

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

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services)	GN Docket No. 14-177
)	
Amendment of the Commission’s Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands)	ET Docket No. 95-183 (Terminated)
)	
Implementation of Section 309(j) of the Communications Act – Competitive Bidding, 37.0-38.6 GHz and 38.6-40.0 GHz Bands)	PP Docket No. 93-253 (Terminated)
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664
)	
To the Commission:)	

REPLY COMMENTS OF SPACEX

Space Exploration Technologies Corp. (“SpaceX”), by its counsel, hereby submits its Reply Comments regarding the Federal Communications Commission’s (“FCC” or “Commission”) *Notice of Inquiry*¹ (“*NOI*”) in the above-referenced proceedings.

I. INTRODUCTION

SpaceX, the world’s fastest growing launch services company, was founded in 2002 with the specific mission to revolutionize space technology – with particular regard to reliability, safety, and affordability. Over the past decade, SpaceX has gained worldwide attention with a series of historic milestones in space transportation and related space technologies, including its Dragon spacecraft (a highly advanced capsule capable of carry significant upmass and downmass

¹ *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, GN Docket No. 14-177, *et. al.*, Notice of Inquiry, FCC 14-154 (rel. Oct. 17, 2014) (“*NOI*”).

to and from the International Space Station (ISS)). Among its many significant commercial space initiatives, SpaceX is under a \$1.6 billion contract to NASA to fly 12 cargo supply missions to the International Space Station (ISS) (the company already has performed six consecutive successful missions to the ISS), as well as a separate contract with NASA to restore America's capability to carry astronauts to and from the ISS. SpaceX has grown to more than 4,000 employees and is headquartered in Hawthorne, California, with launch and satellite processing facilities at Cape Canaveral Air Force Station, Florida and Vandenberg Air Force Base, California, and a rocket development facility in McGregor, Texas.

SpaceX recently announced plans to extend its commitment to innovation in commercial space technologies by implementing a global network of non-geostationary orbit ("NGSO") communications satellites, which it will manufacture, launch, and operate.² In this instance, SpaceX will be a new entrant, as it was in the launch industry, seeking to provide low-cost, high-speed broadband Internet service worldwide. Operating in higher frequency bands, including the Ka-band spectrum at issue in this proceeding, this network will provide high-quality Internet access and other broadband services (including to end users in the United States). The development, construction and launch of this network will employ a large number of highly-skilled workers at a new satellite manufacturing center in the Seattle, Washington area.

The *NOI* initiates a Commission proceeding to examine and develop technical and service rules for the deployment of "Fifth Generation" ("5G") mobile radio services in bands above 24 GHz. The Commission is seeking public comments regarding the policy, licensing, sharing and technical issues associated with the development and introduction of 5G services in these higher bands. SpaceX has a direct interest in this proceeding, particularly as it pertains to

² "SpaceX To Build 4,000 Broadband Satellites in Seattle." *Space News*. January 19, 2015 (accessible at: <http://spacenews.com/spacex-opening-seattle-plant-to-build-4000-broadband-satellites/#sthash.Xsqm3Vdd.dpuf>).

access to Ka-band spectrum by NGSO satellite network operators.

II. BANDS ABOVE 24 GHZ WILL BE USED MORE AND MORE EXTENSIVELY BY SATELLITE OPERATORS

Although the Commission initially considered operational and licensing rules for satellite services in higher bands some time ago, significant deployment in Ka-band has occurred only relatively recently. In the past several years, the United States has seen widespread consumer acceptance of satellite broadband provided by Ka-band GSO FSS systems, and commercial Ka-band NGSO FSS operations have begun. Recent advances in satellite and user terminal designs promise to hasten satellite deployment in higher spectrum bands.

A. Existing and Planned Satellite Operations

The record in this proceeding firmly establishes that satellite operators – domestic and international – have launched or are developing satellite systems to operate in Ka-band frequencies above 24 GHz.³ For example, Inmarsat indicates that it has invested extensively in its I-4 satellite geostationary satellite orbit (“GSO”) network, which provides mobile broadband in the United States and internationally, and will operate Ka-band satellites as part of its “Global Xpress” high-speed broadband offering.⁴ O3b operates a network of 12 NGSO satellites with uplinks in the Ka-band and seeks to offer expanded satellite broadband connectivity in the United States.⁵ ViaSat offers the “Exede” satellite broadband service that competes in the

³ See Comments of O3b Limited, GN Docket No. 14-177 (Jan. 15, 2015) (“O3b Comments”); Comments of Inmarsat PLC, GN Docket No. 14-177 (Jan. 15, 2015) (“Inmarsat Comments”); Comments of ViaSat, Inc., GN Docket No. 14-177 (Jan. 15, 2015) (“ViaSat Comments”); Comments of EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Alta Wireless, Inc., GN Docket No. 14-177 (Jan. 15, 2015) (“EchoStar Comments”).

