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

In the Matters of	)	
	)	
SpaceX Services, Inc.	)	
	)	
Application for Blanket Authorization of Next-Generation Ku-Band Earth Stations in Motion	)	IBFS File No. SES-LIC-20210803-01360
	)	Call Sign E210309
	)	
SpaceX Services, Inc.	)	
	)	
Application for Blanket Authorization of High-Performance Ku-Band Earth Stations in Motion	)	IBFS File No. SES-LIC-20210803-01361
	)	Call Sign E210310
	)	
Kepler Communications Inc.	)	
	)	
Application for Blanket Authorization of Ku-Band Earth Stations on Vessels	)	IBFS File No. SES-LIC-20210809-01568
	)	Call Sign E210416

ORDER AND AUTHORIZATION

Adopted: June 30, 2022 **Released: June 30, 2022**

By the Chief, International Bureau:

I. INTRODUCTION

1. By this Order, we grant, subject to the conditions and limits set forth below, the applications of SpaceX Services, Inc. (SpaceX)[1] to operate consumer[2] and enterprise[3] Ku-band Earth

[1] SpaceX's sister company, Space Exploration Holdings, LLC (SpaceX Holdings), is authorized to launch and operate a constellation of more than 4,400 Non-Geostationary Orbit (NGSO) satellites using Ku- and Ka-band spectrum (Call Signs S2983 and S3018). *See Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018) (SpaceX Space Station License); s*ee also Space Exploration Holdings, LLC*, FCC 21-48 (rel. Apr. 27, 2021) (SpaceX Space Station License Modification), *appeal pending sub nom. Viasat, Inc. v. FCC*, Case No. 21-1123 (D.C. Cir. 2021), which modified the initial license. In May 2019, SpaceX began launching satellites to populate the constellation and has launched more than 2,500 satellites as of June 1, 2022. SpaceX was granted a license for operation of fixed end-user customer earth stations to communicate with SpaceX Holdings' NGSO constellation in 2020. *See Radio Station Authorization*, IBFS File No. SES-LIC-20190211-00151 (Call Sign E190066) (issued Mar. 13, 2020). This Order refers to these applications as "Consumer ESIM application" and "Enterprise ESIM application," respectively.

[2] SpaceX's "next generation" consumer ESIM application requests an unlimited number of ground-based terminals designed for consumers. *See* Application Narrative, IBFS File No. SES-LIC-20210803-01360. This Order refers to this application as the "Consumer ESIM application."

[3] SpaceX's "high performance" enterprise ESIM application requests an unlimited number of ground-based, higher performance or "HP" terminals designed for enterprise customers. *See* Application Narrative, IBFS File No. SES-LIC-20210803-01361. This Order refers to these applications as the "Enterprise ESIM application."

Stations in Motion (ESIM) [4] and the application of Kepler Communications Inc. (Kepler)[5] to operate unlimited Ku-band Earth Stations on Vessels (ESVs) in the territorial waters of the United States and aboard US-registered vessels throughout international waters worldwide.[6] Both SpaceX and Kepler propose to use the 14.0-14.5 GHz band to transmit (Earth-to-space), and the 10.7-12.7 GHz band, including 12.2-12.7 GHz (generally known as the 12 GHz band), to receive (space-to-Earth). The grants are subject to a number of conditions, as described more fully below, some of which are related to the ongoing 12 GHz rulemaking proceeding.[7] We deny the Petitions to Deny or Defer in Part filed by RS Access, LLC (RS Access) in the two SpaceX and the Kepler proceedings, the Petitions to Deny or Hold in Abeyance filed by ViaSat, Inc. (Viasat) in both SpaceX license proceedings, the DISH Network Corporation (DISH) Petition to Deny Waiver Request filed in opposition to SpaceX's enterprise application, and the DISH Petition to Deny in Part filed against the Kepler application.[8] The concerns raised by those pleadings are addressed below.

II. BACKGROUND

A. Applications and Responsive Petitions

2. *SpaceX's ESIM Applications and Responsive Petitions*. SpaceX filed applications for

[4] ESIMs is the collective designation for three types of earth stations that the Commission authorizes to transmit while in motion -- Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs) -- using frequencies allocated to the fixed satellite service. Broadly stated, ESVs, such as those requested by Kepler refers to earth stations that communicates with a satellite or satellites while located on maritime vessels such as boats, cargo ships, or cruise ships, whereas VMES and ESAAs refer to earth stations that communicate with a satellite or satellites while located on land-based vehicles or on aircraft, respectively. *See* 47 CFR § 25.103.

[5] The Commission previously granted U.S. market access for Kepler's Canadian-licensed non-geostationary orbit (NGSO) satellite network to deliver Ku-band fixed-satellite service (FSS) in the United States. *See Kepler Communications Inc., Petition for Declaratory Ruling to Grant Access to the US Market for Kepler's NGSO FSS System*, Order and Declaratory Ruling, FCC 18-162 (Nov. 19, 2018) (Kepler Grant). Kepler was also granted a Ku-band earth station blanket license which authorized communications with fixed terminals situated throughout the United States. *See* Kepler Communications Inc., Radio Station Authorization, IBFS File No. SES-LIC-20190627-00861 (granted Aug. 17, 2020) (Kepler Fixed Blanket License). Kepler has launched and is operating 19 of its planned 140-satellite constellation at the time of its application. *See* Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler, to Marlene H. Dortch, Secretary, FCC (Apr. 5, 2022). Two of these satellites are approved for operation with U.S. earth stations under Kepler's grant of U.S. market access, and Kepler has an application pending for modification of its market access grant to address additional operations. IBFS File No. SAT-MPL-20200904-00104; *see also id.* at 8.

[6] Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler, to Marlene H. Dortch, Secretary, FCC (Feb. 9, 2022).

[7] *See Expanding Flexible Use of the 12.2-12.7 GHz Band*, WT Docket No. 20-443, Notice of Proposed Rulemaking, 36 FCC Rcd 606 (2021) (*2021 12 GHz NPRM*).

[8] Petition to Deny or Defer in Part of RS Access, LLC, IBFS File No. SES-LIC-20210803-01361 (Jan. 21, 2022) (RS Access Enterprise ESIM Petition); RS Access, LLC Letter Opposition (incorporating its Petition to Deny or Defer in Part of RS Access, LLC filed in IBFS File No. SES-AMD-20210731-01295), IBFS File No. SES-LIC-20210803-01360 (Mar. 22, 2022) (RS Access Consumer ESIM Opposition); Viasat Petition to Deny or Hold in Abeyance of Viasat, Inc., IBFS File No. SES-LIC-20210803-01361 (Jan. 21, 2022) (Viasat Enterprise ESIM Petition); Viasat Petition to Deny or Hold in Abeyance of Viasat, Inc., IBFS File No. SES-LIC-20210803-01360 (Feb. 25, 2022) (Viasat Consumer ESIM Petition); DISH Petition to Deny Waiver Request, IBFS File No. SES-LIC-20210803-01361 (Jan. 21, 2022) (DISH Enterprise ESIM Petition); DISH Petition to Deny in Part, IBFS File No. SES-LIC-20210809-01568 (Jan. 3, 2022) (DISH Kepler Petition); RS Access Petition to Deny or Defer In Part, SES-LIC-20210809-01568 (Jan. 3, 2022) (RS Access Kepler Petition).

licenses to operate an unlimited number of consumer and enterprise end-user earth stations for deployment as ESIMs[9] in the Ku-band using the 14.0-14.5 GHz band for transmitting and 10.7-12.7 GHz (including 12.2-12.7 GHz) for receiving.[10] The proposed end-user earth stations would communicate with SpaceX's Non-Geostationary Orbit (NGSO) low earth orbit satellite constellation. SpaceX contends that the 12.2-12.7 GHz band is critical to enable it to provide high quality, low latency broadband services for ESIMs (vehicles, boats, and aircraft) while complying with Commission rules for coordination and spectrum sharing.

