# APPLICATION FOR BLANKET LICENSED HIGH PERFORMANCE EARTH STATIONS IN MOTION

## I. OVERVIEW

The Commission has authorized Space Exploration Holdings, LLC ("SpaceX") to launch and operate a constellation of more than 4,400 non-geostationary orbit ("NGSO") satellites (call sign S2983/S3018) using Ku- and Ka-band spectrum.[1] In doing so, the Commission recognized that the SpaceX NGSO system "will improve the experience for users of the SpaceX service, including in often-underserved polar regions" and "enable[] a better user experience by improving speeds and latency," including for those in areas previously underserved or even totally unserved by other broadband solutions.[2] In May 2019, SpaceX began launching satellites to populate its constellation, and has launched more than 1,700 satellites in orbit.

The Commission has also granted a sister company, SpaceX Services, Inc. ("SpaceX Services"), a blanket license for operation of up to one million end-user customer earth stations that communicate with SpaceX's NGSO constellation.[3] Since securing that authorization, SpaceX has continued to develop and refine innovative user terminal models. Like their predecessors, these new units employ advanced phased-array beam-forming and digital processing technologies to make very efficient use of Ku-band spectrum resources by supporting highly directive antenna beams that point and track the system's low-Earth orbit satellites. But these high-performance ("HP") models will operate with higher gain and lower transmit power (thus maintaining a

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1 *See Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018) ("*SpaceX Authorization*"). The Commission recently granted a request to modify SpaceX's license. *See Space Exploration Holdings, LLC*, FCC 21-48 (rel. Apr. 27, 2021) ("*SpaceX Modification*"). These authorizations anticipate that Ku-band spectrum would be used for communications with subscribers.

2 *SpaceX Modification* ¶ 12.

3 *See* Radio Station Authorization, Call Sign E190066 (issued Mar. 13, 2020). SpaceX Services has filed for modification to increase this authorization to five million user terminals, which remains pending. *See* Application for Modification, IBFS File No. SES-MOD-20200731-00807 (July 31, 2020).

consistent EIRP compared to other SpaceX Services user terminals), a higher scan angle, and features that ruggedize the unit for use in harsh environments.

In this application, SpaceX Services seeks a blanket license authorizing operation of next-generation HP end-user earth stations for deployment as Vehicle-Mounted Earth Stations ("VMESs"), Earth Stations on Vessels ("ESVs"), and Earth Stations Aboard Aircraft ("ESAAs") (collectively, Earth Stations in Motion ("ESIMs")).[4] SpaceX Services seeks authority to deploy and operate these HP earth stations (1) as VMES throughout the United States and its territories, (2) as ESVs in the territorial waters of the United States and throughout international waters worldwide, and (3) as ESAAs on U.S.-registered aircraft operating worldwide and non-U.S.-registered aircraft operating in U.S. airspace. Consistent with SpaceX's space station authorization, these ESIMs will transmit in the 14.0-14.5 GHz band and receive in the 10.7-12.7 GHz band. The Commission's rules specifically contemplate blanket licensing for earth stations operating in these frequency bands.[5] However, the 12.2-12.7 GHz band is not specifically available for use by ESIMs communicating with NGSO systems,[6] so below SpaceX Services requests a waiver to authorize use of that band on an unprotected basis.

Below, we discuss the service to be provided by these HP ESIMs as well as certain spectrum sharing issues relevant to their operation. We then demonstrate that grant of this application, including the requested waiver, would serve the public interest. Lastly, we provide technical information to supplement the information provided in Schedule B to Form 312 filed

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4 *See* 47 C.F.R. § 25.103 (defining VMES, ESV, ESAA, and ESIM).

5 *See id.* § 25.115(f)(2).

6 *See id.* § 25.202(a)(10)(ii).

with this narrative application.[7] To support its ambitious timetable for offering ever more diverse and innovative satellite broadband services, SpaceX Services requests that the Commission grant the requested blanket license as expeditiously as possible.

