with stringent safety protocols and virtually no margin for error. SpaceX’s operational experience in being one of the world’s few “visiting vehicles” to the ISS highlights its capability to maintain safe space operations.

SpaceX is committed to minimizing the risk of damage to all operating spacecraft and other orbital resources. Because of this commitment, SpaceX made sure that its initial application maintained a significant space safety profile. But as this application to operate at a lower altitude makes clear, SpaceX will take every opportunity to further improve the safety of the orbital environment as it develops more advanced technology.

Operating at a lower altitude offers several attractive features both during nominal operation and in the unlikely event something goes wrong. First and foremost, the natural atmospheric advantage of lower altitude helps reduce the impact of potential debris from other sources. At 550 km, the Earth and its atmosphere act like a vacuum cleaner—atmospheric drag naturally removes objects from orbit, including loose debris. But the lower altitude also improves safety when, in off-nominal events, satellites fail to fully complete their disposal operations. The natural orbital decay of a satellite at 1,150 km requires hundreds of years to enter the Earth’s atmosphere, but a SpaceX satellite will take less than five years (even under worst-case

assumptions) if it starts at an altitude of 550 km. This phenomenon alone substantially reduces the risk of persistent orbital debris at low altitudes.<sup>8</sup>

In this particular case, moving to a lower altitude also provides an additional benefit—increasing the space between SpaceX’s satellites and other proposed large NGSO constellations, such as OneWeb, Boeing, and Telesat. The Commission has authorized those companies to operate NGSO systems at altitudes between 1,000 km and 1,200 km. These satellites will operate in orbits that extend through SpaceX’s currently authorized orbit at 1,150 km. By modifying a portion of its constellation to move satellites from 1,150 km to 550 km, SpaceX would reduce potential conflict and improve the safety profile for its constellation as well as for other NGSO operators during nominal operations.

While improved orbital debris mitigation is a significant advantage of this modification, it is not the only one. By operating closer to the Earth, SpaceX would also reduce the latency of its communications signals to as low as 15 milliseconds, at which point it would be virtually unnoticeable to almost all users.<sup>9</sup> In addition, operating at lower altitude reduces the degree to which satellite beams will spread before they reach the Earth. As discussed in the technical analysis, SpaceX’s ability to use even tighter beams will achieve more efficient re-use of spectrum resources.

Despite these well-known advantages, this altitude does pose significant trade-offs, which may be why most other NGSO providers choose to operate at higher orbits. The very same

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<sup>8</sup> The Technical Attachment submitted with this application includes an updated orbital debris mitigation analysis that confirms the improved characteristics of the SpaceX system as modified. *See* Technical Attachment at Section A.11. SpaceX requests that the Commission find that this satisfies the debris-related condition in its authorization. *See* SpaceX Authorization, ¶¶ 15 and 40p.

<sup>9</sup> By contrast, SpaceX expected to target latency of approximately 25-35 ms from the 1,150 km altitude.

atmospheric drag that helps to sweep the orbit clean of debris also forces satellites to work harder to remain in orbit. Staying aloft requires the satellite to be able to overcome more atmospheric drag. In addition, satellites operating at low altitude see less of the Earth, requiring more satellites to serve a given area.<sup>10</sup> SpaceX proposes to separate itself from most other NGSO constellations and operate at this altitude nonetheless based in part on feedback gained from its experimental satellites, which have conducted extensive testing of SpaceX's capabilities to operate in the lower 500 km range. Consequently, SpaceX has learned to mitigate the disadvantages of operating at a lower altitude and still reap the well-known and significant benefits discussed above.

### **III. SPACEX WILL ACHIEVE THESE BENEFITS WITH A MODEST MODIFICATION TO ITS CURRENT AUTHORIZATION AND WILL NOT INCREASE OVERALL INTERFERENCE**

Under this proposed modification, SpaceX would relocate 1,584 satellites currently authorized to operate at 1,150 km to create a new lower shell of the constellation at 550 km. As shown in the table below, the changes in the constellation are actually quite modest—especially when compared to the benefits they enable.

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<sup>10</sup> SpaceX intends to begin service from this lower shell using lower minimum elevation angles to increase initial coverage, but will ultimately raise that angle as the remainder of the constellation is deployed. In all cases, beams from the lower shell will be smaller than those currently authorized at 1,150 km.