3. Three petitions to deny or defer/hold in abeyance were filed by RS Access,[11] DISH,[12] and Viasat[13] in the SpaceX Enterprise ESIM application file, and RS Access and Viasat filed petitions to deny or defer/hold in abeyance in the SpaceX Consumer ESIM application file.[14] RS Access and DISH oppose SpaceX use of spectrum between 12.2-12.7 GHz, and Viasat challenges SpaceX services in the broader Ku-band. SpaceX filed Consolidated Responses to the Petitions in both application files. DISH, RS Access, and Viasat filed replies to the SpaceX Enterprise ESIM response and Viasat filed a reply in both application files. Kepler supported SpaceX's applications.[15]

[9] SpaceX seeks authority to operate these earth stations as (1) vehicle-mounted earth stations throughout the United States and its territories; (2) as earth station on vessels in the territorial waters of the United States and throughout international waters worldwide; and (3) as earth stations aboard aircraft on U.S.-registered aircraft operating worldwide and non-U.S.-registered aircraft operating in U.S. airspace. *See* SpaceX Consumer ESIM Application at 2; SpaceX Enterprise ESIM Application at 2.

[10] SpaceX Services, Inc., Application for Earth Station Authorizations*, Satellite Communications Services Satellite Radio Applications Accepted for Filing,* Public Notice, Report No. SES-02435 (SES-LIC-20210803-01360) (Jan.26, 2022) (Consumer ESIM Application); SpaceX Services, Inc., Application for Earth Station Authorizations*, Satellite Communications Services Satellite Radio Applications Accepted for Filing,* Public Notice, Report No. SES-02425 (SES-LIC-20210803-01361) (Dec. 22, 2021) (Enterprise ESIM Application). In addition to its Applications, SpaceX also filed a supplemental analysis of the non-ionizing radiation levels for its proposed service prepared in compliance with FCC Office of Engineering and Technology Bulletin Number 65 (Edition 97-01) in the Enterprise ESIM application file on Dec. 14, 2021, and the Consumer ESIM file on Mar. 11, 2022. SpaceX's Consumer ESIM application filing on Dec. 14, 2021, also stated that the equivalent diameter of the proposed end user terminal antenna as determined pursuant to Section 25.103 of the Commission's rules is 0.42 meters. An equivalent isotropically radiated power (EIRP) density mask plot was filed in both dockets as a supplement to the record on Mar. 25, 2022. SpaceX has filed *ex parte* notices for meetings held with Commission staff concerning their Enterprise ESIM application on Feb. 28, 2022, Mar. 4, 2022, Mar. 8, 2022, Mar. 11, 2022, Mar. 17, 2022, and Mar. 20, 2022 and incorporated the latter Consumer ESIM application *ex parte* letter into the Consumer ESIM application file on Apr. 7, 2022.

[11] RS Access operates FCC-licensed communications systems in the 12 GHz band for Wi-Fi extension, video, and first-responder services at various academic, commercial, veterans/ service organizations and community anchor institutions at 300 locations inside the United States. RS Access Petition to Deny or Defer SpaceX, IBFS File No. SES-LIC-20210803-01361, at 3.

[12] Through affiliates, DISH holds Direct Broadcast Satellite (DBS) and Multichannel Video and Data Distribution Service (MVDDS) licenses which operate in the 12 GHz band. DISH opposed SpaceX's Enterprise ESIM application.

[13] Viasat is a manufacturer of Ku-band equipment, a provider of Ku-band satellite connectivity, and a Ku-band ESIM licensee. Viasat has opposed both SpaceX's Consumer and Enterprise ESIM applications.

[14] *See Satellite Communications Services Information Action Taken,* Public Notice, Report No. SES-02436 (IBFS File No. SES-LIC-20210803-01360) (effective Jan. 25, 2021).

[15] *See* Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler, to Marlene H. Dortch, Secretary, FCC (June 20, 2022).

4. *Kepler's ESV Application and Responsive Petitions.* Kepler filed an application[16] for a blanket license to operate an unlimited number of end-user ESVs in the territorial waters of the United States and aboard U.S.-registered vessels throughout international waters worldwide.[17] Like SpaceX, the proposed service would transmit in the Ku-band frequencies 14.0-14.5 GHz (Earth-to-space) and receive in the frequency band 10.7-12.7 GHz (space-to-Earth), including 12.2-12.7 GHz (generally known as "12 GHz"). Kepler pledged in its Application to engage in spectrum sharing and coordination, certified that its transmissions will conform to applicable power flux density (PFD) and equivalent power flux density (EPFD) levels specified by Articles 21 and 22 and Resolution 76 of the International Telecommunications Union (ITU) Radio Regulations, and certified that it will not exceed emissions limitations and exceed the radio frequency radiation hazards limits.[18] Kepler asserts that the public interest will be served through a grant of its license by providing connectivity to remote assets in underserved maritime regions and promoting competition and further innovation.[19] Kepler also notes that it has refined its ability to communicate with ESVs through two proof-of-concept FCC-approved Experimental Special Temporary Authorizations[20] and is now able to provide this service commercially in order to serve the public interest while not materially causing interference.[21]

5. Petitions to deny or defer were filed by RS Access[22] and DISH[23] opposing Kepler's use of spectrum between 12.2-12.7 GHz, but not objecting to its use of other spectrum bands. Kepler responded to the petitions in an *ex parte* letter.[24] SpaceX also submitted a letter responding to the DISH

[16] *Kepler Communications Services Satellite Radio Applications Accepted for Filing,* Report No. SES02421, Public Notice, SES-LIC-20210809-01568) (Dec. 1, 2021). *See* Exhibit A Narratives of Kepler Application at 1-2. Note Exhibit B Radiation Hazard Assessment v.2 amendment (May 2, 2022); Exhibit D Waiver Requests (antenna height under 47 CFR Section 25.115(j), and frequency available for use by ESIMs under 47 CFR Section 25.202(a)(10)(ii)). As discussed below, section 25.115(j) applies to fixed earth stations, not ESIMs, so no waiver is required and the request is dismissed.

[17] *See* Kepler Application Narrative at 3 ("Kepler seeks permission to operate these terminals aboard vessels situated throughout the territorial waters of the United States, as well as aboard U.S.-registered vessels in international waters.").

[18] *See* Kepler Application Narrative at 3-8.

[19] *Id*. at 1-2.

