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

In the Matter of	)	
	)	
Kepler Communications Inc.	)	IBFS File No. SAT-PDR-20161115-00114
	)	
Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System	)	Call Sign S2981

ORDER AND DECLARATORY RULING

Adopted: November 15, 2018 **Released: November 19, 2018**

By the Commission: Chairman Pai and Commissioners O'Rielly, Carr, and Rosenworcel issuing separate statements.

I. INTRODUCTION

1. In this Order and Declaratory Ruling, we grant the request of Kepler Communications Inc. (Kepler) for a declaratory ruling concerning access to the U.S. market to provide fixed-satellite service (FSS) using a proposed constellation of 140 non-geostationary-satellite orbit (NGSO) satellites licensed by Canada.[1] In granting this request, we address concerns expressed by commenters seeking various conditions on the grant and requests by Kepler for waiver of certain rule provisions. Grant of Kepler's request will help to advance the Commission's mandate "to make available, so far as possible, to all the people of the United States . . . rapid, efficient, Nation-wide, and world-wide" communication services by permitting Kepler to offer global connectivity for the Internet of Things, especially sensors and other intelligent devices, in the United States.[2]

II. BACKGROUND

2. *Petition*. On November 15, 2016, Kepler filed a petition for declaratory ruling seeking access to the U.S. market for a proposed NGSO FSS satellite system.[3] The proposed Kepler system

[1] *Kepler Communications Inc., Petition for a Declaratory Ruling*, IBFS File No. SAT-PDR-20161115-00114 (filed Nov. 15, 2016) (Kepler Petition). Although the Kepler Petition was originally filed as IBFS File No. SAT-LOI-20161115-00114, the Commission made an administrative change to the IBFS file number from a Letter of Intent (LOI) to a Petition for Declaratory Ruling (PDR) to reflect the nature of Kepler's request.

[2] 47 U.S.C. § 151; Kepler Petition, Narrative at 2. Although various characterizations exist, the International Telecommunication Union (ITU) had defined the Internet of Things (IoT) in Recommendation ITU-T Y.2060 (06/2012) as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. Internet of Things Global Standards Initiative http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx.

[3] The Commission developed the market access procedure we follow here to facilitate the participation of non-U.S.-licensed satellite systems in the FCC licensing process, even though such systems do not seek a U.S. space station license. As such, favorable action on such a request is in the nature of a policy statement or declaratory ruling with respect to the availability of spectrum and other public interest considerations for future licensing of U.S. earth stations that would operate with the non-U.S.-licensed space station. *See Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites to Provide Domestic and International Service in the United States*, Report and Order, 12 FCC Rcd 24094, 24106, para. 29, 24173-74, paras. 184-88 (1997) (*1997 Report*

consists of a constellation of 140 satellites in Low Earth Orbit.[4] The satellites will operate under a license issued by Innovation, Science and Economic Development Canada (ISED).[5] Kepler is seeking market access to provide FSS in the 14.0-14.5 GHz (Earth-to-space) and 10.7-12.7 GHz (space-to-Earth) frequency bands.[6] On June 6, 2017, Kepler provided updated Schedule S information to correct errors and to provide more information in response to questions from the International Bureau.[7]

3. In its Petition, Kepler seeks waivers of certain Commission rules.[8] In its application, Kepler states that its proposed system will "make real-time connectivity available for devices both on and off the earth's surface" and will "provide localized and extremely economic terminals that can aggregate data from IoT devices."[9] Data from these IoT devices will then be backhauled to users through the Kepler space system.[10] Kepler states that its infrastructure will enable many IoT applications in remote areas, such as animal monitoring, crop monitoring, seismic data collection, weather data collection, and asset tracking.[11]

4. *Comments*. Two parties filed pleadings in response to the public notice of Kepler's petition for U.S. market access: (i) SES S.A. and O3b Limited (SES and O3b); and (ii) Space Exploration

(Continued from previous page)
and Order). In addition to the present petition, Kepler must file, and the Commission must approve, corresponding earth station applications before Kepler may provide its proposed services in the United States.

[4] Kepler has described a variety of orbital parameters for the system, but in general it appears to consist of 7 orbital planes (20 satellites per plane) in circular near-polar sun synchronous orbits at an approximate altitude of 500-600 kilometers.

[5] Kepler Additional Information Regarding Authorization (filed May 2, 2018); Kepler ISED Spectrum License, (filed May 2, 2018).

[6] *Id.* at 5. Kepler filed its petition for U.S. market access as part of a processing round for additional NGSO-like applications and petitions in the Ku- and Ka-band frequencies requested by WorldVu Satellites Limited (OneWeb). *OneWeb Petition Accepted for Filing, IBFS File No. SAT-LOI-20160428-00041; Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 10.7-12.7 GHz, 14.0-14.5 GHz, 17.8-18.6 GHz, 18.8-19.3 GHz, 27.5-28.35 GHz, 28.35-29.1 GHz, and 29.5-30.0 GHz Bands*, Public Notice, 31 FCC Rcd 7666 (IB Jul. 15, 2016). Eleven additional applications and petitions were filed for NGSO-like satellite systems, including Kepler's application. Under the Commission's rules, the term "Ku-band" includes both the "conventional Ku-band" (11.7-12.2 GHz and 14.0-14.5 GHz) and the "extended Ku-band" (10.95-11.2 GHz, 11.45-11.7 GHz, and 13.75-14.0 GHz). 47 CFR § 25.103. The term "Ka-band" refers to 18.3-18.8 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz, and 29.25-30.0 GHz frequency bands, also known as the "conventional Ka-band," which the Commission has designated as primary for GSO FSS operation. *See* 47 CFR § 25.103.

[7] Kepler Additional Information for 140 Satellite Filing, (filed June 6, 2017).

