Before the
U.S. DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, D.C. 20230

In the Matter of	)	NTIA Docket No. 230308-0068
Development of a National Spectrum Strategy	)	Docket NTIA-2023-0003

COMMENTS OF SPACE EXPLORATION HOLDINGS, LLC

Networks of the future present a welcome opportunity to rethink spectrum policies and regulations to bring high-speed, low-latency connections to anyone, anywhere, using any technology available. Our policies should recognize that American consumers do not care what technology delivers their connection, so long as they have quality service. While existing expectations of fast speeds, low latency, and high reliability should remain, next-generation wireless technologies will advance complementary aims of truly global coverage, sustainability, and secure communications. A spectrum framework for the future can best facilitate these objectives by emphasizing operational flexibility and technological-neutrality in spectrum access and management, as well as enabling efficiency-focused sharing frameworks to maximize use of limited spectrum resources.

NTIA is showing forethought and vision in crafting a National Spectrum Strategy and SpaceX provides these comments in response to ensure that the strategy encompasses all next-generation technologies that can benefit the American public.[1] Next-generation satellite networks are central to NTIA's proposed pillars for spectrum planning and management, encompassing

[1] *See* Development of a National Spectrum Strategy, 88 Red. Reg. 16,244 (Mar. 16, 2023) ("NTIA RFC").

every consumer, industry, and federal service that NTIA lists for continued and future spectrum use. America's wireless capabilities extend to space and next-generation satellite systems will drive future spectrum initiatives throughout the next decade and beyond.

I. CONSUMERS DEMAND HIGH-QUALITY, UBIQUITOUS COVERAGE THAT WILL LEVERAGE ALL NEXT-GENERATION WIRELESS TECHNOLOGIES

NTIA's National Spectrum Strategy provides an opportunity to rethink how spectrum resources can be put to their highest and best use to meet the growing demands of consumers and businesses.[2] Through the use of new technologies and the application of forward-looking policies, historic divisions between transmission technologies, unlicensed or licensed uses, and federal or commercial allocations have been reduced or eradicated entirely in many instances. Sharing regimes and policies that create incentives for efficient operations improve the possibilities for co-existence between services and operators. While some band allocations may be particularly challenging for inter-service operations, others provide promising opportunities for sharing, as already demonstrated by the multiple co-allocated spectrum bands today. Meeting the needs of today's consumers will require inter-service reforms and requirements that incentivize individual operators to deploy efficient systems that optimize use of scarce frequencies.[3]

Next-generation satellite operations require access to spectrum to serve consumers. Growing consumer demand for next-generation satellite systems, such as SpaceX's constellations, is increasing the need for adequate spectrum to facilitate broadband access. Next-generation satellite systems now provide a service for commercial and federal customers that matches

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[2] *Id.*

[3] *See, e.g.*, Petition for Rulemaking, Revision of Section 25.261 of the Commission's Rules to Increase Certainty in Spectrum Sharing Obligations Among Non-Geostationary Orbit Fixed-Satellite Service Systems, FCC Docket No. RM-11855 (Apr. 30, 2020) (suggesting simple amendment to existing spectrum sharing provisions for satellite operators that would give the more spectrally efficient system first choice of spectrum during interference events).

terrestrial networks and provides service virtually anywhere on the planet. Satellites services enable both fixed and mobile use cases, and can operate as a standalone service or as high-capacity backhaul for other technologies, including terrestrial fixed and mobile networks.[4] But to provide this great diversity of high-quality services, next-generation satellite networks must have access to adequate spectrum not only to connect end users, but also for both robust backhaul services for gateway earth stations that interconnect with the rest of the Internet.[5]

Next-generation satellite operators like SpaceX have already deployed services that use several globally harmonized, high-band frequencies designated for fixed satellite use. These include the 10.7-14.5 GHz ("Ku-band") and 17.3-30.0 GHz ("Ka-band") frequency ranges that the FCC has licensed on a shared basis to satellite operators through multiple processing rounds.[6] Several satellite systems have also been authorized for, and are deploying, services that will utilize the 37.5-51.4 GHz band ("Q/V-band") to expand backhaul link capacity to meet ever-increasing consumer demand.[7]

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[4] See, e.g., *Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) ("*Gen2 Order*"); SpaceX Services, Inc. IBFS File Nos. SES-LIC-20210803-01360, SES-LIC-20210803-01361 June 30, 2022); Application for Modification of Authorization for the SpaceX Gen2 NGSO Satellite System to Add a Direct-to-Cellular System, IBFS File No. SAT-MOD-20230207-00021 (Feb. 7, 2023); Application for Modification of Authorization for the SpaceX Gen2 NGSO Satellite System to Add a Mobile-Satellite Service System, IBFS File No. SAT-MOD-20230207-00022 (Feb. 7, 2023)

[5] *See* Remarks of Commissioner Geoffrey Starks at the Open Technology Institute Event, "LEO Satellite Constellations: Why Smart Sharing Rules Matter in Space" (Oct. 25, 2022), *available at* https://www.fcc.gov/document/starks-remarks-open-technology-institute-ngso-satellite-event (noting that satellite networks "can even improve the reach of terrestrial broadband networks, through satellite backhaul and, perhaps one day soon, base stations flying low-earth orbit"); *see also* Lluc Palem, *Satellite's Window of Opportunity in Backhaul and 5G*, VIA SATELLITE (May 25, 2021), https://interactive.satellitetoday.com/satellites-window-of-opportunity-in-backhaul-and-5g/.