[20] *See* Kepler Communications Inc., Experimental Special Temporary Authorization, OET File No. 0438-EX-ST-2021 (Apr. 16, 2021); Kepler Communications Inc., Experimental Special Temporary Authorization, OET File No. 0721-EX-ST-2021 (May 24, 2021).

[21] Kepler Application Narrative at 1-2.

[22] Petition to Deny or Defer in Part of RS Access, LLC, IBFS File No. SES-LIC-20210809-01568 (Jan. 3, 2022) (RS Access Kepler Petition). *See also* Letter from V. Noah Campbell, CEO, RS Access, LLC, to Marlene H Dortch, Secretary, FCC (Feb. 10, 2022) (RS Access Kepler Reply to Space X); Letter from V. Noah Campbell, CEO, RS Access, LLC, to Marlene H. Dortch, Secretary, FCC (Feb. 15, 2022) (RS Access Kepler Response).

[23] Petition to Deny in Part of DISH Network Corporation, IBFS File No. SES-LIC-20210809-01568 (Jan. 3, 2022) (DISH Kepler Petition). *See also* Letter from Pantelis Michalopoulous, Counsel, DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC (Feb. 11, 2022); Letter from Pantelis Michalopoulous, Counsel, DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC (Feb. 22, 2022).

[24] *See* Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler, to Marlene H. Dortch, Secretary, FCC (Feb. 9, 2022). DISH contends that Kepler's *ex parte* letter filed under 47 CFR 1.1206 was, in fact, an untimely Reply to Petitions filed 27 days late and that Kepler's application should be denied for failure to prosecute. Letter from Pantelis Michalopoulous, Counsel to DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC (Feb. 22, 2022). While Kepler was untimely in submitting its letter on February 9 as an opposition to petitions to deny or a response to comments, under Section 1.1204 of the Commission's rules, Kepler was able to submit this letter as an exempt *ex parte* presentation. As the Commission previously noted, "[t]he Commission's ex parte rules attempt to assure that the Commission's use of ex parte presentations as a means of obtaining timely information is

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and RS Access petitions.[25]

B. Review of NGSO ESIMs and the 12 GHz Band

6. Although Fixed Satellite Service (FSS) traditionally involves communications between satellites in orbit and earth stations at fixed locations, the growing demand for broadband communications to vessels, land vehicles, and aircraft has resulted in increased use of FSS for mobility applications.[26] ESIMs can enable the provision of very high data rate broadband communications, navigation, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies.[27] Licensees use ESIMs to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and control stations used to serve earth stations at fixed locations.[28]

7. In the United States, the 12 GHz band is allocated on a co-primary basis for non-federal use for the Broadcasting Satellite Service (BSS), referred to in U.S. regulations as Direct Broadcast Satellite (DBS), for NGSO FSS (space-to-Earth), and for Fixed Service, referred to in U.S. regulations as Multi-Channel Video and Data Distribution Service (MVDDS).[29] While these three services are co-

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consistent with the need to assure that interested parties, and the public, know what information and arguments are being presented to the Commission and who is presenting them." *Amendment of the Commission's Ex Parte Rules and Other Procedural Rules*, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 4517 (2011). We will therefore include Kepler's *ex parte* letter in the record in order to provide the Bureau, and the public, with a more complete record for consideration.

[25] Letter from David Goldman, Director, Satellite Policy, Space Exploration Technologies Corp. to Marlene H. Dortch, Secretary, FCC (Jan. 28, 2022). DISH asserts that SpaceX's letter in opposition to the petitions filed by DISH and RS Access should be ignored and returned because it is not a party to the proceeding, was untimely under 47 CFR 1.1206(b)(2)(iii), and was meritless because it did not specifically discuss Kepler's application and seeks a rule change to generally permit NGSO ESIM use of the 12 GHz band through a waiver request instead of a rulemaking process. Letter from Pantelis Michalopoulous, Counsel to DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC (Feb. 11, 2022). We will consider SpaceX's *ex parte* letter to be a part of the record. As an applicant seeking to provide similar services to Kepler, SpaceX would appear to have an interest in the outcome of Kepler's application.

[26] A detailed account of the regulatory changes that permitted the increased use of FSS for mobility applications has been set forth in a previous proceeding and is not repeated here. *See Amendment of 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*, Notice of Proposed Rulemaking, 32 FCC Rcd 4239, 4241-42, paras. 3-6 (2017) (*2017 GSO ESIMs NPRM*).

[27] *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Non-Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed-Satellite Service,* Notice of Proposed Rulemaking, 33 FCC Rcd 11416, para. 2 (2018) (*2018 NGSO ESIMs NPRM*).

[28] *Id*. at 11416-17, para. 2.

[29] *See* 47 CFR § 2.106, United States Table of Frequency Allocations, non-Federal Table for the band 12.2-12.7 GHz. NGSO FSS (space-to-Earth) operations are allocated pursuant to footnote 5.487A, which provides additional allocations including in Region 2 as follows:

> [The 12.2-12.7 GHz frequency band is] allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to NGSO systems and subject to application of the provisions of [ITU Radio Regulations] No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service cannot claim protection from geostationary-satellite networks in the broadcasting-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the [ITU Radiocommunication] Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite

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primary, NGSO FSS and MVDDS are allocated on a non-harmful interference basis (NIB) with respect to BSS/DBS.[30] The Commission's rules enable sharing between co-primary NGSO FSS and MVDDS using a combination of technical limitations, information sharing, and first-in-time procedures.[31] Today, two U.S.-licensed DBS providers, DISH and DIRECTV,[32] use the band throughout the United States to provide DBS directly from geostationary-orbit (GSO) satellites to relatively small dish antennas at tens of millions of individual homes and businesses, with over 22 million combined subscribers as of the third quarter of 2020.[33] Meanwhile, eight companies (10 legal entities) currently hold 191 of the total 214 MVDDS licenses which were acquired through auctions in 2004 and 2005 for a 10-year term with renewal expectancy upon a showing of substantial service at license renewal.[34]

8. In 2017, the Commission proposed to modernize its ESIMs rules in a proceeding that focused on communications with satellites in geostationary (GSO) orbit.[35] In 2018, it expanded its modernization efforts to include NGSO satellites and ultimately issued a *Second Report and Order in IB Docket No. 17-95 (GSO) and a Report and Order in IB Docket No. 18-315 (NGSO) and a Further Notice of Proposed Rulemaking*.[36] Though the 12 GHz band was not initially proposed for ESIMs use, some

> networks, and [international footnote] No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the [12 GHz band] shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

47 CFR § 2.106, n.5.487A. This international footnote has been applied without modification to non-Federal operations, by placing the footnote on the non-Federal Table. *See* 47 CFR § 2.105(d)(5).

[30] *See* 47 CFR § 2.106, n.5.490 (International Footnote). In Region 2, in the 12.2-12.7 GHz band, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in conformity with the broadcasting satellite Plan for Region 2 contained in Appendix 30. "Harmful Interference" is defined under the Commission's rules as "[i]nterference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with the ITU Radio Regulations." 47 CFR § 2.1(c).

[31] *See* 47 CFR §§ 101.113(a) n.11, 101.147(p).