[8] Kepler requests waivers of Sections 25.114(c), 25.137(c), 25.137(d)(1), 25.137(d)(4), 25.146, 25.146(a)(1)(iii) and 25.146(a)(2)(iii), 25.146(i), 25.157(e), and 25.164(b) of the Commission's rules. Kepler also requests waiver of footnote NG52 to the U.S. Table of Frequency Allocations, Section 2.106. However, by its terms, NG52 applies only to GSO operations, and therefore is not relevant to this application.

[9] Kepler Petition, Narrative at 3.

[10] *Id.* at 3-4.

[11] *Id.* at 4. Although not part of its petition for U.S. market access, Kepler also states that its Software Defined Radio (SDR), electronically steerable antenna array, and networking protocol, in combination with inter-satellite links, will allow other NGSO operators to communicate with each other and the ground in real-time, and enable operators of other NGSOs to dynamically request and release bandwidth as their system need dictates. Kepler states that this infrastructure could reduce the number of ground stations that must be deployed by NGSO systems, which would directly promote licensing and spectrum efficiency. *Id.*

Technologies Corp. (SpaceX).[12] SES and O3b jointly stated that the Commission must require Kepler to comply with the Ku-band single-entry and aggregate equivalent power flux density (EPFD) limits in Section 25.208.[13] SES and O3b also requested that any grant of the Kepler Petition be subject to the same conditions that were placed on the grant of U.S. market access for OneWeb and for the O3b NGSO FSS system in the 2015 O3b grant.[14] SES and O3b also requested that the Commission require Kepler to demonstrate that it will maintain its interference profile regardless of the insertion altitude of its satellites.[15] SpaceX filed comments expressing concerns regarding sharing spectrum with Kepler's operations.[16] Kepler responded to the comments.[17]

III. DISCUSSION

5. After review of the record, we conclude that grant of Kepler's petition will serve the public interest, subject to the requirements and conditions specified herein. Below, we address the various issues raised by commenters.[18] We also address Kepler's waiver requests. Where appropriate, we defer matters of general applicability to ongoing or potential future rulemakings.

6. *Sharing with Other NGSO FSS Systems*. In its comments on the Kepler Petition, SpaceX raises concerns about the ability of Kepler's proposed system to coexist and share spectrum with other NGSO systems because the asserted large satellite beam width of the Kepler system will increase the probability of "in-line" interference events.[19] In last year's *NGSO FSS Report and Order*, the Commission defined the sharing environment among NGSO FSS systems filed in a given processing round.[20] The Commission determined first to require NGSO FSS satellite operators to attempt coordination based on the specifics of their individual systems. If coordination is ongoing or cannot be reached when both systems are operational, the Commission provided that NGSO FSS operators must avoid causing harmful interference by dividing the commonly authorized frequencies when a technical

[12] Kepler's petition for market access was accepted for filing on August 11, 2017. *Satellite Policy Branch Information: Space Station Applications Accepted for Filing*, Public Notice, Report No. SAT-01259 (rel. Aug. 11, 2017).

[13] SES S.A. and O3b Limited Comments at 3 (filed Sept. 11, 2017).

[14] *Id*. at 3-6 (citing *Satellite Policy Branch Information: Action Taken*, Public Notice, Report No. SAT-01090 (rel. June 2, 2015)).

[15] *Id*. at 4.

[16] *See generally* Space Exploration Technologies Corp. (SpaceX) Comments (filed Sept. 11, 2017).

[17] Kepler Consolidated Response to Comments on Kepler Communications Inc. (filed on Sept. 25, 2017) (Kepler Consolidated Response). Although it did not file comments on the Kepler Application, the MVDDS 5G Coalition has expressed concern in other proceedings regarding protection of current and potential future MVDDS operations in the 12.2-12.7 GHz band. *See*, *e.g.*, Letter from MVDDS 5G Coalition to Marlene H. Dortch, Secretary, FCC (dated March 6, 2018), *available in* IBFS File No. SAT-LOA-20161115-00118. Such concerns are addressed in paragraphs 24(d) and 29 below, requiring Kepler to comply with established PFD limits in this band and subjecting the authorization to modification to conform it to any future rules or policies adopted by the Commission in pending rulemaking proceedings. *See*, *e.g.*, Petition of MVDDS 5G Coalition for Rulemaking, RM-11768 (filed Apr. 26, 2016).

[18] SES and O3b requested that the Commission include -in any Kepler market access grant- standard operating conditions and specifically, several of the same grant conditions included on O3b's initial market access. *See* SES and O3b Comments at 5-6. To the extent that Kepler's market access request raises the same concerns as other authorized NGSO FSS systems, we impose substantially identical conditions on Kepler as we did in those orders. In addition, since O3b's initial market access grant, the Commission has adopted significant revisions to its rules and policies governing NGSO FSS systems. The conditions herein are consistent with these rule changes.

[19] SpaceX Comments at 2-3.

[20] *See Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order, 32 FCC Rcd 7809, 7825-26, paras. 48-50 (2017) (*NGSO FSS Report and Order*).

interference threshold is exceeded, defined as a when change in system noise temperature caused by interference, or ΔT/T, exceeds 6 percent. This sharing mechanism was codified as Section 25.261(c).[21] In the same proceeding, the Commission also considered adopting technical requirements to promote sharing between NGSO FSS systems, including a SpaceX proposal to give preferential treatment to systems that use design elements that may facilitate sharing. The Commission declined to adopt such technical restrictions, noting that its adopted framework does not "mandate[] any particular system architecture," and concluding that "given the variety of NGSO FSS system proposals and their potential to offer broadband services directly to consumers, we believe it is premature to adopt any additional technical limitations to promote sharing among NGSO FSS systems."[22] SpaceX's comments, filed before the *NGSO FSS Report and Order* was adopted, raise concerns that were considered and rejected in that proceeding and do not provide any basis to re-visit the Commission's decision to allow design flexibility and avoid technical requirements on NGSO FSS systems outside of the sharing mechanism adopted.