## II. HIGH-PERFORMANCE ESIMS WILL EXPAND SPACEX'S INNOVATIVE BROADBAND SATELLITE SERVICE TO USERS IN MOVING VEHICLES, VESSELS, AND AIRCRAFT, ESPECIALLY IN DEMANDING SCENARIOS

SpaceX Services' ESIMs will communicate with those SpaceX satellites that are visible on the horizon above a minimum elevation angle of 25 degrees. The proposed phased array user terminal will track SpaceX's NGSO satellites passing within its field of view. As the terminal steers the transmitting beam, it automatically changes the power to maintain a constant level at the receiving antenna of its target satellite to the extent possible, compensating for variations in antenna gain and path loss associated with the steering angle. Compared to other ESIMs SpaceX Services proposes to deploy,[8] the HP model has been ruggedized to handle harsher environments so that, for example, it will be able to continue to operate at greater extremes of heat and cold, will have improved snow/ice melt capabilities, and will withstand a greater number of thermal cycles.

At the phased array's equivalent of an "antenna flange," the highest transmit power is 4.0 W[9] while the highest EIRP for all carriers is 38.2 dBW. The antenna gain is highest at boresight (35.8 dBi and 37.2 dBi for the receive and transmit antennas, respectively) and lowest at maximum slant (31.5 dBi and 32.2 dBi for the receive and transmit antennas, respectively).[10]

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[7] To the extent relevant, SpaceX Services hereby incorporates the technical information submitted with SpaceX's space station applications. *See* IBFS File Nos. SAT-LOA-20161115-00118, SAT-LOA-20170726-00110, SAT-MOD-20181108-00083, and SAT-MOD-20200417-00037.

[8] *See, e.g.,* Application for Blanket Licensed Earth Stations in Motion, IBFS File No. SES-LIC-20210309-00698 (filed Mar. 9, 2021).

[9] There is no difference in transmit power between ESIMs at the center or edge of the spot or between clear sky or heavy rain conditions.

[10] For purposes of Form 312 accompanying this application, SpaceX Services has supplied the highest transmit power and EIRP figures to present worst-case conditions.

Table 1 summarizes the technical specifications of the proposed ESIMs.[11]

| Link Type | Frequency | Modulation | Emission Designator | Maximum EIRP |
|---|---|---|---|---|
| Broadband Downlink (space-to-Earth) | 10.7-12.7 GHz | Up to 64 QAM | 240MD7W | N/A |
| Broadband Uplink (Earth-to-space) | 14.0-14.5 GHz | Up to 64 QAM | 60M0D7W | 38.2dBW |

**Table 1. HP ESIM Terminal Specifications**

The EIRP masks for these HP ESIMs, for co-polarized and cross-polarized signals, are set forth in Exhibit A hereto. In addition, SpaceX Services has submitted with this application a radiation hazard analysis to demonstrate that these earth stations are compliant with and will not result in exposure levels exceeding the applicable radiation hazard limits established by the Commission.

SpaceX Services will ensure installation of HP ESIM terminals on vehicles, vessels, and aircraft by qualified installers who have an understanding of the antenna's radiation environment and the measures best suited to maximize protection of the general public and persons operating the vehicle and equipment. An HP ESIM terminal exhibiting radiation exposure levels exceeding 1.0 $mW/cm^2$ in accessible areas, such as at the exterior surface of the radome, will have a label attached to the surface of the terminal warning about the radiation hazard and will include thereon

[11] The Commission's rules do not require applicants to submit a maximum number of user terminals to be deployed in the Ku band because, as the Commission concluded, the number of terminals "will not significantly affect any necessary coordination." *Comprehensive Review of Licensing and Operating Rules for Satellite Services,* 30 FCC Rcd. 14713, ¶ 291 (2015). However, Form 312 Schedule B requires a number of antennas to be entered. To satisfy this technical form-validation requirement, SpaceX Services has entered a value of "0" on the accompanying Form 312 Schedule B. However, this is strictly to satisfy the form-validation requirements and is not intended to establish a maximum number of units that SpaceX Services may deploy.

a diagram showing the regions around the terminal where the radiation levels could exceed the maximum radiation exposure limit specified in 47 C.F.R. § 1.1310 Table 1.[12]