[32] DIRECTV became a subsidiary of AT&T in July 2015. *See, e.g., Applications of AT&T, Inc. and DIRECTV for Consent to Assign or Transfer Control of Licenses and Authorizations*, MB Docket No. 14-90, Memorandum Opinion and Order, 30 FCC Rcd 9131 (2015). DIRECTV is now a separate, independent entity. *See Applications of AT&T, Inc. and DIRECTV for Consent to Assign or Transfer Control of Licenses and Authorizations*, DA 21-838 (rel. July 16, 2021).

[33] *See* S&P Market Intelligence, Multichannel Operators by DMA (Q3 2020).

[34] *See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operations of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band with Frequency Range;* ET Docket No. 98-206, Second Report and Order, 17 FCC Rcd 9614 (2002) (2002 *Second Report and Order*) (describing what constitutes substantial service). *See also Requests of Three Licensees of 22 Licenses in the Multichannel Video and Data Distribution Service for Extension of Time to Meet the Final Buildout Requirement for Providing Substantial Service under Section 101.1413 of the Commission's Rules, Applications of Three Licensees for Renewal of 22 Licenses in the Multichannel Video and Data Distribution Service*, Order, 33 FCC Rcd 10757, 10757-60, paras. 2-7 (WTB BD Oct. 29, 2018) (providing an extensive discussion of the background for the MVDDS service authorizations).

[35] *See 2017 GSO ESIMs NPRM*, 32 FCC Rcd 4239. *See also 2018 NGSO ESIMs NPRM,* 33 FCC Rcd 11416, and *Amendment of 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*, IB Docket No. 17-95, Report and Order and Further Notice of Proposed Rulemaking, 33 FCC Rcd 9327 (2018) (*2018 GSO ESIMs R&O & NPRM*).

[36] *Amendment of 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*; *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, Second Report and Order in IB Docket No. 17-95, Report and Order in IB Docket No. 18-315, and Further Notice of Proposed Rulemaking, 35 FCC Rcd 5137 (2020) (*2020 ESIMs Second R&O & FNPRM*).

commenters sought expansion of the scope of the proceeding to include this band, and others opposed doing so.[37] The Commission declined to include the 12.2-12.7 GHz band among the bands specifically identified for ESIMs communications with NGSO FSS satellites because the additional frequency band was not included in the rulemaking proceeding and the record was insufficient to consider use of the 12 GHz band.[38]

9. In 2021, the Commission initiated a rulemaking proceeding to specifically seek comment on how best to maximize the efficient use of the 12 GHz band spectrum and to determine whether the Commission could add a new or expanded terrestrial mobile allocation in the 12 GHz band without causing harmful interference to incumbent licensees.[39] The Commission sought comment concerning whether that action would promote or hinder the delivery of next-generation services in the 12 GHz band given the existing and emergent services offered by incumbent licensees and noted that it wished to undertake an examination of the characteristics of each spectrum band under consideration—including its propagation and capacity characteristics, the nature of in-band and adjacent band incumbent use, and the potential for international harmonization—before deciding whether and, if so, how to make it available for more intensive terrestrial use.[40]

III. DISCUSSION

A. Status of ESIM Operations in the 12 GHz Band

10. We first address the status of ESIM operations in the 12 GHz band under part 25 of the Commission's rules. Section 25.202 of the Commission's rules lists certain frequencies available for use by ESIMs communicating with NGSO FSS space stations, subject to the provisions in the U.S. Table of Frequency Allocations.[41] SpaceX and Kepler seek waiver of section 25.202(a) of the Commission's rules.[42] We find, however, that waiver of section 25.202 is not required in this instance, because the inclusion of a list of frequencies for ESIMs communicating with NGSO FSS space stations in paragraph (a) of section 25.202 does not limit our ability to authorize these operations in other frequency bands. Instead, operations in frequency bands not on the list may be assigned on a case-by-case basis as indicated in paragraph (b) of section 25.202, in conformance with the U.S. Table of Frequency Allocations, section 2.106 of the Commission's rules.[43] Accordingly, waiver of section 25.202(a) is not necessary, and the requests for waiver by SpaceX and Kepler are dismissed as moot. Operations of the NGSO FSS in the Earth-to-space direction in the 12.2-12.7 GHz band are permitted under the relevant footnote allocation of the U.S. Table of Allocations,[44] and the ESIM terminals authorized through this grant will be receiving in the FSS in the 12.2-12.7 GHz band. Further, as discussed below, SpaceX and Kepler have otherwise demonstrated that they can operate in accordance with the Commission's rules and policies. Therefore, we will authorize operations by SpaceX and Kepler ESIMs in the 12.2-12.7 GHz band, as appropriately

[37] *See 2020 ESIMs Second R&O & FNPRM*, 35 FCC Rcd 5137, 5153-54, para. 45.

[38] *Id.* 35 FCC Rcd at 5153-54, paras. 45-46.

[39] *See 2021 12 GHz NPRM*, 36 FCC Rcd at 607, para. 2. For an extensive, heavily-annotated discussion of the history, service rules and current use for allocations in 12 GHz band, see *id.* at 607-614, paras. 3-18.

[40] *2021 12 GHz NPRM*, 36 FCC Rcd at 614-629, paras. 19-60. SpaceX, DISH, RS Access, and Viasat are among the parties who filed comments, replies, or *ex parte* notices in this docket.

[41] 47 CFR § 25.202(a)(10)(i).

[42] *See* SpaceX Consumer ESIM Application, Narrative at 8-11; SpaceX Enterprise ESIM Application, Narrative at 8-11; Kepler Application, Exhibit D at 1-2.

[43] 47 CFR § 25.202(b) ("Other frequencies and associated bandwidths of emission may be assigned on a case-by-case basis to space systems under this part in conformance with § 2.106 of this chapter and the Commission's rules and policies).

[44] *See* 47 CFR § 2.106, fn. 5.487A, U.S. Table of Frequency Allocations (stating that in Region 2, the band 12.2-12.7 GHz is also allocated to the fixed-satellite service (space-to-Earth), limited to NGSO systems).

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11. RS Access[45] and DISH[46] contend that the Commission has not provided by rule for NGSO ESIMs in the 12 GHz band and that SpaceX and Kepler, therefore, cannot be licensed to offer service in this band.[47] They argue that the Commission's decision in the *NGSO ESIMs NPRM* and its *2020 ESIMs Second R&O & FNPRM*, as well as the U.S. Table of Frequency Allocations, exclude ESIMs from the 12 GHz band.[48] They further assert that the Commission has declined to deviate from the rules and policies that prohibit ESIM operations in the band due to potential harms to co-frequency licensees.[49] They note that the Commission declined to include 12 GHz for use by NGSOs ESIMs in the *2020 ESIMs Second R&O* due to an insufficient record to address concerns raised by Petitioners, including MDS Operations and MVDDS 5G Coalition.[50]

12. While the Commission did not specifically adopt rules addressing ESIM operations with NGSOs in the 12.2-12.7 GHz band as part of the *2020 ESIMs Second R&O & FNPRM*,[51] nothing in that proceeding prevents us from considering on a case-by-case basis the requests of SpaceX and Kepler to operate in that frequency band, provided that we carefully consider whether the operations are consistent with the Commission's rules and policies and whether the assignment of those frequencies is in the public interest, and ensure that any grant is conditioned appropriately. The *2020 ESIMs Second R&O & FNPRM* adopted a regulatory framework for communications of ESIMs with NGSO FSS satellites, and the Commission explained that such a framework would offer a streamlined path to deployment for such space stations, which is analogous to the framework for ESIMs communicating with GSO FSS space stations.[52] The identification of frequencies in section 25.202(a) for communications by NGSO FSS with ESIMs was part of this effort to create a more routine, streamlined path for authorization of NGSO FSS communications with ESIMs, but did not foreclose consideration of operations using other frequencies on a case-by-case basis under section 25.202(b).