7. Instead, we include a condition requiring Kepler, like all other NGSO FSS operators, to comply with the spectrum sharing requirements specified in Section 25.261 of the Commission's rules with respect to any other NGSO system licensed or granted U.S. market access pursuant to the processing round in which Kepler participated.[23] Through the application of Section 25.261, the protection of any other authorized NGSO FSS system, including SpaceX, is provided because all NGSO FSS operators within a processing round will have an incentive to avoid interference to each other in order to maximize their individual use of spectrum. However, we note that outside the United States (*i.e.*, when communications to or from the U.S. territory are not involved) the coexistence between Kepler's operations and operations of a U.S.-licensed system or a system that received a grant for access to the U.S. market are governed only by the ITU Radio Regulations as well as the regulations of the country where the earth station is located and are not subject to Section 25.261. We include a condition, which was also included in the *OneWeb Order*, that provides that when Section 25.261 is not applicable, Kepler, when coordinating with other systems, is required to comply with the ITU Radio Regulations.[24]

8. *EPFD Analysis.* We find that Kepler's EPFD analysis provided in its Petition and associated filings is sufficient to justify this grant of market access.[25] However, to ensure that Kepler will satisfy its EPFD obligations going forward, we condition this grant on Kepler receiving a favorable or "qualified favorable" rating of its EPFD demonstration by the ITU prior to initiation of service. Review by the ITU of Kepler's compliance with ITU EPFD limits, using methods now approved by the ITU,[26] will provide sufficient assurances beyond the other technical demonstrations that Kepler has already provided that Kepler will comply with the EPFD limits specified in Article 22 of the Radio Regulations.

9. In addition, as a condition to this grant of U.S. market access, Kepler must communicate the ITU finding to the Commission and submit the files containing the data used as input to the ITU

[21] 47 CFR § 25.261(c).

[22] *NGSO FSS Report and Order*, 32 FCC Rcd at 7827, para. 55.

[23] *See OneWeb Order*, 32 FCC Rcd at 5377; *see also infra,* para. 29.

[24] *OneWeb Order,* 32 FCC Rcd at 5376, para. 23(a). Compliance with ITU coordination procedures is a requirement of the ITU Radio Regulations, which hold the force of treaty to which the United States is a party. Compliance with the ITU Radio Regulations is a typical condition of both U.S. space station licenses and grants of U.S. market access. *See* 47 CFR 25.111(b); *see also, e.g.*, *Inmarsat Mobile Networks, Inc., Application to Operate a Fixed-Satellite Service Gateway Earth Station Facility in Lino Lakes, Minnesota with the Inmarsat-5 F2 Space Station*, Order and Authorization and Declaratory Ruling, 30 FCC Rcd 2770, 2784, para. 41c (IB 2015).

[25] *See* Technical Narrative and EPFD Files, IBFS File No. SAT-PDR-20161115-00114; *see also* Letter from Nickolas G. Spina, Manager Launch and Regulatory Affairs, Kepler Communications Inc., to Marlene H. Dortch, Secretary FCC, IBFS File No. SAT-PDR-20161115-00114, (dated Nov. 5, 2018).

[26] Letter from Francois Rancy, Director, ITU Radiocommunication Bureau, to Administrations of ITU Member States, "Examinations under Resolution 85 (WRC-03)" (Dec. 6, 2016), https://www.itu.int/md/R00-CR-CIR-0414/en.

validation software.[27] We find such a requirement satisfies the concerns of GSO FSS operators who request verification, either by the Commission or third parties, of the complete set of input information used for the EPFD showing to the ITU.[28] Submission of the data input files used for the ITU validation of Article 22 limits will allow such verification, either by the Commission or third-parties. SES and O3b also argue that the Commission must take steps to ensure that applicable aggregate EPFD limits are met by all operating Ku-band NGSO systems and requests that any grant of Kepler's Petition incorporate aggregate EPFD compliance requirements.[29] These concerns are addressed by including a condition requiring compliance with ITU Resolution 76, which makes all NGSO FSS systems, operating in a frequency band where protection of GSO FSS systems is required, jointly responsible for keeping aggregate EPFD levels within limits specified in the same Resolution.[30]

10. As we did in other recent approvals for NGSO FSS operations,[31] we are permitting Kepler to operate up to the power-flux density (PFD) and EPFD levels specified in applicable regulations, rather than the levels associated with specific demonstrations in its Petition. We find this flexibility is warranted given the preliminary nature of the system design, the fact that this grant is conditioned on Kepler's satisfaction of the ITU's EPFD assessment, and the condition that Kepler cooperate with other NGSO operators to meet limits for aggregate EPFD.

11. *Orbital Debris*. An applicant for a space station authorization must submit a description of the design and operational strategies that it will use to mitigate orbital debris, including a statement detailing post-mission disposal plans for space stations at the end of their operating life.[32] Kepler included an orbital debris mitigation plan in its Petition.[33] We have reviewed Kepler's orbital debris mitigation plan, as supplemented.[34]

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[27] *Id.* If the files have already been submitted to the Commission and do not need any update, then Kepler need not resubmit these files.

[28] *See, e.g.,* Letter from Susan H. Crandall, Associate General Counsel, Intelsat Corporation, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 16-408 (filed Sept. 15, 2017) (stressing the importance of EPFD limits specified in Article 22 to protect GSO satellites from harmful interference from NGSO systems). *See also* SES and O3b Comments at 3-4.

[29] SES and O3b Comments at 3.

[30] *See infra*, para. 25a.

[31] *See WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System,* Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017) (*OneWeb Order*); *Space Norway AS,* Order and Declaratory Ruling, 32 FCC Rcd 9649 (2017) (*Space Norway Order*); *Telesat Canada*, Order and Declaratory Ruling, 32 FCC Rcd 9663 (2017) (*Telesat Canada Order*); *Space Exploration Holdings, LLC*, Memorandum Opinion, Order and Authorization, FCC 18-38 (March 28, 2018) (*SpaceX Order*).

[32] *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11619 (2004); 47 CFR § 25.114(d)(14).