Parameter	Original Authorization	Proposed Modification
Orbital Planes	32	24
Satellites Per Plane	50	66
Total Satellites	1,600	1,584
Altitude	1,150 km	550 km
Inclination	53°	53°

In the initial phase, SpaceX will launch and operate first-generation satellites that it designed to simplify the manufacturing process and support a faster pace of deployment. For example, SpaceX will deploy initial satellites that use only Ku-band spectrum for communications from satellites to both gateways and user terminals. SpaceX will then phase the Ka-band antennas back into subsequent generations. This phased-in approach will allow SpaceX to advance its satellite construction and deployment schedule with a simplified design while continuing to develop dual Ku/Ka-band antenna technology. SpaceX will introduce the use of Ka-band spectrum for gateway communications as it continues to populate its constellation and add features to its subsequent spacecraft. The first-generation satellites are an initial application of the iterative process SpaceX has been planning since the inception of this constellation,<sup>11</sup> and which will

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<sup>11</sup> See, e.g., Consolidated Opposition to Petitions and Response to Comments of Space Exploration Holdings, LLC, IBFS File No. SAT-LOA-20161115-00118, at 8 (July 7, 2017) (“SpaceX does not intend to freeze the design process for its spacecraft at the first launch. Rather, it will continue to explore new technologies and implement upgrades in an iterative process to ensure that its satellites are highly reliable – a necessity not only for maintaining the continued safety of space, but also for delivering a high quality broadband service.”).

continue even after launch of its full constellation—constantly improving its technology on an ongoing basis as it upgrades each generation of satellites with another.

As demonstrated here, SpaceX’s commitment to good spectrum stewardship remains unwavering. Through both a lower altitude and by technological planning, SpaceX will continue to ensure that its constellation will be able to share spectrum resources fairly and efficiently. None of SpaceX’s modifications will increase interference to other NGSOs, GSOs, or terrestrial wireless spectrum users. First, SpaceX does not propose to increase the number of satellites in its constellation beyond that previously authorized; in fact, the modification will slightly decrease the total number of satellites from 4,425 to 4,409. Moreover, because the modified satellites will operate at lower altitude, fewer of them will be visible above the minimum elevation angle at any particular time throughout the United States. The Commission has previously recognized this factor as demonstrating that a modification will not increase interference to other NGSO systems.<sup>12</sup> In addition, by operating at lower altitude, these satellites will be able to transmit and receive at lower EIRP levels—another factor that will reduce the potential for interference. Because these satellites will operate closer to the Earth, their spot beams can cover less area than constellations at higher altitudes, but map to the same grid. As confirmed by the analysis presented in the Technical Attachment to this application,<sup>13</sup> these attributes of the proposed modification ensure that they will not increase overall interference.

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<sup>12</sup> See *Teledesic LLC*, 14 FCC Rcd. 2261, ¶ 13 (IB 1999) (“*Teledesic*”).

<sup>13</sup> See Technical Attachment at Section A.8.

Next, SpaceX will stay true to its commitment to ensure harmonious operations with GSO satellite systems and will comply with applicable EPFD limits.<sup>14</sup> And, as demonstrated in the Technical Attachment, SpaceX's operations will also continue to protect terrestrial fixed services.<sup>15</sup> Importantly, even the earliest generations of SpaceX satellites will use advanced phased-array technology to implement the beam forming and steering strategies that give the constellation the flexibility to share spectrum fairly and efficiently, unlike other NGSO satellite systems. In other words, the outsized benefits of this modification do not change the fundamental advantages of SpaceX's constellation.

#### **IV. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST**

Worldwide demand for broadband services and Internet connectivity continues to increase with escalating requirements for speed, capacity, and reliability and ongoing adaptations for usage. Yet even as the volume of traffic flowing over the world's networks has exploded, some people find themselves being left behind. As the Commission has recognized, many communities across the United States and the world lack access to reliable broadband connectivity, and therefore are unable to participate fully in economic, social, and civic activities.<sup>16</sup> Chairman Pai

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<sup>14</sup> See 47 C.F.R. §§ 25.108(c)(3) and (9), 25.146(c) (incorporating ITU Radio Regs., Article and 22). The Commission has found these limits sufficient to prevent harmful interference to other spectrum licensees. See, e.g., *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range*, 16 FCC Rcd. 4096, ¶¶ 39, 72 (2000) ("the single-entry and aggregate EPFD limits we are adopting also define the level of acceptable interference from a NGSO FSS system into a GSO FSS system under our rules"). Based on the showing in Annexes 1 and 2 to the Technical Attachment and the underlying data submitted under separate cover, SpaceX requests that the Commission find that the condition in its license related to EPFD compliance has been satisfied, or that waiver of that condition is justified. See SpaceX Authorization, ¶ 40n.

