Before the FEDERAL COMMUNCATIONS COMMISSION Washington, D.C. 20554

In the Matter of)
)
Application of Space Exploration Holdings, LLC)
For Modification of Authorization for the SpaceX)
NGSO Satellite System)

File No. SAT-MOD-20181108-0008

To: The International Bureau

<u>COMMENTS AND CONDITIONAL PETITION TO DENY OF KEPLER</u> <u>COMMUNICATIONS INC.</u>

Kepler Communications Inc. ("Kepler") hereby submits the following comments and conditional petition to deny regarding the above-referenced application¹ of Space Exploration Holdings, LLC ("SpaceX") which, *inter alia*, seeks to reduce the altitude of 1,584 satellites from their currently authorized 1,150 km altitude to a 550 km altitude. Kepler believes, contrary to SpaceX², that the combined effects of the requested altitude reduction and expansions in Ku-band will increase the difficulty of Kepler's ability to manage interference. The Modification will also present new physical risks to satellites operating in the region around 550 km, including Kepler's presently-authorized 140-satellite network.

¹ Application of Space Exploration Holdings for Modification of Authorization for the SpaceX NGSO Satellite System, File No. SAT-MOD-20181108-0008 (filed Nov. 8, 2018) (the "Modification").

² See Modification, Legal Narrative, Summary; SpaceX has broadly claimed that its modification will accomplish its objectives "without increasing overall interference". See also Modification, Section III; SpaceX asserts that "[n]one of SpaceX's modifications will increase interference to other NGSOs, GSOs, or terrestrial wireless spectrum users."

SPECIFIC OBJECTIONS

I. SPACEX MODIFICATION WILL ALTER THE INTERFERENCE ENVIRONMENT FOR OTHER KU-BAND SATELLITE SYSTEMS OPERATING IN NON-GEOSTATIONARY ORBIT

For the past two years, Kepler has been using information gleaned during the OneWeb processing round³ to navigate its own interference concerns. The changes proposed by the Modification are positioned to negatively affect Kepler's operations both by increasing the difficulty of uplink interference mitigation, and by increasing SpaceX's overall use of interfering Ku-band transmissions during its proposed 'initial deployment phase'. SpaceX's belated submission of the Modification the week before the Commission convened to approve Kepler's existing constellation design⁴ does not provide sufficient time for affected systems to adapt to its requests, and its approval would not comport with the spirit of equality mandated by the processing round. As a result, SpaceX should be required to shoulder the burden of any changes brought about by an approval of its late Modification, particularly those that affect the local interference environment.

In the Modification, it was claimed that "None of SpaceX's modifications will increase interference to other NGSOs, GSOs, or terrestrial wireless spectrum users"⁵. SpaceX framed their general analysis of interference to NGSO networks around the IK-NGSO-A10K-1 system, which operates in a circular orbit at an altitude of 10,355 km – nearly 6.5 times the 1,150 km altitude of SpaceX's original shell. With a reduction in altitude to 550 km (i.e. a change in separation distance between SpaceX and IK-NGSO-A10K-1 of only about 6%), SpaceX's analysis predictably shows little impact on IK-NGSO-A10K-1 operations. SpaceX uses this analysis to imply that if IK-NGSO-A10K-1 is unaffected, then so too should other Ku-band NGSO networks⁶. This is

³ See Public Notice, 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, DA 16-804, (July 15, 2016).

⁴ See November 2018 Open Commission Meeting (November 15 2018). URL: <u>https://www.fcc.gov/news-events/2018/11/november-2018-open-commission-meeting</u>.

⁵ See Modification, Legal Narrative, at 11.

⁶ See Modification, Technical Information to Supplement Schedule S, at 26; "*To assess the potential impact of the modification on an NGSO system operating in the Ku-band*, SpaceX used the characteristics of the

fallacious, and when using Kepler's system as an example of an "NGSO system operating in Kuband"⁷, the proposed altitude modification, among other things, restricts Kepler's ability to use limited uplink power to reduce interference to the SpaceX shell⁸. This is due to the fact that the SpaceX constellation would now be **below** that of Kepler's, a situation that Kepler has neither anticipated nor prepared for since the collective submission of proposals for the OneWeb processing round. This change could provide significant implications for Kepler's operations, such that new strategies would need to be developed to avoid the SpaceX satellites.

Further impacted by the altitude reduction is the fact that SpaceX satellites will have fewer beams available at any given point on Earth's surface, thus reducing their capability to mitigate interference via pointing. This could be compensated for by increasing the number of satellites in the shell, but SpaceX has chosen to do the opposite, reducing the total number by 16. SpaceX also notes that "satellites operating at low altitude see less of the Earth, requiring more satellites to serve a given area.", and yet offer no long-term answer to their reduced coverage. Kepler openly ponders whether SpaceX is planning to simply accept this reduction, or possibly alter their system in a yet-undisclosed manner to make up for the loss. SpaceX states that the reduced beamwidths achieved by the altitude reduction will "achieve more efficient re-use of spectrum resources", though fail to acknowledge that the spectrum re-use benefits of tighter beams are effectively offset by the overall reduction in coverage.

As noted in the table below, the Modification raises additional concern by seeking to introduce Ku-band frequencies for SpaceX's gateway transmissions, and retain those frequencies for the lifetime of the constellation.