[33] *See* Kepler Petition, Technical Narrative, Annex A. Kepler states that its proposed system is subject to direct and effective regulatory oversight by Canada's regulatory authorities with respect to its orbital debris mitigation plans. Kepler Petition, Narrative at 12.

[34] Letter from Nickolas G. Spina, Manager Launch and Regulatory Affairs, Kepler Communications Inc. (dated Apr. 20, 2017); Letter from Nickolas G. Spina, Manager Launch and Regulatory Affairs, Kepler Communications Inc. (dated June 22, 2018) (Kepler June 22, 2018 Letter); Letter from Nickolas G. Spina, Manager Launch and Regulatory Affairs, Kepler Communications Inc. (dated Aug. 2, 2018) (Kepler Aug. 2, 2018 Letter); Letter from Nickolas G. Spina, Manager Launch and Regulatory Affairs, Kepler Communications Inc. (dated Sept. 21, 2018) (Kepler Sept. 21, 2018 Letter).

12. Kepler provided supporting information concerning the technical specifications and orbital debris mitigation plan for the "3U CubeSats" it plans to use in its initial configuration,[35] and in subsequent filings indicated that evolution in its satellite design may result in use of 6U CubeSats.[36] The updated filings include some information on potential collision risk for the possible 6U satellites, but omit other technical information concerning those satellites, of which currently a single satellite is in development.[37] Accordingly, we believe it is appropriate to condition grant of Kepler's market access for any additional satellites other than 3U CubeSats on the Commission's approval of an updated technical description and orbital debris mitigation plan for its system, or a demonstration that Kepler is subject to direct and effective regulation by Canada, particularly focusing on 6U CubeSats.[38] This approach allows Kepler to start providing service, upon grant of an earth station license, with the 3U CubeSat that has already been launched and any other 3U CubeSats in Kepler's proposed constellation that may be launched in the future. The 6U CubeSats are still in the design stage and have not yet been authorized by Canada, allowing Kepler the necessary time to seek to modify its market access grant to include additional information for 6U CubeSats. We note that the Commission recently opened a proceeding that proposes to update the current orbital debris rules.[39] Kepler's updated orbital debris mitigation plan for any 6U CubeSats must comply with any new rules adopted by the Commission in this proceeding.

13. *Waiver Standard.* As part of its application, Kepler seeks waivers of certain Commission rules.[40] Generally, the Commission may waive any rule for good cause shown.[41] Waiver is appropriate where the particular facts make strict compliance inconsistent with the public interest.[42] In making this determination, we may take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.[43] Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation will serve the public interest.[44] We address the specific requests for waivers below, as well as conditions that the Commission imposes on Kepler's grant of market access.

14. *Waiver of Band-Splitting Procedure*. Kepler seeks to operate in the United States throughout the 10.7-12.7 GHz and 14.0-14.5 GHz frequency bands. In its petition for market access, Kepler requests a waiver of Section 25.157(e) of the Commission's rules, that provides for "available

[35] The CubeSat is a standardized interface consisting of an approximately 10 cm x 10 cm x 10 cm unit or "U" that can be scaled up to create CubeSats that are 3U (three units) or 6U (6 units) in size, for example.

[36] *See* Kepler June 22, 2018 Letter; Kepler Aug. 2, 2018 Letter.

[37] Kepler Sept. 21 Letter.

[38] *See* condition below in paragraph 25g. We have required applicants to file a modification application including updated orbital debris mitigation information in some instances. *See, e.g., SpaceX Order*, FCC 18-38, para. 12*; Space Norway Order*, 32 FCC Rcd 9649, para. 11; *Telesat Canada Order*, 32 FCC Rcd 9663, para. 14. *See also Northrop Grumman Space & Mission Systems Corp.*, Order and Authorization, 24 FCC Rcd 2330, 2363-64, para. 102 (IB 2009) (*Northrop Grumman Order*); *ContactMEO Communications*, LLC, Order and Authorization, 21 FCC Rcd 4035, 4052-53, para. 47 (IB 2006).

[39] *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking, FCC 18-159 (rel. Nov. 19, 2018).

[40] *See supra*, note 8.

[41] 47 CFR § 1.3.

[42] *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

[43] *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972); *Northeast Cellular*, 897 F.2d at 1166.

[44] *Northeast Cellular*, 897 F.2d at 1166.

spectrum" to be "divided equally" among the applications granted as the result of a processing round.[45] Kepler requests a waiver to permit it to share the full Ku-band spectrum with other NGSO FSS operators through avoidance of interference events, rather than by assignment of only a portion of these frequency bands.[46] A waiver of Section 25.157(e), however, is not needed to achieve Kepler's desired result, since Kepler's market access request is limited to Ku-band frequencies for which the Commission previously adopted rules and policies that allow shared use of frequencies among NGSO FSS systems by avoidance of interference events.[47] Furthermore, since the time Kepler filed its petition, the Commission adopted changes to the Commission's rules that will apply a spectrum sharing mechanism to all NGSO FSS systems that have sharing capabilities (e.g., directional earth station antennas)—capabilities that Kepler's system, as proposed, will have, such as the ability to dynamically allocate bandwidth and channels based on user needs,[48] regardless of the frequency bands used.[49] Thus, Kepler's request for waiver of Section 25.157(e) is moot.

15. *Waivers for EPFD Software Code*. Section 25.146 requires NGSO FSS applicants in certain bands to use software to demonstrate that their systems will comply with EPFD limits included in Section 25.208.[50] If software approved by the ITU is not available, applicants must provide the source code used. Kepler used a beta version of EPFD software in development with the ITU, Transfinite, a final version of which was subsequently approved by the ITU.[51] Kepler requests waiver of the requirement to provide its source code in light of the proprietary nature of the third-party software, and given that its version had not been approved by the ITU at the time of use. The source code requirement of Section 25.146(a)(1)(iii), (2)(iii) was eliminated, however, in the *NGSO FSS Report and Order*.[52] Accordingly, we dismiss Kepler's request for waiver as moot.