⁴ Inmarsat Comments at 4.

⁵ O3b Comments at 2. See Application of O3b Limited for Blanket License Permitting Operation of Up to One Thousand 1.2 Meter, One Thousand 1.8 Meter, and One Thousand 2.4 Meter Fixed Earth Stations to Communicate with its Non-Geostationary Satellite System, Call Sign E140101, File No. SES-LIC-20141001-00781 (filed Oct. 1, 2014).

United States with terrestrial alternatives.⁶ Hughes operates two GSO Ka-band satellites serving over one million users in the United States and Canada, and plans to launch an advanced Ka-band satellite in 2016 to provide 150 Gbps throughput with more than 120 spot beams.⁷

For its part, SpaceX will join the ranks of Ka-band satellite operators in the near term as it begins to test and deploy its planned NGSO satellite network. When fully deployed, this network will comprise some 4,000 small low-Earth orbit (“LEO”) satellites providing low-latency, broadband connectivity for Internet access and other services throughout the United States and the entire world. The SpaceX and the other Ka-band operator offerings are just a few of the innovative and competitive satellite applications already deployed or soon to be operational in higher frequency bands.

B. The Commission Should Ensure Adequate Spectrum for Existing and Future Satellite Requirements

As the record in this proceeding demonstrates, existing and future satellite networks share bands above 24 GHz with other satellite systems and select terrestrial services capable of effective co-frequency sharing. In the Ka-band, for example, the Commission determined that Local Multipoint Distribution System (“LMDS”) networks can operate co-frequency with certain satellite feeder links and the satellite operations can be conducted on a secondary basis in primary LMDS spectrum. While accepting appropriate sharing, satellite interests ask that the Commission ensure adequate spectrum for existing and future satellite requirements as it considers possible 5G services in these higher bands.

⁶ ViaSat Comments at 3.

⁷ EchoStar Comments at 3-4.

ViaSat’s Exede broadband service, for example, is “based on reliable access to a core segment of Ka-band spectrum” and also relies on “opportunistic” access to other portions of the Ka-band originally designated for other technologies.⁸ In this proceeding, ViaSat urges the Commission “to consider a regulatory framework that would facilitate” these types of spectrum sharing between satellite networks and with terrestrial operations.⁹

EchoStar states that the “future of satellite broadband is bright,” and that the Commission should “ensure that the Ka-band continues to remain available for the growing needs of the satellite community and their users.”¹⁰ O3b writes that “incumbent satellite services above 24 GHz are on a strong growth trajectory.”¹¹ Accordingly, the instant proceeding for possible 5G services, or any other proceeding, needs to assess the compatibility of any 5G services with the “continued growth and expansion” of incumbent satellite services in these bands.¹² Similarly, the Satellite Industry Association (“SIA”) asks that the Commission “carefully consider” the potential impact on incumbent satellite services in bands above 24 GHz from possible sharing with new 5G services, noting the direct impact that shared use can have on both current and future services.¹³

SpaceX echoes these observations; however, the language of the *NOI* also speaks in terms of considering the spectrum needs of existing services in these higher bands. Specifically,

⁸ ViaSat Comments at 3.

⁹ EchoStar Comments at 12.

¹⁰ *Id.* at 17, 18.

¹¹ O3b Comments at 4.

¹² *Id.* at 10.

¹³ Comments of Satellite Industry Association, GN Docket No. 14-177 (Jan. 15, 2015) (“SIA Comments”), at 9.

the Commission notes that it must carefully consider the characteristics of any technology that “might coexist without impact on incumbent services that occupy the relevant frequency bands.”¹⁴ Moreover, as emphasized by the Commission, any adopted 5G policies should “accommodate the widest possible range of technologies and uses, including compatibility with incumbent services.”¹⁵

SpaceX fully agrees with these commenters that the Commission must ensure that any new allocation and service designation decisions enable existing and planned services to flourish and expand in a shared-spectrum environment. SpaceX notes that even in satellite uplink bands there are potential challenges to sharing between intensive, high-power terrestrial operations and satellite services. Not only do satellite earth station uplink operations have the potential to cause interference into terrestrial receive antennas, but aggregate interference from terrestrial operations could adversely impact satellite receive operations. These effects are particularly important to consider in the context of NGSO operations, where steerable earth station transmit antennas would have a wider geographic impact and significantly lower satellite altitudes magnify the impact of aggregate interference from terrestrial transmissions. While spectrum sharing between some terrestrial and satellite operations remains possible in appropriate circumstances, the Commission should remain cognizant of technical and operational differences between services that may effectively limit sharing opportunities.