## III. SPECTRUM SHARING ISSUES

The Commission has allocated the Ku-band that SpaceX Services proposes to use for uplink communications (14.0-14.5 GHz) from these blanket-licensed earth stations on a primary basis only to the fixed-satellite service ("FSS"). Nonetheless, SpaceX Services recognizes that its earth station operations will be subject to certain sharing conditions.[13] With respect to the requirements in Section 25.228(j), SpaceX Services will coordinate the operations of its HP ESIMs in the 14.0-14.2 GHz band within 125 km of NASA TDRSS facilities at three specified locations (for ESVs and VMESs) or within radio line of sight (for ESAAs); until such coordination has been completed, these HP ESIMs will not exceed an EIRP spectral density towards the horizon of 12.5 dBW/MHz and will not exceed an EIRP towards the horizon of 16.3 dBW when operating within that 125 km zone (for ESVs and VMESs) or within radio line of sight (for ESAAs).[14] In addition, SpaceX Services will not operate these earth stations in the 14.47-14.5 GHz band in the vicinity of radio astronomy observatories at sixteen locations, without first completing coordination.[15] SpaceX Services will use Global Positioning Satellite-related or other similar position location technology to ensure compliance with this commitment.[16]

Prior to operations of its HP ESAAs on U.S.-registered aircraft within a foreign nation's

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12 *See* 47 C.F.R. § 25.228(d).

13 *See, e.g.*, 47 C.F.R. §§ 25.115(f)(2), 25.208(o), 101.1409, 2.106 nn.5.487A & US342. In addition, pursuant to Section 25.115(i), SpaceX Services hereby certifies that it is planning to use a contention protocol (TDMA/FDMA), and such protocol usage will be reasonable.

14 *See* 47 C.F.R. § 25.228(j)(1), (2). *See also SpaceX Authorization* ¶ 37 (requiring SpaceX to take note of NASA TDRSS facilities at three locations).

15 *See* 47 C.F.R. § 25.228(j)(3).

16 *See id.* § 25.228(j)(5).

airspace, SpaceX Services will ascertain whether the relevant administration has operations that could be affected by HP ESAA terminals and determine whether that administration has adopted specific requirements concerning ESAA operations. When the ESAA-equipped aircraft enters foreign airspace, the HP ESAA terminal will operate under the Commission's rules, or those of the foreign administration, whichever is more constraining.[17] To the extent that all relevant administrations have identified geographic areas from which ESAA operations would not affect their radio operations, SpaceX Services will operate within those identified areas without further action. To the extent that the foreign administration has not adopted requirements regarding ESAA operations, SpaceX Services will coordinate its operations with any potentially affected operations.

SpaceX Services HP ESAA transmissions in the 14.0-14.5 GHz band from international airspace within line-of-sight of the territory of a foreign administration, where fixed service networks have primary allocation in this band, will be limited to a maximum power flux-density ("PFD") produced at the surface of the Earth by emissions from a single aircraft to not exceed the values provided in Section 25.228(i) of the Commission's rules, unless the foreign administration has imposed other conditions for protecting its fixed service stations.

Certain portions of the 10.7-12.7 GHz downlink band are shared with other commercial and government services. Notably, the proposed SpaceX Services HP ESIMs would not transmit in those bands and thus could not cause any interference to other operators using those bands. Moreover, SpaceX has engineered its NGSO system design to achieve a high degree of flexibility to facilitate spectrum sharing with other authorized satellite and terrestrial systems. In addition, its system is capable of immediately ceasing operations in the unlikely event it is notified that

[17] *See id.* § 25.228(g)(3).

harmful interference has occurred. SpaceX Services understands that its operations in the 10.7-11.7 GHz band would be authorized on an unprotected basis with respect to current and future systems operating in the fixed service.[18] In addition, as mentioned above, SpaceX Services seeks a waiver for its HP ESIMs to receive on an unprotected basis in the 12.2-12.7 GHz band.