B. Public Interest Analyses and the Radiofrequency Environment

13. We agree with SpaceX and Kepler that the public interest would benefit by granting with conditions their applications. Authorizing a new class of terminals for SpaceX's satellite system will

[45] *See* RS Access Petition to Deny or Defer Consumer Application at 4; IBFS File No. SES-LIC-20210809-01568, Letter from V. Noah Campbell, CEO, RS Access, LLC, to Marlene H. Dortch, Secretary, FCC (Feb. 15, 2022) (reply to Kepler Feb. 9, 2022 response to petitioners).

[46] *See* DISH Enterprise Petition to Deny Waiver Request at 2; Letter from Pantelis Michalopoulous, Counsel to DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC (Feb. 22, 2022).

[47] *2020 Second ESIM R&O & FNPRM*, 35 FCC Rcd at paras. 26-27.

[48] *See, e.g.,* DISH Petition to Deny SpaceX Waiver Request at 3 *(citing 2018 NGSO ESIMs NPRM*, 33 FCC Rcd 11416, 11419 (2018) (outlining proposed frequency bands for use by ESIMs with NGSO satellites that did not include the 12 GHz band in the list of authorized NGSO ESIMs frequencies)).

[49] *See, e.g.*, RS Access Petition to Deny or Defer Consumer Application at 1. RS Access cites to several part 25 earth station grants in which the Commission did not authorize use of the 12 GHz band with ESIMs in the United States, but we note that these applications did not seek authority to operate in the 12.2-12.7 GHz band in the United States or provide analysis in support of such operations. *Id.* at 1-2, n.4 (citing Panasonic Avionics Corporation, IBFS File No. SES-MFS-20200513-00528 (granted May 18, 2021); Astronics AeroSat Corporation, IBFS File No. SES-MOD-20180223-00157 (granted June 5, 2019); Intelsat License LLC, as debtor-in-possession, IBFS File No. SES-LIC-20170626-000682 (granted Oct. 4, 2017)).

[50] *2020 Second ESIM R&O & FNPRM*, 35 FCC Rcd at 5154, para. 46. *See* 47 CFR § 25.202(a) (10)(ii) (listing frequency bands not including the 12 GHz band).

[51] *2020 Second ESIM R&O & FNPRM*, 35 FCC Rcd at 5154-55, para. 46 (noting that several frequency bands, including 12.2-12.7 GHz, had not been part of the proposals in the NPRM, and that the record was insufficient to include the frequency bands in the rules adopted in that proceeding).

[52] *2020 Second ESIM R&O & FNPRM*, 35 FCC Rcd at 5154-55, para. 46.

expand the range of broadband capabilities to meet the growing user demands that 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.[53] Similarly, authorization of the Kepler ESVs service will provide much-needed connectivity to vessels in territorial waters of Hawaii and Alaska and remote areas throughout the world, including the Arctic and Antarctic polar regions. In order to grant such authorizations on a case-by-case basis under section 2.202(b), we must ensure that it can be done in a way that does not violate our rules or harm the public interest. Therefore, we examine closely the potential effects on the existing and future radiofrequency environment.

14. *Operations Under Existing Rules.* Petitioners opposed to the SpaceX ESIM and Kepler ESV applications contend that grant of the applications is unwarranted because SpaceX and Kepler have failed to prove that their proposed systems are capable of complying with Commission rules and policies. First, Petitioners assert that SpaceX and Kepler have not shown they can operate in a manner consistent with the 12 GHz sharing regime established in the 2002 Ku-band Order[54] which permitted MVDDS and NGSO FSS service through a detailed site selection and coordination process.[55] Second, petitioners also assert that the SpaceX and Kepler proposals would disregard the existing terminal separation and coordination rules and create significant interference.[56] Third, Petitioners argue that SpaceX has not shown it can conduct its NGSO operations within the interference environment established by the 2016-2017 NGSO Processing Round as required in the *Third SpaceX Modification Order*.[57] DISH argues that the introduction of roving NGSO FSS earth stations in the 12 GHz band would substantially increase the chance of interference with DBS antennas because the proposed ESIMs moving earth stations would activate satellite downlinks that would otherwise not be operational. DISH also contends that, despite SpaceX's assurance that its satellites will be operating in compliance with the EPFD and PFD limits that the Commission has found sufficient to protect GSO and terrestrial systems, its system will violate the limits adopted by the International Telecommunication Union (ITU) and the Commission to protect the more than 20 million DBS customers in the United States.[58] DISH claims that this flaw is not corrected through a requirement in SpaceX's modified authorizations that it not employ more than one satellite beam using the 12 GHz frequencies in the same area (*i.e.*, Nco of 1).[59] DISH argues that the SpaceX system would still exceed the EPFD limits, even using the 45 cm and 60 cm antennas, and that the

[53] *See* SpaceX Consumer ESIM Application at 12 (citing 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). *See also* Letter from John Maya, Vice President, Operational Excellence, Royal Caribbean Group, to Tom Sullivan, Chief, International Bureau at 1-2 (June 10, 2022) (identifying SpaceX's services to its cruise ships as a "true next-generation solution" that will set the standard for other cruise operators).

[54] *See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operations of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range et al. Second Report and Order et. al*, 17 FCC Rcd 9614, 9625-26, para. 23 (2002) (*Ku-band Order*).

[55] *See* RS Access Enterprise ESIM Petition at 5; Kepler RS Access Petition at 5.

[56] Kepler RS Access Petition at 5; Viasat Consumer ESIM Petition at 5-6, 9; RS Access Enterprise ESIM Petition at 5; Viasat Enterprise ESIM Petition at 3-4, 7.

[57] Viasat Consumer ESIM Petition at 6-8; Viasat Enterprise ESIM Petition at 4-6; *see also* DISH Enterprise ESIM Petition at 4-6 (citing *Space Exploration Holdings, LLC,* 36 FCC Rcd 7995, 8047, at para. 97 (2021) *(Third SpaceX Modification Order)*).

[58] DISH Enterprise ESIM Petition at 4-6.

[59] DISH Enterprise ESIM Petition at 5-6 (*citing* Space Exploration Holdings, LLC Request for Modification of the Authorization for the SpaceX NGSO Satellite System, *Order and Authorization and Order on Reconsideration*, 26 FCC Rcd 7995, 8047 para. 97(e) (2021), *appeal pending, Viasat v. FCC*, Case No. 21-1123 (D.C. Cir. 2021).) Note that the Commission refused to consider this argument on procedural grounds at page 8021 para. 40, but DISH contends that the substance of the showing remains unrebutted.

effective Nco would be 3 or possibly more based upon testimony by its satellite engineer.[60] SpaceX responds that its system is fully compliant with Commission rules.