[6] *See Cut-off Established for Additional NGSO FSS Applications or Petitions for Operations in the 10.7-12.7 GHz, 12.75-13.25 GHz, 13.8-14.5 GHz, 17.7-18.6 GHz, 18.8-20.2 GHz, and 27.5-30 GHz Bands,* Public Notice, FCC Docket No. DA 20-325 (IB Sat. Div. 2020).

[7] *See Cut-off Established for Additional NGSO-like Satellite Systems in the 37.5-40.0 GHz, 40.0-42.0 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz Bands*, Public Notice, FCC Docket No. DA 21-941 (IB Sat. Div. 2021).

But to help alleviate congestion in these crowded shared bands and provide more opportunity for consumer services, SpaceX has been looking toward even higher frequency bands, developing cutting edge technology that can spectrum that didn't seem feasible for satellite use in the past. Specifically, SpaceX has applied to use the 71-76 GHz and 81-86 GHz bands (the "E-band"), and has already begun to deploy and operate satellites using E-band spectrum pursuant to special temporary authority.[8] In doing so, SpaceX has leveraged the high-gain, narrow "pencil beam" nature of E-band links to design gateway earth stations that can coexist efficiently with terrestrial earth stations in the band using minimal separation distances and common frequency coordination techniques.

Beyond technical innovation, the efficient operations in E-band enable innovative, multi-service licensing frameworks, such as "unified light-licensing." In a unified light-licensing framework, operators receive a nationwide, non-exclusive license to operate in a frequency band, and then register their equipment (e.g., fixed links or gateways) on a first-come, first-served basis through a shared public database, which conducts an automated frequency analysis to determine whether a new deployment will cause harmful interference to earlier-in-time deployments or federal deployments. If the new deployment passes those automated checks, then the operator may immediately deploy to serve consumers, dramatically reducing the time to deployment compared to traditional site-by-site coordination and licensing. The unified light-licensing approach in E-band can serve as a proof of concept to create more flexible sharing regimes between fixed and satellite services in other millimeter wave ("mmW") and terahertz ("THz") bands with similar properties.

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8 *See Gen2 Order* at ¶¶ 67-69.

Moreover, next-generation satellite operators are working to make better and more efficient use of mobile satellite service ("MSS") frequencies, particularly in the 137-460 MHz ("VHF-band"), 1-2 GHz ("L-band"), and 2-4 GHz ("S-band") frequencies. Over the past few decades, these bands have been under-used because access to the frequencies was allowed to atrophy to only a single operator per band, despite clear policies designed to ensure these bands were shared. These frequencies represent untapped opportunities for new entrants to usher in a new generation of expanded mobile services for consumers.

Demand for satellite services is growing rapidly as consumers seek more broadband connectivity options.[9] In its two years of offering commercial service, SpaceX already serves over 1.3 million consumers globally.[10] A new national spectrum policy should ensure that the foundational spectrum bands for next-generation satellite services (Ku, Ka, Q/V) are maintained. These bands have spawned a new golden age in space-based communications, with next-generation satellite licensees having deployed at an unprecedented pace. SpaceX alone has already launched 4,200 satellites that provide high-quality, low-latency broadband service to people, businesses, and public entities that would otherwise be without these services. And while next-generation satellite systems are designed to share spectrum, in some cases inter-service sharing may be technically infeasible or practically inadvisable. For example, in traditional shared satellite bands such as the downlink Ku-band (10.7–12.7 GHz)—which satellite operators rely to provide high-quality end-user service—permitting high-power, outdoor terrestrial networks would drown out satellite signals and deprive American consumers of an essential option for broadband

9 *See Communications Marketplace Report*, FCC 22-103, ¶ 6 (2022) (approximately 98% of all satellite launches in 2021 were deployed into low-Earth orbit to provide internet connectivity); *see also State of the Satellite Industry Report,* SATELLITE INDUSTRY ASSOCIATION (June 29, 2022), available at https://sia.org/commercial-satellite-industry-growing-as-it-continues-to-dominate-expanding-global-space-business-sia-releases-25th-annual-state-of-the-satellite-industry-report/.

10 *See generally Starlink Resources*, SPACEX (last updated Feb. 26, 2023), https://www.starlink.com/resources.

connectivity.[11] Meanwhile, the nearby 12.7–13.25 GHz band provides the same beneficial propagation characteristics without creating an untenable interference environment for existing satellite operations that will harm Americans. Unlike the 10.7–12.7 GHz band, co-existence appears feasible in the 12.7–13.25 GHz band and has robust support from the wireless industry, satellite broadband providers, hardware developers, and satellite television programmers. The best way to promote productive use of these high frequencies is to adequately protect proven services, while identifying opportunities for spectrum access where it is technically feasible.