SpaceX is aware of its obligations under its authorization to protect terrestrial and space systems in these shared bands, and has certified that it will comply with the applicable equivalent power flux-density ("EPFD") limits set forth in Article 22 and Resolution 76 of the ITU Radio Regulations.[19] SpaceX has also demonstrated that it will comply with the applicable PFD limits in the Ku-band set forth in the Commission's rules and Article 21 of the ITU Radio Regulations.[20] The Commission has found that compliance with these EPFD and PFD limits is sufficient to protect GSO systems and terrestrial systems, respectively, against unacceptable interference.[21]

As required under the Commission's rules, each HP ESIM will be self-monitoring and, should a condition occur that would cause the HP ESIM to exceed any emission limits included in the conditions of its license, the HP ESIM will automatically cease transmissions within 100 milliseconds and not resume transmissions until the condition that caused the HP ESIM to exceed those limits is corrected.[22] In addition, each HP ESIM will be monitored and controlled by a

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[18] *See id.* § 25.115(f)(2).

[19] *See* Application for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20200417-00037, Technical Attachment at 15 (Apr. 17, 2020) ("Modification Application"); 47 C.F.R. § 25.115(f)(1) (incorporating certification requirement in 47 C.F.R. § 25.146(a)(2)).

[20] *See* Modification Application, Technical Attachment at 10-12.

[21] *See, e.g.*, *Updates to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 32 FCC Rcd. 7809, ¶ 32 (2017) ("*NGSO Update Order*") ("Any NGSO FSS system operating in compliance with these [EPFD] limits is considered as having fulfilled its obligation under Article 22 of the ITU Radio Regulations not to cause unacceptable interference to any GSO network."); 47 C.F.R. § 25.289 (same); *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, ¶ 42 (2000) (observing PFD limits should protect terrestrial systems in the band).

[22] *See* 47 C.F.R. § 25.228(b).

network control and monitoring center ("NCMC") or equivalent facility located in the United States.[23] Each HP ESIM will be designed to comply with a "disable transmission" command from the NCMC within 100 milliseconds of receiving the command. In addition, the NCMC will monitor the operation of each HP ESIM in its network and transmit a "disable transmission" command to any HP ESIM that operates in such a way as to exceed any emission limits included in the conditions of its license. The NCMC will not allow the HP ESIM(s) under its control to resume transmissions until the condition that caused the HP ESIM(s) to exceed the authorized emission limits is corrected.[24]

SpaceX is confident that the highly advanced and flexible capabilities of its NGSO system, including the HP ESIMs proposed by SpaceX Services herein, will be able to comply with the limitations discussed above. Nonetheless, in the extremely unlikely event that harmful interference should occur due to transmissions to or from its HP ESIMs, SpaceX Services can be reached at its Starlink network operations center via phone at (360) 780-3103 or email at satellite-operators-pager@spacex.com, which links to the pagers of appropriate technical personnel with authority and ability to cease all transmissions from these HP ESIMs on a 24/7 basis.

## IV. GRANTING A WAIVER TO ALLOW THESE HP ESIMS TO USE THE 12 GHZ BAND WOULD PROVIDE REQUIRED OPERATIONAL FLEXIBILITY WITHOUT AFFECTING OTHER AUTHORIZED USERS OF THE BAND

As discussed above, although the Commission's rules provide for blanket licensing of NGSO earth stations operating in the 12.2-12.7 GHz band (the "12 GHz band"), this spectrum is not specifically listed among the bands available for ESIM operations. The Commission did not

[23] *See id.* § 25.228(e)(2), (f). In addition, to the extent SpaceX Services uses the NCMC to communicate with HP ESVs on vessels of foreign registry, it will maintain detailed information on each such vessel's country of registry and a point of contact for the relevant administration responsible for licensing those HP ESVs. *Id.* § 25.228(e)(3).