15. Viasat requests that the company explain how its ESIM terminals would make the frequent antenna-pointing adjustments necessary for working with moving platforms sufficiently quickly to ensure compliance with the EIRP density mask and applicable EPFD limits and how they would accurately determine whether and to what extent they are mispointed as the result of movements in the underlying mobile platform.[61] According to Viasat, the Commission conclusion that SpaceX would not cause harmful interference under this standard was calculated on fixed location usage rather than ESIM locations and unacceptable levels of interference will result when ESIMs are involved.[62]

16. In response, SpaceX argues that Viasat submits an interference analysis based on the erroneous assumption that SpaceX ESIMs will not operate as designed.[63] SpaceX contends that its advanced phased arrays use software to track its NGSO satellite and platform motion, and that they observe main beam parameters, minimum elevation, and GSO protection requirements.[64] SpaceX asserts that its antennas comply with Commission rules and do not "necessitate additional requirements on ESIM communications with NGSO FSS space stations."[65] SpaceX notes that its ESIM terminals incorporate industry-standard technologies such as micro-electro-mechanical system (MEMS) inertial measurement unit (IMU) sensors and GPS receivers as well as advanced phased array antennas with efficient sidelobes to maintain correct point, detect mispointing, and cease transmission well within the 100-microsecond threshold to comply with requirements set forth in the Commission's rules.[66]

17. With respect to potential interference in the 12 GHz band, SpaceX notes that the Commission already allows fixed, blanket-licensed NGSO earth stations to deploy in the band, and asserts that the risk of interference into a terrestrial antenna already exists.[67] Further, SpaceX argues that the Commission has indicated that it will generally grant requests for non-conforming spectrum uses 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."[68] In this case, SpaceX asserts that there is no interference because the ESIMs will only receive, rather than transmit, signals in the band, and it already has a blanket license to deploy fixed user terminals in the 12 GHz band and meet applicable EPFD limits and power flux-density (PFD) limits sufficient to protect

[60] *See* Letter from Jeff Blum, DISH, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20200417-00037; WT Docket No. 20-443 (Mar. 25, 2021) (attaching EPFD Assessment of SpaceX into DISH Ku-band GSO networks located in the United States).

[61] *See* Viasat Petition to SpaceX Consumer ESIM Petition at page 2 ("the instant Application raises the same issues as SpaceX's previous requests for ESIM authority"); Viasat Petition to Deny or Hold in Abeyance, IBFS File No. SES-LIC-20210309-00698 (filed May 21, 2021) (Viasat ESIM Petition).

[62] Viasat Petition to Deny or Hold in Abeyance SpaceX Consumer ESIM Application at 4.

[63] SpaceX Consolidated Response at ii.

[64] SpaceX Consolidated Response at 13-14.

[65] SpaceX Consolidated Response at 8-11 (citing *2018 NGSO ESIMs NPRM*, 33 FCC Rcd at 11421-22, para. 22).

[66] SpaceX Consumer and Enterprise ESIM Applications, SpaceX *ex parte* letters (March 17, 2022 and May 20, 2022).

[67] SpaceX Consolidated Response at 4-6.

[68] *See* SpaceX Consolidated Response at 6 *(citing Fugro-Chance, Inc*., 10 FCC Rcd 2860, para. 2 (IB 1995) (authorizing non-conforming MSS in the C-band). *See also* Motorola Satellite Communications, Inc. 11 FCC Rcd 13952, para. 11 (IB 1996) (authorizing service to fixed terminals in bands allocated to the mobile satellite service).

GSO and terrestrial systems.[69]

18. Further, petitioners contend that the request is not in the public interest because the mere assertion that SpaceX will operate on an unprotected, non-harmful interference basis provides inadequate interference protection for authorized, primary services already operating in the band, including MVDDS licensees, and ignores the likely service disruptions SpaceX customers will experience from primary users in the band. Petitioners assert that current primary users of the band would also likely be required to assume the costs to prevent interference and the Commission would assume the administrative burden of processing interference complaints.

19. We agree with SpaceX and Kepler that their proposed ESIM operations on an unprotected, non-harmful interference basis in the 12 GHz band will not materially impact the interference environment in that band. In the case of SpaceX, the satellite network's downlink beams that will be used for ESIMs in 12 GHz are already used with blanket-authorized fixed user terminals. These beams are independently steerable over the full field of view of the Earth, and the fixed earth stations will be distributed throughout the service area based on a wide range of factors. These factors render predictions about deployment of earth stations to specific locations speculative. While the ESIMs terminals will, like any terminal, alter the interference environment when in use, in this case, in which the terminal will be a receiver of potential interference on an unprotected basis, the differences in impacts on other operations can be expected to be minimal. The primary difference would be the change in the downlink beam due to the motion of the individual ESIM, assuming that the downlink satellite beams are designed to stay with their boresight centered on the individual ESIM and bearing in mind that the satellite beams should already be expected to be providing coverage over the area. Further, given the necessarily short duration of any contact between any individual SpaceX or Kepler satellite and an individual earth station there is no reason to expect that the motion of the ESIM terminal during that short duration will substantially or materially impact the over-all interference environment.

20. We also find that Kepler and SpaceX have both complied with the application requirements of the Commission's rules, including those rules concerning: (1) compliance with the Commission's radio frequency radiation exposure requirements; (2) the requirements to self-monitor and cease transmissions to the extent off-axis EIRP density limits are exceeded and identify a U.S. network operation center; and (3) providing a 24/7 point of contact with authority to cease all operations.[70]

21. With respect to DISH's assertions that SpaceX's satellites will not be in compliance with the EPFD and PFD limits established by the Commission and the ITU, we note that these EPFD and PFD compliance issues were considered, and rejected, in the *Third SpaceX Modification Order*.[71] That *Order* is currently subject to pending petitions for reconsideration and an appeal before the U.S. Court of Appeals for the D.C. Circuit. We note that these authorizations are subject to modification to bring them into conformance with any future court or Commission actions, including any decision or policies adopted in response to pending petitions for reconsideration in the *Third SpaceX Modification Order*, FCC 21-48, IBFS File No. SAT-MOD-20200417-00037, and SpaceX's pending space station application, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105. Accordingly, any investments made toward operations in the bands authorized in this order by SpaceX 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.

22. *Potential Impact of Operations on 12 GHz Rulemaking and Other 12 GHz Use Issues.*

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[69] *See* SpaceX Application, *Ex Parte* Letter from Jameson Dempsey, SpaceX, to Marlene H. Dortch, Secretary, FCC (Mar 8, 2022).

[70] *See* SpaceX Enterprise Application; SpaceX Consumer Application; Kepler Application. *See also* Letter from Nickolas Spina, Kepler to Marlene H. Dortch, Secretary, FCC, IBFS File No. SES-LIC-20210809-01568 (filed June 29, 2022).

[71] *See Third SpaceX Modification Order*, 36 FCC Rcd 7995, 8014-21, paras. 26-28, 32-42 (2021).