IK-NGSO-A10K-1 network filed with the ITU, for a victim earth station with 35.1dBi antenna gain." (emphasis added)

⁷ See Id.

 $^{^{8}}$ A 600 km altitude reduction would increase the magnitude of received uplink transmissions by a factor of 6 dB due to free-space path loss alone.

Table 1: Comparison of SpaceX and Kepler operational frequencies. In its previous filings, SpaceX had notrequested to use Ku-band for gateway transmissions. New frequency additions are shown in bold, frequencies withincreased use have been underlined, and frequencies of no concern are colored grey.

	SpaceX Previous ⁹	SpaceX Modification		Kepler
Type of Link and Transmission Direction	Operating Frequencies (Lifetime)	Operating Frequencies (Initial)	Operating Frequencies (Final)	Operating Frequencies (Lifetime)
User Downlink (Satellite to User terminal)	10.7 – 12.7 GHz	10.7 – 12.7 GHz	10.7 – 12.7 GHz	10.7 – 12.7 GHz
Gateway Downlink (Satellite to Gateway)	17.8 – 18.6 GHz 18.8 – 19.3 GHz 19.7 – 20.2 GHz	10.7 – 12.7 GHz	10.7 – 12.7 GHz 17.8 – 18.6 GHz 18.8 – 19.3 GHz 19.7 – 20.2 GHz	10.7 – 12.7 GHz
User Uplink (User terminal to satellite)	12.75 – 13.25 GHz 14.0 – 14.5 GHz	<u>14.0 – 14.5 GHz</u>	12.75 – 13.25 GHz 14.0 – 14.5 GHz	<u>14.0 – 14.5 GHz</u>
Gateway Uplink (Gateway to satellite)	27.5 – 29.1 GHz 29.3 – 29.5 GHz 29.5 – 30.0 GHz	14.0 – 14.5 GHz	14.0 – 14.5 GHz 27.5 – 29.1 GHz 29.5 – 30.0 GHz	14.0 – 14.5 GHz

The requested use of Ku-band for SpaceX gateway transmissions would open a new avenue for potential interference to Kepler's ground stations, posing a risk to those that are located sufficiently close to SpaceX gateways to share a common downlink beam footprint. Similarly, Kepler would also be required to account for SpaceX gateways when downlinking to its own ground stations. Thus, unless SpaceX accepts all new interference incurred as a result of its request, Kepler's ability to meet its interference mitigation targets will be diminished. Furthermore, SpaceX requests to increase the scope of their communications to occur **completely** in Ku, as opposed to being distributed between Ku- and Ka-band (see Table 1). Kepler is concerned that this will further expand SpaceX's overall traffic in Ku-band, and thus compound the increasing potential for interference, especially since SpaceX has provided no indication of how long they intend to operate in this fashion. Without clarification, an approval of the Modification would give

⁹ See Space Exploration Holdings, LLC, *Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System Supplement*, File No. SAT-LOA-20170726-00110 (filed Jul. 26, 2017).

SpaceX the freedom to continue performing all operations in Ku-band for the arbitrary length of their 'initial deployment phase', and potentially allowing them to hoard the Ka-band spectrum for which they have been previously authorized.

Kepler strongly believes that it should not be forced to reconsider or adjust its own network architecture, as described in its authorization¹⁰, to compensate for any changes requested by SpaceX's Modification. Collectively for the reasons above, Kepler requests that the Commission condition an approval of the Modification on the requirement that SpaceX must accept all additional interference received as a result of the modifications proposed in full, and that it must protect all ground and space stations that would be newly victimized by the proposed changes. To do otherwise would require Kepler, and any other affected systems, to spend limited internal resources working to accommodate the untimely changes desired by SpaceX. Additionally, as explained in the comments submitted by the Commercial Satellite Spectrum Management Association (CSSMA)¹¹, the increase in the number of satellites in the region combined with the larger mass and cross-sectional area of SpaceX's satellites may require that Kepler execute more differential drag maneuvers in response to potential conjunction events, resulting in a noticeable capacity loss.¹²

II. CONCERNS REGARDING ORBITAL COLLISION RISK

The changes requested by the Modification raise concern regarding the physical environment in the 500 - 600 km region in which Kepler, and the newly proposed SpaceX shell, would operate. Kepler's position on these risks are covered in the CSSMA Comments.

For all the reasons above and those discussed in the CSSMA Comments, and absent the specified conditions listed herein, Kepler cannot agree to the changes requested by SpaceX and petitions to deny the application for Modification, as proposed. In the alternative, Kepler supports the CSSMA position to defer action on the SpaceX Modification until SpaceX provides sufficient information to mitigate the concerns raised by Kepler and the CSSMA.

¹⁰ See Kepler Communications Inc., *Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System*, Order and Declaratory Ruling, FCC 18-162 (Nov. 19, 2018).

¹¹ See Commercial Smallsat Spectrum Management Association, Comments and Petition to Defer, File No. SAT-MOD-20181108-0008, (filed Jan. 29, 2019) ("CSSMA Comments").

¹² See CSSMA Comments at 4-5, n. 15

Respectfully Submitted

/S/ Nickolas G. Spina

Nick G. Spina Director, Launch & Regulatory Affairs

CERTIFICATE OF SERVICE

I, Nickolas Spina, hereby certify that on January 29, 2019, a true and correct copy of the Comments and Petition to Defer was sent via Canada Post, first class postage prepaid, to the following:

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