[24] *See id.* § 25.228(c), (e)(1).

affirmatively prohibit ESIM operations in this band—though it did so with respect to other spectrum.[25] Rather, the omission of this band from the list of available ESIM spectrum is largely a result of the way the rules were promulgated. The Commission adopted rules for GSO ESIMs first and then proposed an analogous approach for NGSO ESIMs. With respect to the spectrum available for ESIM use, the *NGSO ESIMs NPRM* makes clear that the Commission initiated the proceeding to enable "ESIMs to communicate with NGSO FSS systems in the Ku- and Ka-bands where the Commission's rules allow ESIM communications with GSO FSS space stations."[26] Unfortunately, because GSO systems (other than Direct Broadcast Satellite ("DBS")) are not allowed to operate in the 12 GHz band, that band had not been contemplated for use by GSO ESIMs—and thus, it was omitted from the list considered for NGSO ESIMs. After several commenters in the proceeding argued for extension of the rules to include the 12 GHz band, the Commission concluded only that the record was not sufficient at that point to include the band, not that ESIM operation would cause any technical impediment to other authorized uses in the band.[27]

Accordingly, SpaceX Services seeks a waiver to allow its HP ESIMs to use the 12 GHz band on a non-protected basis, notwithstanding the fact that this spectrum is not listed as available for NGSO ESIM operations in Section 25.202(a)(10)(ii). The Commission may waive its rules for good cause shown.[28] "Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence

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[25] *See id.* § 25.115(f)(2) (prohibiting ESIM operations in the 28.35-28.4 GHz band).

[26] *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, 33 FCC Rcd. 11416, ¶ 8 (2018) ("*NGSO ESIMs NPRM*").

[27] *Amendment to Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, 35 FCC Rcd. 5137, ¶¶ 45-46 (2020).

[28] 47 C.F.R. § 1.3. *See also WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969); *NE. Cellular Tel. Co. v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990).

to the general rule," including "more effective implementation of overall policy."[29] In considering requests for non-conforming spectrum uses, the Commission has indicated that it would generally grant such waivers "when there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the non-conforming operator accepts any interference from authorized services."[30] As shown below, there is good cause for the Commission to grant a waiver to allow SpaceX Systems HP ESIMs to receive signals in the 12 GHz bands.

The proposed HP ESIMs will only receive in the 12 GHz band, and because SpaceX will operate its satellites in compliance with the EPFD and PFD limits that the Commission has found sufficient to protect GSO and terrestrial systems, they present no risk of interference to other authorized spectrum users. On the other hand, granting SpaceX Services access to this band is necessary to provide robust broadband service to American consumers. The 12 GHz band represents 500 MHz of the potential spectrum authorized for downlinks from SpaceX satellites to customer user terminals. SpaceX must share all the downlink spectrum for which it is authorized with other NGSO operators, must operate on a secondary basis with respect to fixed systems in half this spectrum (10.7-11.7 GHz), and must avoid 250 MHz at the bottom of the band (10.7-10.95 GHz) in order to protect radio astronomy operations in the adjacent band. Accordingly, the 12 GHz band constitutes a large portion of the spectrum available for communications with user terminals and gives SpaceX needed flexibility to accommodate sharing with other spectrum users in these bands while still providing robust broadband service to underserved and unserved American consumers.

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[29] *GE American Communications, Inc.*, 16 FCC Rcd. 11038, ¶ 9 (IB 2001) (quoting *WAIT Radio*, 418 F.2d at 1159).

[30] *Fugro-Chance, Inc.*, 10 FCC Rcd. 2860, ¶ 2 (IB 1995) (authorizing non-conforming MSS in the C-band); *See also Motorola Satellite Communications, Inc.*, 11 FCC Rcd. 13952, ¶ 11 (IB 1996) (authorizing service to fixed terminals in bands allocated to the mobile-satellite service).

SpaceX recognizes that its non-conforming use of the 12 GHz band would be authorized on a non-protected basis. That means that its HP ESIMs would have to accept interference from both DBS (which it was already required to do) and MVDDS (without the protection of coordination rules applicable to fixed earth stations).[31] However, the Commission has recognized that allowing satellite operators to make opportunistic use of spectrum on an unprotected basis provides operational flexibility and more intensive use of spectrum without compromising service to customers. For example, although earth stations would have to operate on an unprotected basis in the 10.7-11.2 GHz band used by SpaceX, the Commission found such use would serve the public interest because "[i]n the event of harmful interference, operators could switch to alternative spectrum not shared with the fixed service, such as the adjacent 11.7-12.2 GHz band. In addition, any operations that require certainty of protection may be individually coordinated and licensed."[32]

Accordingly, granting a waiver would serve the public interest by enhancing SpaceX Services' ability to make productive use of valuable spectrum resources to provide high-speed, low-latency service to customers on moving platforms, including those in otherwise underserved or unserved areas of the United States. Moreover, it would do so without any offsetting interference or customer service concerns.