<sup>15</sup> See Technical Attachment at Section A.7. Based on this showing, SpaceX requests that the Commission find that the condition in its license related to protection of fixed service systems in the Ka-band has been satisfied. See SpaceX Authorization, ¶¶ 35 and 40q.

<sup>16</sup> See, e.g., *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 33 FCC Rcd. 1660, ¶ 50 (2018) (noting that "over 24 million Americans still

has noted the importance of this issue, as well as the role of next-generation satellite systems in addressing it.

My top priority as Chairman of the FCC is closing the digital divide. I've often said that in order to bring digital opportunity to all Americans, we need to use all of the tools in the toolbox. Satellite broadband service is one of those tools. . . . Next-generation satellites are bringing new competition to the broadband marketplace and new opportunities for rural Americans who have had no access to high-speed Internet access for far too long. That's why the FCC under my leadership has moved quickly to give a green light to satellite innovators.<sup>17</sup>

SpaceX shares Chairman Pai's sense of urgency, and requests this modification toward the goal of advancing the deployment of an NGSO system capable of initiating service in the near term while also providing feedback for integration into the evolving design of SpaceX satellites to change with broadband needs in the longer term.

The Commission recognized that granting the SpaceX Authorization would “enable SpaceX to bring high-speed, reliable, and affordable broadband service to consumers in the United States and around the world, including areas underserved or currently unserved by existing networks.”<sup>18</sup> That is precisely what the modification will enable SpaceX to do—with both

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lack fixed terrestrial broadband at speeds of 25 Mbps/3 Mbps,” and that “the gap in rural and Tribal America remains notable: 30.7 percent of Americans in rural areas and 35.4 percent of Americans in Tribal lands lack access to fixed terrestrial 25 Mbps/3 Mbps broadband”). Internationally, the disparities between broadband access and absence are even greater, with 4.2 billion people (or 57% of the world's population) offline. *See* BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT, “Open Statement from the Broadband Commission for Sustainable Development to the UN High-Level Political Forum (HLPF)” (July 11, 2016), *available at* <http://broadbandcommission.org/Documents/publications/HLPF-July2016.pdf>. *See also* BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT, “The State of Broadband 2015,” at 8 (Sep. 2015), *available at* <http://www.broadbandcommission.org/Documents/reports/bb-annualreport2015.pdf> (“A large body of evidence has now been amassed that affordable and effective broadband connectivity is a vital enabler of economic growth, social inclusion and environmental protection.” (footnotes omitted)).

<sup>17</sup> Remarks of FCC Chairman Ajit Pai at the Satellite Industry Association's 21<sup>st</sup> Annual Leadership Dinner at 2 (Mar. 12, 2018), *available at* <https://www.fcc.gov/document/chairman-pai-remarks-satellite-industry-association-dinner>.

<sup>18</sup> SpaceX Authorization, ¶ 1.

enhanced safety in space and no increase in overall spectral interference. Granting the modification will speed deployment of space-based infrastructure that can help to close the digital divide by bringing robust broadband services to areas where they currently are not available.

The Commission often receives requests to modify space station authorizations. “In recognition of the length of time it takes to construct a satellite system, the rapid pace of technological change, and the goal of promoting more efficient use of the radio spectrum, the [Commission] has granted such requests in cases where the proposed modification presents no significant interference problem and is otherwise consistent with Commission policies.”<sup>19</sup> As demonstrated in the Technical Attachment, that is exactly the case that SpaceX presents here. This modification will serve the public interest by enabling SpaceX to accelerate deployment and improve space safety without increasing overall interference.

### **CONCLUSION**

For the foregoing reasons, and for the reasons set forth in the accompanying materials, SpaceX requests that the Commission find that granting the requested modification to authorize deployment and operation of the lower shell would serve the public interest, and issue such grant expeditiously.

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<sup>19</sup> *The Boeing Co.*, 18 FCC Rcd. 12317, ¶ 7 (IB 2003).

Respectfully submitted,

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