RS Access and DISH argue that granting the Kepler and SpaceX applications would effectively constrain the Commission's decision-making in the ongoing 12 GHz rulemaking proceeding to decide whether to allow more intensive use of the 12 GHz band by terrestrial licenses without interference to established services.[72] Petitioners contend that grant of these applications would inject new ESIM encumbrances into the 12 GHz band in ways that threaten to complicate the Commission's ability to repurpose spectrum for terrestrial mobile use.[73] RS Access and DISH argue that there would be no detrimental effects to denial of either Kepler's or SpaceX's blanket application with respect to use of the 12 GHz band for NGSO ESIM links because the Commission has authorized sufficient other bandwidth for ESIMs.[74] Petitioners also assert that the use of the spectrum will be so restricted that it will lead to customer dissatisfaction, FCC complaints and result in primary band users having to pay for interference protections.[75] SpaceX and Kepler respond that granting the applications would serve the public interest by expanding the range of broadband capabilities of ESIMs, including ESVs, subject to the outcome of the 12 GHz rulemaking proceeding, while the on-going rulemaking continues.[76]

23. We find that the public interest would be served by granting these applications given the public interest benefits of enabling the introduction of higher speed, lower latency earth stations in motion broadband through NGSO low-earth orbit systems. These services, never before available, promise the potential for expanding reach to remote and rural areas and facilitating higher quality broadband services in the air, on the road, and on the water. We recognize, however, that the introduction of a potentially significant number of additional end users could affect the 12 GHz spectrum environment. We therefore impose conditions to ensure grant of this application does not materially impact the outcome of the 12 GHz rulemaking proceeding.

24. First, the authorizations are granted on a non-interference protected, *i.e.*, unprotected, basis with respect to operations in the 12.2-12.7 GHz band. Therefore, the applicants' ESIM operations must accept any interference received from both current and future services authorized in the band – even if such interference causes undesirable operations -- and must not cause harmful interference to any authorized service, whether licensed or not. We also require SpaceX and Kepler to disclose to their customers that their ESIM service is being provided under these conditions so that their customers understand that there is no expectation of interference protection. SpaceX and Kepler must disclose the unprotected status of their ESIM offering on their websites, promotional literature, and other means of consumer notifications, including retail locations, online platforms, and telemarketing calls.

25. Second, Kepler and SpaceX, should they accept these license grants, do so subject to the outcome of any future rulemaking, including the pending 12 GHz rulemaking. Given that the licenses are granted on an unprotected basis, we do not anticipate the presence of ESIMs in the 12 GHz band materially affecting the analysis in that rulemaking. These authorizations are subject to modification to

[72] *See* RS Access Kepler Petition at 5-6; DISH Kepler Petition at 2-3; RS Access Consumer ESIM Petition at 5-6; RS Access Enterprise ESIM Petition at 6-7; DISH Enterprise ESIM Petition at 4, 7; Enterprise ESIM Petition at 6-7; DISH Enterprise ESIM Petition at 7.

[73] *See* RS Access Kepler Petition at 5-6; RS Access Consumer ESIM Petition at 5; RS Access Enterprise ESIM Petition at 5-6; RS Access Kepler Petition at 2. S*ee also* DISH Kepler Petition at 2-3.

[74] *See* DISH Consumer ESIM Petition at 6. DISH Consumer ESIM Reply opposition, at 1-2. *See also* DISH Kepler Petition at 4.

[75] *See* RS Access Kepler Petition at 4-5; DISH Kepler Petition at 2; RS Access Consumer ESIM Petition at 4-5; RS Access Enterprise ESIM Petition at 4-5; *see also* Letter from Harold Feld, Public Knowledge, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-433 and GN Docket No. 17-183 at 4 (June 28, 2022) (requesting, in case of 12 GHz NGSO ESIM license grants, disclosure to customers no expectation of interference protection).

[76] *See* SpaceX Consumer and Enterprise ESIM Applications, SpaceX Consolidated Responses (Jan. 28, 2022) and (Mar. 10, 2022), respectively, at ii. *See also* Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler, to Marlene H. Dortch, Secretary, FCC (Feb. 9, 2022) at 3.

bring them into conformance with any rules or policies adopted by the Commission in the future, including in WT Docket No. 20-443, *Expanding Flexible Use of the 12.2-12.7 GHz Band*. Accordingly, any investments made toward operations in the bands authorized in this Order by SpaceX or 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.

26. Third, these authorizations are issued on the applicants' representation that the statements contained in the application are true and that the undertakings described will be carried out in good faith including, but not limited to, the applicants' representation that their NGSO systems have been engineered to achieve a high degree of flexibility to facilitate spectrum sharing with other authorized satellite and terrestrial systems.[77] In line with these representations, we require, to the extent that any end-user terminals is capable of operating, *e.g.*, receiving, in 12.2-12.7 GHz must also be capable of such operation in 10.7-12.2 GHz.[78] We do not require ESIMs capable of operating only in the 10.7-12.2 GHz band to be capable of operating in the 12 GHz band.[79]

27. Finally, we note that our case-by-case analyses of these applications are limited to the facts and circumstances of these particular applications and have no broader applicability beyond these specific applications.

IV. CONCLUSION

28. We conclude that grant of SpaceX's requests for ESIM authorizations and Kepler's request for ESV authority, including for operations in the 12.2-12.7 GHz band, as conditioned and set forth herein, will serve the public interest by enabling SpaceX and Kepler to offer expanded broadband capabilities and serve unserved and underserved areas.

V. ORDERING CLAUSES

29. Accordingly, IT IS ORDERED, that the Applications filed by SpaceX Services, Inc. and Kepler Communications Inc. ARE GRANTED, pursuant to Sections 0.51 and 0.261 of the Commission's rules, 47 CFR §§ 0.51 and 0.261, and Sections 4(i), 301, 302, 303(r), 308, and 310 of the Communications Act, as amended, 47 U.S.C. §§ 154(i), 301, 302, 303(r), 308, 309, and 310, subject to the requirements and conditions set forth below, and that SpaceX is authorized to operate: (1) vehicle-mounted earth stations throughout the United States and its territories; (2) earth stations on vessels in the territorial waters of the United States and throughout international waters worldwide; and (3) earth stations aboard aircraft on U.S.-registered aircraft operating worldwide and non-U.S.-registered aircraft operating in U.S. airspace. Kepler is authorized to operate earth stations on vessels in U.S. territorial waters and throughout international waters worldwide. SpaceX and Kepler are afforded 30 days from the date of release of these grants and authorizations, as conditioned, to decline them. Failure to respond within this period will constitute formal acceptance of the authorizations as conditioned.

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

a. These authorizations are granted on a non-interference protected (NIP), *i.e.*, unprotected, basis with respect to terrestrial fixed operations in 10.7-11.7 GHz band.

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[77] *See, e.g.*, IBFS SES-LIC-20210803-01360, Narrative (Application for Blanket Licensed Earth Stations in Motion) at 6.

[78] *Id.* at 4, Table 1 (the technical specifications indicate that the proposed ESIMs will receive Broadband Downlink (space-to-Earth) signals in 10.7-12.7 GHz).