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[31] SpaceX recognizes that the Commission has initiated a rulemaking to explore whether to "continu[e] with the current framework" for NGSO/MVDDS sharing or "increase[e] terrestrial use of the shared band." *Expanding Flexible Use of the 12.2-12.7 GHz Band*, 36 FCC Rcd. 606, ¶ 19 (2021). However, the Commission has expressly restricted that proceeding—at the very outset—to only those changes it could make "without causing harmful interference to incumbent licensees," such as SpaceX. *Id.* ¶ 2. In any event, the unprotected operation of SpaceX Services ESIMs in this band would not preclude Commission action consistent with this premise in this rulemaking.

[32] *NGSO Update Order* ¶ 25.

## V. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST AND PROVIDE SERVICE TO VEHICLES, VESSELS, AND AIRCRAFT OPERATING IN AREAS OTHERWISE UNSERVED OR UNDERSERVED BY HIGH-THROUGHPUT, LOW-LATENCY BROADBAND IN CHALLENGING ENVIRONMENTS

Over the last two years, SpaceX has deployed over 1,700 satellites, sufficient to support introduction of its high-capacity, low-latency broadband services in portions of the United States. This system is now on the brink of delivering this service across the entire United States—including to the most remote corners and Polar Regions of the country that too often get left behind. The demand for more broadband is surging and the need for connections has never been more important. Granting this application would serve the public interest by authorizing a new class of ground-based component for SpaceX's satellite system that will expand the range of broadband capabilities available to moving vehicles throughout the United States and to moving vessels and aircraft worldwide—and most particularly, to those in challenging environments where ruggedization is appropriate. U.S. and worldwide demand for broadband services and Internet connectivity continues to increase with escalating requirements for speed, capacity, and reliability and ongoing adaptations for usage. The volume of traffic flowing over the world's networks continues to grow, with one report estimating more traffic in 2022 alone than in the 32 years combined since the Internet started, and more than six out of ten people in the world being online.[33] Another report estimates that annual global Internet protocol traffic will grow from 1.5 zettabytes

[33] *See Cisco Predicts More IP Traffic in the Next Five Years Than in the History of the Internet*, CISCO (Nov. 27, 2018), https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1955935.

in 2017 to 4.8 zettabytes in 2022.[34] Similarly, the average Internet user will generate 84.6 gigabytes of Internet traffic per month by 2022, compared to 28.8 gigabytes in 2017.[35]

Moreover, consumers are interacting with broadband platforms in an increasing variety of ways. Users now require connectivity while on the move, whether driving an RV across the country, moving a freighter from Europe to a U.S. port, or while on a domestic or international flight. In many cases, these users lack any true high-throughput, low-latency options. To close this gap, SpaceX has deployed an innovative, cost-effective, and spectrum-efficient satellite system capable of delivering robust broadband service to customers around the world. SpaceX has already secured U.S. authority for the space station components of its NGSO system. This application takes the next step by seeking authority for HP ESIMs that will enable the extension of that network from homes and offices to moving vehicles, vessels, and aircraft, even in challenging environments. Operation under the requested blanket license will provide the first option for some and promote competition for others in the market for in-motion broadband services, to the benefit of drivers, ship operators, and air travelers in the United States and abroad. These services will enhance the security of mobile platforms and allow operators and passengers to access services that enable increased productivity. Accordingly, an expeditious grant of this application would serve the public interest.

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[34] *See VNI Complete Forecast Highlights*, CISCO, 1 (2018), https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-highlights/pdf/Global_2022_Forecast_Highlights.pdf.

[35] *Id.* at 5.

Respectfully submitted,

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## EXHIBIT A – EIRP MASK