III. FCC SHOULD PRESERVE THE ABILITY OF NEW SATELLITE ENTRANTS TO UTILIZE KA-BAND SPECTRUM

SpaceX urges the Commission to preserve the ability of new satellite entrants to use higher frequency bands, including Ka-band spectrum. As the comments from the satellite

¹⁴ *NOI* at ¶ 17.

¹⁵ *Id.*

operators have shown, the Ka-band is a critical resource for FSS operations in the United States and throughout the world. New satellite network operators, such as SpaceX, will also rely on Ka-band spectrum to bring added competition, innovation and new services to users. Accordingly, SpaceX urges the Commission to consider new satellite entrants in the Ka-band and avoid taking steps in the instant proceeding that might otherwise create barriers to entry into the band.

A. Enhancing Competition and Innovation Should Drive FCC Policy Considerations for Ka-band

Enhancing competition and innovation are two fundamental policy goals long-held by the Commission because they result in lower costs and new service applications for consumers. Nowhere is this more true than in the Ka-band. As described above, the existing satellite network operators commenting in this proceeding explain how they are continuing to expand satellite infrastructure with new capabilities to provide more and better services to the public. These commenters are careful to point out that the Commission's proceeding regarding 5G services should consider the potential impact on current and future services by existing satellite network operators in the Ka-band.

New satellite entrants in the Ka-band will similarly enhance competition and innovation, and thereby bring better and more efficient services to users at lower cost. In short, new satellite entrants should have equal access to spectrum in the Ka-band as existing operators. New satellite operators, such as SpaceX, must have meaningful opportunities to access Ka-band frequencies and should be fully considered in any 5G sharing proposals along with existing users.

B. The Commission’s Policies Should Continue To Facilitate Entry of New Ka-band Satellite Service Providers

As noted previously, SpaceX has announced plans to deploy a large NGSO satellite network operating in multiple satellite frequency bands, including the Ka-band, to provide broadband Internet access to fixed and mobile users in the United States and abroad. Extensive Ka-band GSO operations have been conducted in the United States for years, and limited Ka-band NGSO operations have been permitted in the United States pursuant to waivers based on findings that these operations can accommodate future entrants.¹⁶

While technical and regulatory approaches exist to facilitate sharing between GSO and NGSO Ka-band operations, as well as other incumbent services, the Commission should remain mindful of the impact that changes to the current operational circumstances and sharing proposals may have on future entrants. For example, protection of incumbent satellite operators in the Ka-band from interference by possible 5G services is important, but should not undermine new satellite entrants in the Ka-band. In addition, further expansion of limited Ka-band NGSO operations via waiver should not be afforded priority over or be allowed to limit or preclude new entrants. SpaceX therefore urges the Commission to fully analyze and consider new Ka-band satellite entrants and ensure that intra-service and inter-service sharing mechanisms, as well as processing of further Ka-band satellite market access requests, accommodate new service providers.

¹⁶ See Application of O3b Limited for Authority to Operate Earth stations Aboard Maritime Vessels to Communicate with its Non-Geostationary Satellite System, Call Sign E1300198, File No. SES-LIC-20130528-00455. See also Application of O3b Limited for O3b Limited for Authority to Operate a Gateway Earth Station in Haleiwa, Hawaii with its Non-Geostationary Ka-Band Satellite System, Call Sign E100088, File No. SES-LIC-20100723-00952 (granted Sept. 25, 2012) and Application of O3b Limited for O3b Limited for Authority to Operate a Gateway Earth Station in Vernon, Texas with its Non-Geostationary Ka-Band Satellite System, Call Sign E130021, File No. SES-LIC-20130124-00089 (granted June 20, 2013).

IV. CONCLUSION

Comments in this proceeding evidence the extensive and growing use of frequency bands above 24 GHz by satellite operators, particularly in the Ka-band. However, in any consideration of introducing 5G services into these bands, the Commission is urged to take into account new satellite entrants and not just incumbent satellite operators and their existing or planned operations. SpaceX is committed to introducing a new NGSO network in the Ka-band, further enhancing competition and innovation for satellite services. Any adopted 5G policies should contemplate the continued march of innovation and new entrant business models so as to enhance competition and expand consumer choices in the Ka-band.

Respectfully submitted,

**SPACE EXPLORATION TECHNOLOGIES
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February 18, 2015¹⁷

¹⁷ These Reply Comments are being submitted on February 18, 2015 due to the closing of the Commission for inclement weather on February 17, 2015, the scheduled filing date.