16. *Geographic Coverage Requirements*. Kepler requests a partial waiver of Section 25.146(i) of the Commission's rules.[53] Prior to the *NGSO FSS Report and Order*, Section 25.146(i) require NGSO FSS systems using certain Ku-band frequencies to provide service coverage to (i) all locations as far north as 70 degrees latitude and as far south at 55 degrees latitude for at least 75% of every 24-hour period and (ii) on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands.[54] Kepler argues that its system, when fully deployed, will meet the international coverage requirements of these rules, and thus it should be granted a waiver of the international geographic coverage requirements for its initial deployment. Waiver of Section 25.146(i) is unnecessary however because since Kepler filed its application, the Commission eliminated the international coverage requirements.[55] We therefore dismiss Kepler's waiver request as moot.

17. *Waiver of Milestone and Bond Requirements*. Kepler requests waiver of the

[45] Kepler Petition, Narrative at 13; 47 CFR § 25.157(e).

[46] *See* Kepler Petition, Narrative at 12-13.

[47] *The Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ku-band*, Report and Order, 17 FCC Rcd 7841, 7850, para. 27 (2002).

[48] Kepler Petition, Narrative at 7.

[49] 47 CFR § 25.261; *NGSO FSS Report and Order*, 32 FCC Rcd at 7826, para. 52 (applying the newly adopted Section 25.161 to NGSO FSS systems in any frequency band).

[50] 47 CFR §§ 25.146(a)(1)(iii), (2)(iii), 25.208.

[51] Additionally, Kepler has submitted updated public data files that would enable interested parties with access to the Transfinite software to review the EPFD analysis for Kepler's system. *Id*.

[52] *NGSO FSS Report and Order*, 32 FCC Rcd at 7822, para. 41.

[53] 47 CFR § 25.146(i).

[54] *Id.*

[55] *NGSO FSS Report and Order*, 32 FCC Rcd at 7831-32, para.69.

Commission's milestone and bond requirements,[56] which requires NGSO system licensees to launch the space stations, place them into the assigned orbits, and operate them in accordance with the station authorization within six years of grant of the license.[57] Kepler argues that requirement to post the bond for its proposed NGSO system, as required by the Commission's rules,[58] could significantly hamper Kepler's ability to construct a replacement satellite for Phase I, due to circumstance beyond its control.[59] Kepler also expresses concern that the bond requirement could hamper its plans to "roll out its constellation over the course of four years and continuously update its constellation with the latest technology every three years."[60] In order to satisfy the bond and milestones, Kepler asserts that "it may be forced to complete the constellation where replacing existing satellites could potentially make better sense for end consumers and as such the business."[61] Finally, Kepler states that given the reasonable expectation that it will have at least part of its system operational by the time this authorization is issued as well as the "financial burden and risk to the continued operation of Kepler associated with a launch failure," it is not in the public interest to require the placement of a bond.[62] Kepler argues that waiver of Section 25.164(b) would minimize the overall operational risk associated with the launch of its system and accommodate the replenishing nature of the system which is not contemplated

18. We agree with SES and O3b that Kepler has not provided sufficient grounds for a waiver of the Commission's bond requirement.[63] Kepler's justifications for waiver of the milestone and bond requirements are not unique to Kepler and do not rise to the level of special circumstances warranting waiver of our rules. We also agree that a preemptive waiver would thus undermine the policy goals of the milestone and bond rules, which is to "prevent harmful 'warehousing' of spectrum and orbital resources."[64] We note that this issue was addressed in the NGSO FSS rulemaking,[65] and this grant is subject to those rules.

19. *Waivers for Frequency Use*. Kepler requests waivers of the U.S. Table of Frequency Allocations to allow NGSO FSS communications in the 10.7-11.7 GHz band with user terminal earth stations on a non-conforming, non-interference, unprotected basis.[66] This waiver request is moot because subsequent to Kepler's request, the Commission stated in the *NGSO FSS Report and Order* that it now permits blanket licensing of receive earth stations operating with a NGSO FSS space station in the band

[56] Kepler requests waivers of Section 25.164(b) of the Commission's rules, as well as related milestone and bond requirements in the Commission's rule governing the demonstrations that must be made in connection with a request to access the U.S. market through non-U.S. licensed space stations, 47 CFR § 25.137(d)(1) and (4). Kepler Petition, Narrative at 16. Sections 25.137(d)(1) and (4) incorporate the provisions of Sections 25.164 and 25.165 of the Commission's rules, governing milestones and surety bonds. 47 CFR §§ 25.164 and 25.165.

[57] 47 CFR § 25.164(b).

[58] 47 CFR § 25.165(a)(1). Kepler states that the initial amount of the bond to be posted is $1 million. Kepler Petition, Narrative at 16. The actual amount of the surety bond to be posted is determined by means of a formula set forth in the Commission's rules, which works out to an amount of $1,670,000 during the first year after receiving a grant of U.S. market access.

[59] Kepler Petition, Narrative at 16.

[60] *Id*.

[61] *Id.*

[62] *Id.*

[63] *Id*.

[64] SES and O3b Comments at 4-5. *See also Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters, Notice of Proposed Rulemaking,* 31 FCC Rcd 13651, 13663, para. 31, n. 77 (2016).

[65] *NGSO FSS Report and Order*, 32 FCC Rcd at 7830-31, para. 67.

[66] Kepler Petition, Narrative at 1-2, 14-15.

10.7-11.7 GHz on an unprotected basis.[67]

20. *Schedule S Waiver*. As required by the Commission's rules, Kepler submitted a completed Schedule S for its application, which contains certain technical information in a prescribed form. This is the first NGSO processing round in which the new version of the Schedule S has been used. Kepler argues that the Schedule S and Form 312 are not formulated to readily accommodate non-traditional satellite systems, such as Kepler's system.[68] Specifically, Kepler states that the Software Defined Radio onboard Kepler's systems means that the certain values can be changed to facilitate coordination, among other requirements.[69] By way of example, Kepler states that listing all the possible center frequencies using 1 kilohertz bandwidths would result in an excessive amount of data to input and subsequently be processed by the Commission. To the extent necessary, Kepler requests a limited waiver of Section 25.114(c) of the Commission's rules, which requires certain information to be filed in the Schedule S. Because Kepler has provided representative data that will allow the Commission to conduct an accurate technical assessment of Kepler's system, we find that a waiver of the requirement to complete certain aspects or fields of Schedule S is warranted.