[79] DISH claims in an *ex parte* letter that SpaceX's Chief Executive Officer, Elon Musk, has encouraged customers to use earth stations in moving vehicles prior to the grant of these applications. *See* Letter from Pantelis Michalopoulos, Counsel to DISH to Marlene H. Dortch, Secretary, FCC (filed May 31, 2022). Grant of the applications herein does not preclude future enforcement action, if warranted.

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

c. In the 10.7-11.7 GHz (space-to-Earth) 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).

d. 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.

e. These authorizations are granted on non-interference protected (NIP), *i.e.*, unprotected, basis for operations in the 12.2-12.7 GHz frequency band in the United States. The ESIM operations of SpaceX and Kepler must accept any interference received from both current and future services authorized in the band – even if such interference causes undesirable operations -- and must not cause harmful interference to any authorized service, whether licensed or not. SpaceX and Kepler are required to disclose to their customers that their ESIM service is being provided under these conditions so that their customers understand that there is no expectation of interference protection. SpaceX and Kepler must disclose the unprotected status of their ESIM offering on their websites, promotional literature, and other means of consumer notifications, including retail locations, online platforms, and telemarketing calls.

f. Reception of downlink transmissions by SpaceX's earth stations in motion and Kepler's earth stations on vessels is limited to the operations requested in these applications only.

g. To the extent that any end-user terminals is capable of operating, *e.g.*, receiving, in the 12.2-12.7 GHz band, such terminals must also be capable of such operation in 10.7-12.2 GHz band. Terminals capable of operating in 10.7-12.2 GHz band are not required to be capable of operating in the 12.2-12.7 GHz band.

h. These authorizations are subject to modification to bring them into conformance with any future court ruling and with any rules or policies adopted by the Commission in the future, including in WT Docket No. 20-443, *Expanding Flexible Use of the 12.2-12.7 GHz Band*, and with respect to the outcome of pending petitions for reconsideration in the third SpaceX modification proceeding, FCC 21-48, IBFS File No. SAT-MOD-20200417-00037, and IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105. Accordingly, any investments made toward operations in the bands authorized in this order by SpaceX and Kepler assume the risk that operations may be subject to additional conditions or requirements or even cessation of operation as a result of any future court ruling or Commission actions.

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

j. Operations: (a) in the band 14.0-14.2 GHz, within 125 kilometers (for ESVs and VMESs) or within radio line-of-sight (for ESAAs) of the National Aeronautics and Space Administration (NASA) Tracking and Data Relay Satellite System (TDRSS) earth stations are subject to prior coordination with the National Telecommunications and Information Administration (NTIA) in order to minimize harmful interference; and (b) in the band 14.47-14.5 GHz, in the vicinity (for ESVs and VMESs) or within radio line-of-sight (for ESAAs) of the National Science Foundation radio astronomy stations are subject to coordination with NTIA in order to minimize harmful interference.

k. 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, fn. US342, and all practicable steps must be taken to protect the radio astronomy service from harmful interference.

l. Communications with ESIMs in the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 GHz (Earth-to-space) bands may not cause unacceptable interference to, or claim protection from, geostationary satellite networks.

m. SpaceX's 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 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.

n. SpaceX's ESIMs must operate in accordance with the minimum elevation angles specified in SpaceX's space station license.

o. All existing transmitting facilities, operations and devices regulated by the Commission must be in compliance with the Commission's radiofrequency (RF) exposure guidelines, pursuant to Section 1.1307(b)(1) through (b)(3) of the Commission's rules, or if not in compliance, file an Environmental Assessment (EA) as specified in section 1.1311. *See* 47 CFR § 1.1307 (b)(5). SpaceX and Kepler shall take all necessary measures to ensure that the earth stations do not create potential exposure of humans to radiofrequency radiation in excess of the FCC exposure limits defined in 47 CFR §§ 1.1307(b) and 1.1310 wherever such exposures might occur. Measures must be taken to ensure compliance with limits for both occupational controlled exposure and for general population/uncontrolled exposure, as defined in these rule sections. Requirements for restrictions can be determined by predictions based on calculations, modeling or by field measurements. The FCC's requirements (available online at https://www.fcc.gov/general/oet-bulletins-line) provide information on predicting exposure levels and on methods for ensuring compliance.

p. Kepler's earth stations on maritime vessels must not transmit at elevation angles less than ten degrees, measured from the horizontal plane to the direction of maximum radiation.

q. The earth stations on maritime vessels authorized herein must be monitored and controlled by a ground-based network control and monitoring center (NCMC). Such stations must be able to receive "enable transmission" and "disable transmission" commands from the NCMC and must cease transmission immediately after receiving a "parameter change" command until receiving an "enable transmission" command from the NCMC. The NCMC must monitor operation of each earth station to determine if it is malfunctioning, and each earth station on a maritime vessel must self-monitor and automatically cease transmission within 100 milliseconds on detecting an operational fault that could cause harmful interference.

r. SpaceX's and Kepler's ground-based NCMC or equivalent facility must be located in the United States, except that earth stations on U.S.-registered vessels may operate under control of a NCMC location outside the United States provided SpaceX and Kepler maintain a point of contact within the United States that will have the capability and authority to cause an earth station on a U.S.-registered vessel to cease transmitting if necessary.

s. SpaceX and Kepler must maintain a U.S. point of contact available 24 hours per day, seven days per week, with the authority and ability to terminate operations authorized herein.

t. When communicating with earth stations on maritime vessels of foreign registry, the NCMC must maintain detailed information on each such vessel's country of registry and a point of contact for the relevant administration responsible for licensing those earth stations on maritime vessels.

u. Transmissions between the earth stations under call sign E210416 and Kepler's NGSO space stations must comply with existing and future coordination agreements reached between Canada and

other Administrations, including Canada and the United States.

v. Operations outside the United States must also ensure compliance with the applicable laws, regulations, and licensing procedures of other countries, including, as appropriate regulations concerning operations from national or adjacent airspace, and territorial or adjacent waters, as well as with the conditions of this authorization.

w. Authority is granted to operate stations by remote control provided that the operator is responsible for ensuring the operations are in accordance with the terms and conditions of the license and pursuant to section 25.271 of the Commission's rules.

31. IT IS FURTHER ORDERED that the Petition to Deny or Defer filed by RS Access, LLC, Petition to Deny Waiver Request filed by DISH Network Corporation, and the Petitions to Deny or Hold in Abeyance filed by ViaSat, Inc. against the SpaceX applications and the Petition to Deny in Part filed by DISH Network Corporation and the Petition to Deny or Defer in Part filed by RS Access, LLC against the Kepler application ARE DENIED.

32. IT IS FURTHER ORDERED that the requests of SpaceX and Kepler for a waiver of section 25.202(a)(10)(ii) of the Commission's rules regarding the 12.2-12.7 GHz (space-to-Earth) frequency band ARE DISMISSED.

33. IT IS FURTHER ORDERED that Kepler's request for a waiver of section 25.115(j) of the Commission's rules IS DISMISSED. Section 25.115(j) applies to fixed earth stations, not earth stations in motion.

34. IT IS FURTHER ORDERED that SpaceX and 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 (EPFD down) contained in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (WRC-03) of the ITU Radio Regulations.

FEDERAL COMMUNICATIONS COMMISSION

Thomas P. Sullivan
Chief
International Bureau