21. *Section 25.137(c) – Contemporaneous Consideration*. Kepler filed its application for its space station license through the Canadian Administration which was subject to a moratorium on issuing licenses for NGSO systems.[70] As such, at the time Kepler filed its petition for U.S. market access, it was unable to have its respective license to operate issued by ISED. Kepler therefore requested a waiver of Section 25.137(c) in order to be considered and participate in this processing round. Given the end of the moratorium and subsequent award of a satellite license to Kepler from ISED, this request for waiver is moot.[71]

22. *Other*. In the 14-14.2 GHz band, the National Aeronautics and Space Administration (NASA) operates Tracking and Data Relay Satellite System facilities at three locations: Guam (latitude 13°36′55″ N, longitude 144°51′22″ E); White Sands, New Mexico (latitude 32°20′59″ N, longitude 106°36′31″ W and latitude 32°32′40″ N, longitude 106°36′48″ W); and Blossom Point, Maryland. For transmissions in the 14-14.2 GHz band from NGSO FSS earth stations located within 125 kilometers of these three sites, earth station operators should take account of these NASA facilities.

IV. ORDERING CLAUSES

23. Accordingly, IT IS ORDERED, that the request for a declaratory ruling set forth in the Petition for Declaratory Ruling filed by Kepler Communications Inc. IS GRANTED IN PART, DENIED IN PART, and DISMISSED as MOOT IN PART, pursuant to section 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. § 303(r) and section 25.137(c) of the Federal Communication Commission's rules, 47 CFR § 25.137(c), subject to the requirements and conditions set forth below.

24. IT IS FURTHER ORDERED that communications between U.S.-licensed earth stations and Kepler space stations must comport with all existing and future space station coordination agreements reached between Canada and other administrations. In the absence of a coordination agreement, such communications must comport with applicable provisions of the ITU Radio Regulations.

25. IT IS FURTHER ORDERED that Kepler's use of Ku-band frequencies is subject to the following requirements and conditions:

a. Operations in the 10.7-11.7 GHz (space-to-Earth) frequency band are authorized up to the

[67] *NGSO FSS Report and Order*, 32 FCC Rcd at 7817, paras. 24-25. *See also* Section 25.115(f).

[68] Kepler Petition, Narrative at 15.

[69] *Id*.

[70] *See* Spectrum Advisory Bulletin (SAB) SAB-001-16, https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11200.html.

[71] Kepler Additional Information Regarding Authorization, (filed May 2, 2018); Kepler ISED Spectrum License, (filed May 2, 2018).

applicable power flux-density limits in 47 CFR § 25.208(b), and up to the equivalent power flux-density limits of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

b. In the 10.7-11.7 GHz (space-to-Earth) frequency band, operations must be coordinated with the radio astronomy observatories listed in 47 CFR § 2.106, n.US131, to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities operating in the 10.6-10.7 GHz band. For the purposes of coordination with these listed facilities or the National Radio Quiet Zone, correspondence should be directed to the National Science Foundation Spectrum Management Unit (Email: esm@nsf.gov).

c. Operations in the 11.7-12.2 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations, and up to the equivalent power flux-density limits of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

d. Operations in the 12.2-12.7 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in 47 CFR § 25.208(o) and Article 21 of the ITU Radio Regulations, and up to the equivalent power flux-density limits of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

e. Operations in the 14.0-14.5 GHz (Earth-to-space) frequency band are authorized up to the equivalent power-flux density limits of Article 22 of the ITU Radio Regulations

f. In the 14.47-14.5 GHz band, operations are subject to footnote US342 to the U.S. Table of Frequency Allocations, 47 CFR § 2.106, and all practicable steps must be taken to protect the radio astronomy service from harmful interference.

g. Prior to initiation of service by any satellite other than the 3U CubeSats, Kepler must seek and obtain the Commission's grant of a modified ruling based on a petition containing an updated description of the technical specification of its satellites and orbital debris mitigation plans for its system, as discussed in paragraph 11 above.

26. IT IS FURTHERED ORDERED that, prior to initiation of service, Kepler must receive a favorable or "qualified favorable" finding in accordance with Resolution 85 with respect to its compliance with applicable EPFD limits in Article 22 of the ITU Radio Regulations. Kepler must communicate the ITU finding to the Commission and submit the files containing the data used as input to the ITU validation software, unless they have been submitted before and do not need any update. *See also* 47 CFR 25.146(c).

27. IT IS FURTHER ORDERED that Kepler must comply with the sharing of ephemeris data procedures described in new Section 25.146 of the Commission's rules. 47 CFR § 25.146(e).

28. Upon receipt of a conjunction warning from the JSpOC or other source, Kepler must review the warning and take all possible steps to assess and, if necessary, to mitigate collision risk, including, but not limited to: contacting the operator of any active spacecraft involved in such warning; sharing ephemeris data and other appropriate operational information with any such operator; modifying spacecraft attitude and/or operations.IT IS FURTHER ORDERED that Kepler's operations to and from the U.S. territory must comply with spectrum sharing procedures among NGSO FSS space stations specified in 47 CFR § 25.261 with respect to any NGSO system licensed or granted U.S. market access pursuant to the Ku-Ka-band processing round initiated in Public Notice, DA 16-804. Spectrum sharing between Kepler's operations and operations of U.S. licensed NGSO systems, or NGSO systems granted U.S. market access, where such operations do not include communications to or from the U.S. territory, are governed only by the ITU Radio Regulations and are not subject to Section 25.261.

29. IT IS FURTHER ORDERED that this grant of U.S. market access and any earth station licenses granted in the future are subject to modification to bring them into conformance with any rules or policies adopted by the Commission in the future. Accordingly, any investments made toward operations

in the bands authorized in this order by Kepler in the United States assume the risk that operations may be subject to additional conditions or requirements as a result of any future Commission actions.

30. IT IS FURTHER ORDERED that Kepler must cooperate with other NGSO FSS operators in order to ensure that all authorized operations jointly comport with the applicable limits for aggregate equivalent power flux-density in the space-to-Earth direction (EPFDdown) contained in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (WRC-03) of the ITU Radio Regulations.

31. IT IS FURTHER ORDERED that this grant of U.S. market access does not address the provision of any Direct-to-Home (DTH) service, Direct Broadcast Satellite Service (DBS)[72] or Digital Audio Radio Service (DARS) to, from, or within the United States.

32. IT IS FURTHER ORDERED that Kepler's request for waiver of 47 CFR §§ 25.165(a)(1) & (b), and 47 CFR § 25.164(b) IS DENIED.

33. IT IS FURTHER ORDERED that this grant is subject to the following requirements:

a. Kepler must post a surety bond in satisfaction of 47 CFR §§ 25.165(a)(1) & (b) no later than **December 19, 2018**, and thereafter maintain on file a surety bond requiring payment in the event of a default in an amount, at minimum, determined according to the formula set forth in 47 CFR § 25.165(a)(1); and

b. Kepler must launch 50 percent of the maximum number of proposed space stations, place them in the assigned orbits, and operate them in accordance with the station authorization no later than **November 19, 2024**, and Kepler must launch the remaining space stations necessary to complete its authorized service constellation, place them in their assigned orbits, and operate each of them in accordance with the authorization no later than **November 19, 2027**. 47 CFR § 25.164(b).

Failure to post and maintain a surety bond will render this grant null and void automatically, without further Commission action. Failure to meet the milestone requirements of 47 CFR § 25.164(b) may result in Kepler's grant of market access being reduced to the number of satellites in use on the milestone date. Failure to comply with the milestone requirement of 47 CFR § 25.164(b) will also result in forfeiture of Kepler's surety bond. By **December 4, 2024**, Kepler must either demonstrate compliance with its milestone requirement or notify the Commission in writing that the requirement was not met. 47 CFR § 25.164(f).

34. IT IS FURTHER ORDERED that the request for waiver of international geographic service requirements in 47 CFR § 25.146(i) IS DISMISSED AS MOOT for the reasons set forth herein.

35. IT IS FURTHER ORDERED that Kepler's request for waiver of the band segmentation provision in 47 CFR § 25.157(e) IS DISMISSED as MOOT.

36. IT IS FURTHER ORDERED that Kepler's request for waiver of the source code requirement in Section 25.146(a)(1)(iii), (2)(iii) IS DISMISSED AS MOOT.

37. IT IS FURTHER ORDERED that the request for waiver of the requirement to complete certain aspects or fields of Schedule S as required by 47 CFR § 25.114(c) is GRANTED for the reasons set forth herein.

38. IT IS FURTHER ORDERED that the request for waiver of the requirements for contemporaneous consideration of 47 CFR § 25.137(c) IS DISMISSED AS MOOT.

39. IT IS FURTHER ORDERED that the request for waiver of 47 CFR § 2.106, footnote NG52 IS DISMISSED AS MOOT for the reasons set forth herein.

[72] With respect to DBS and DTH, this paragraph excludes from the scope of the grant those services specified in 47 CFR § 25.701(a)(1)-(5).

40. IT IS FURTHER ORDERED that the request for waiver of 47 CFR § 25.202(a)(1), n.6, to permit Kepler to operate its user terminal earth stations in the 10.7-11.7 GHz band on a non-conforming, non-interference, unprotected basis, IS DISMISSED AS MOOT.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Space Exploration Holdings, LLC Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System, IBFS File No. SAT-LOA-20170301-00027; In the Matter of Kepler Corporation Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System, IBFS File No. SAT-PDR-20161115-00114; In the Matter of Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-band NGSO Constellation, IBFS File No. SAT-PDR-20170301-00023;In the Matter of LeoSat MA, Inc., Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112*.

Today, we're considering applications involving four proposed constellations of non-geostationary orbit satellites. Two of them involve repeat players; two involve startups. One proposed constellation would be authorized by the United States; three would be authorized by foreign governments and receive U.S. market access. But what they all have in common is the promise of variety in the burgeoning field of non-geostationary satellite services and innovative solutions to bridging the digital divide.

From providing high-speed broadband services in remote areas to offering global connectivity to the Internet of Things through "routers in space" for data backhaul, I'm excited to see what services these proposed constellations have to offer. Our approach to these applications reflects this Commission's fundamental approach: encourage the private sector to invest and innovate and allow market forces to deliver value to American consumers.

I'd also like to take a moment to recognize the staff of the International Bureau, not just for their efforts in bringing up to the Commission the items we're considering at this meeting, but for their ongoing efforts over these past two years. Since last June, the Commission has approved 13 market access requests and satellite applications to nine companies for NGSO systems, including the four that we add to the list today. This productivity is primarily due to your hard work and expertise. Thanks to your efforts, I'm optimistic that the American people will benefit from new satellite-based services.

In particular, I'd like to express my gratitude to Jose Albuquerque, Christopher Bair, Jennifer Balatan, Curtrisha Banks, Stephen Duall, Jennifer Gilsenan, Joseph Hill, Karl Kensinger, Sylvia Lam, Julia Malette, Kathyrn Medley, Sankar Persaud, Cindy Spiers, Tom Sullivan, Troy Tanner, and Jay Whaley from the International Bureau. I'd also thank those from other Bureaus and Offices who have played a critical role in advancing these items: Michael Ha, Nick Oros, and Jamison Prime from the Office of Engineering and Technology; Stephen Buenzow, John Schauble, and Becky Schwartz from the Wireless Telecommunications Bureau; and Deborah Broderson, David Horowitz, and Bill Richardson from the Office of General Counsel.

STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY

Re: *Space Exploration Holdings, LLC Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System, IBFS File No. SAT-LOA-20170301-00027; In the Matter of Kepler Corporation Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System, IBFS File No. SAT-PDR-20161115-00114; In the Matter of Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-band NGSO Constellation, IBFS File No. SAT-PDR-20170301-00023;In the Matter of LeoSat MA, Inc., Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112*.

These are exciting times in the development and deployment of new global satellite constellations that will serve consumers. Not since the early 1990s have satellite systems received such attention and captured the imagination of what new technologies, including high-speed broadband offerings, may bring. This also comes with some apprehension as few can predict which satellite systems, if any, will succeed or make money, and existing satellite offerings are indeed being subject to greater scrutiny. But, this new race to satellite orbit provides a first-class seat to the dreams of visionaries, and I look forward to seeing what NGSO systems develop and what services are eventually offered. Quite frankly, our job at the Commission is to approve the qualified applications and then let the market work its will.

In these four items, the Commission approves four additional systems, which will add at least another 7,859 satellites into orbit, if everything goes according to the submitted plans; and this comes on top of the nine applications and petitions the Commission has approved over the last 17 months. Between SpaceX's current application and the one previously consented to by the Commission, SpaceX alone is envisioning a future constellation of an unprecedented 11,943 satellites. As I said earlier today, new technologies – especially ones that revolutionize an industry model – oftentimes require the Commission to modernize and streamline our rules to provide a limited, but sound, framework to deal with accompanying policy issues. That is what today is all about.

I support granting the SpaceX application and the Kepler, LeoSat, and Telesat petitions for market access. While there are still issues to be explored, including communications with ESIMs and orbital debris, and policy calls that we may not have gotten quite right, such as how we handle in-line interference, the Commission continues to take the necessary steps to allow investment and future deployment of these ambitious projects.

I approve.

STATEMENT OF
COMMISSIONER BRENDAN CARR

Re: *Space Exploration Holdings, LLC Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System, IBFS File No. SAT-LOA-20170301-00027; In the Matter of Kepler Corporation Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System, IBFS File No. SAT-PDR-20161115-00114; In the Matter of Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-band NGSO Constellation, IBFS File No. SAT-PDR-20170301-00023;In the Matter of LeoSat MA, Inc., Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112*.

Never before have there been so many companies using such diverse technologies to connect Americans—and that is phenomenal news. We used to focus on improved speeds over copper, and then fiber, and then over the air using LTE. Today, the buzz includes fixed wireless and gigabit connections powered by high-band spectrum and 5G. With these four decisions, we authorize another tool in the broadband toolbox: large constellations of satellites in low-earth orbit.

These satellites are smaller and less expensive to launch than the traditional geostationary satellites that have been going up since the 1960s. They promise lower latency connections because they typically orbit only a few hundred miles above Earth, as opposed to many thousands. Many corners of our country that don't have broadband today, or don't have many broadband choices, could soon see new, high-speed services thanks to these low-earth orbit satellites. At least two of the applicants we consider today plan to offer services that could enable IoT devices—powering smart cities and smart ag. And those use cases complement the many connections satellites make today on ships, airplanes, and other vehicles.

The broader point is that, at this moment, innovation in tech and telecom has the extraordinary potential to benefit everyday Americans. As we move towards 5G, satellite, fiber, cable, fixed wireless, and a range of other offerings are all going to compete for your broadband dollars. And we can help move competition in that direction through smart policies.

That's what we're doing today. We're not picking winners and losers in the competition to provide more broadband to more Americans. We don't have the foresight to centrally plan the particular mode of connectivity everyone will use. Recognizing this is a good thing. After all, if your family is getting fast, affordable broadband, you probably don't care whether that connection is through a low-earth satellite or high-band spectrum. So that's the approach we take here. We let these four companies move forward and allow the market to decide their success.

For my part, I am excited to see what services these four companies will offer. And I'm glad we're clearing the way for more choices and more connections for Americans, regardless of where they live. Once again, I want to thank the International Bureau for its work on these items. They have my support.

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STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL

Re: *Space Exploration Holdings, LLC Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System, IBFS File No. SAT-LOA-20170301-00027; In the Matter of Kepler Corporation Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System, IBFS File No. SAT-PDR-20161115-00114; In the Matter of Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-band NGSO Constellation, IBFS File No. SAT-PDR-20170301-00023;In the Matter of LeoSat MA, Inc., Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112*.

The United Nations is well known for its Human Development Index. It's a lot like a national report card. It's a composite of indicators involving life expectancy, education, and per capita income. As indices go, this one gets all the glory at the General Assembly. But there's another United Nations index that deserves some time in the spotlight—and that's the Index of Objects Launched into Outer Space. Moreover, it's one that directly informs our satellite work at the Federal Communications Commission.

According to this index, there are currently 4,857 satellites orbiting the globe. If you start counting from the fall of 1957, when Russia's Sputnik became earth's first artificial star, a total of 8,126 objects have been launched into space.

Now consider this. Today this agency is approving more than 7,500 new satellites for orbit. That's on top of more than 4,500 new satellites already authorized this year. Then consider that we have another 1,200 proposed satellites still in our pipeline for review.

Do the math. It adds up to a next-generation space race. New commercial models, players, and technologies are coming together and rapidly multiplying the range of satellite services. With these services come all kinds of opportunities. They include new capacities to connect more people in more places, use scarce resources more efficiently, support expanded access to education and health care, and grow economies beyond the limits of today's terrestrial networks. In other words, they could help with improving the very sorts of things that are measured by the United Nations in its Human Development Index. This is exciting.

Of course, increasing the number of satellites in orbit like this brings new challenges. That's because left unchecked, the growing amount of debris in orbit could make some regions of space unusable for decades to come. This should concern us all—because junking up our far altitudes will constrain our ability to innovate, connect, and make progress with satellite systems.