To meet the consumer demand of tomorrow, satellite operators are now developing antennas that will provide even greater capacity through extremely high frequency bands. These innovations will enable previously unusable spectrum bands to reach even more consumers with even higher quality broadband service, without reallocating spectrum from other services. Specifically, operators are exploring how the tight beams of terahertz ("THz") frequency bands (e.g., 75-110 GHz ("W-band") and 110-170 GHz ("D-band")) can further enhance connectivity to support end users. As with E-band frequencies, these new operations are being developed with spectrum sharing at the forefront to facilitate efficient coexistence between and among satellite and terrestrial uses within the bands.

[11] *See, e.g.*, Letter from David Goldman to Marlene H. Dortch, WT Docket No. 20-443 and GN Docket No. 17-183 (Oct. 4, 2022) (discussing and attaching independent report of SAVID LLC, which validated below-referenced technical study); Letter from Jayson L. Cohen to Marlene H. Dortch, WT Docket No. 20-443 and GN Docket No. 17-183 (Sept. 16, 2022) (discussing technical study finding terrestrial mobile services will cause significant service degradation); Letter from David Goldman to Marlene H. Dortch, WT Docket No. 20-443 and GN Docket No. 17-183 (June 21, 2022) (discussing and attaching technical study finding significant interference to NGSO operations from proposed terrestrial mobile service); Letter from Brian D. Weimer to Marlene H. Dortch, WT Docket No. 20-443 and GN Docket No. 17-183 (Oct. 7, 2022) (same); Comments of Space Exploration Holdings, LLC, WT Docket No. 20-443 and GN Docket No. 17-183 (May 7, 2021); Comments of OneWeb, WT Docket No. 20-443 and GN Docket No. 17-183 (May 7, 2021); Reply Comments of Space Exploration Holdings, LLC, WT Docket No. 20-443 and GN Docket No. 17-183 (July 7, 2021); Reply Comments of Kepler Communications Inc., WT Docket No. 20-443 and GN Docket No. 17-183 (July 7, 2021).

The unique propagation characteristics and narrow beams employed on these THz frequency bands will support innovative and flexible sharing frameworks to maximize the productive use of these frequencies. For example, many sub-bands between 100 and 200 GHz may support bidirectional backhaul transmissions from earth station gateways, despite being currently allocated for downlink transmission. Flexible allocations in these bands will help support innovation in these bands.[12] The United States leads the world in adopting allocations that provide needed services to American consumers, and has already recognized the benefits of accepting non-conforming uses where co-existence is feasible and will not cause harmful interference.[13] These THz frequency bands present an opportunity for innovative new sharing frameworks, such as unified light licensing, that can establish flexible operating bands for high-capacity, low-latency backhaul transmissions to and from Earth.

Remaining at the forefront of developing and exploring additional frequency opportunities will ensure that American satellite operators can keep pace with growing and evolving consumer demand, driving new services and capabilities that promote consumer adoption, access, and use anywhere in the country. In particular, the national spectrum strategy should consider additional lower THz frequencies, such as frequencies above 200 GHz. As next-generation mobile networks evolve, additional lower-band spectrum may also prove useful for providing adequate service coverage for an expanding mobile broadband ecosystem, including for internet-of-things ("IoT") devices.

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12 *See generally* 47 C.F.R. § 2.106.

13 *See, e.g.*, *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, 7 FCC Rcd. 6886 (1992); *Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59)*, 17 FCC Rcd. 1022 (2002); *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, 29 FCC Rcd. 6567 (2014); *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services et al.*, 31 FCC Rcd. 8014 (2016); *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, 32 FCC Rcd. 10988 (2017); *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, 35 FCC Rcd. 2343 (2020).

Satellite connectivity is crucial for next-generation networks and emerging technologies. Dramatic improvements in launch services and satellite technology have made it possible, for the first time, for satellite providers to reach economies of scale and serve as a critical component of next-generation networks. Just as terrestrial providers are deploying millions of new antennas for densified networks to meet urban demand, next-generation satellite operators like SpaceX satellite constellations are rapidly deploying densified satellite constellations to extend the reach of high-capacity, low-latency broadband service for both fixed and mobile off-the-shelf user devices, as well as IoT devices,[14] to every corner of the globe.[15] Additionally, satellite-enabled networks provide dynamic topologies for satellite-based routing—including via optical inter-satellite links—that contribute additional levels of redundancy and enhanced security previously been unattained by broadband networks.

SpaceX is leading the way for next-generation satellite connectivity, completing the fastest ever deployment of a high-speed, low-latency nationwide network. The ability for next-generation satellite networks to innovate and deploy at a similar rate as terrestrial services enables more expansive, integrated future networks that can reach consumers in exciting new ways. Satellite-enabled networks will augment network capabilities at every point of the communications architecture by providing complementary end-user coverage and capacity, enhanced core functions and redundancies, and also robust, reliable backhaul where or when terrestrial backhaul is unavailable. Recent cellular standards make clear that modern network architectures will utilize

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14 *See* Public Notice, 36 FCC Rcd. 14264 (IB 2021) (confirming authority for Swarm, a company authorized to deploy and operate NGSO satellites for narrowband IoT services, transfer of control to SpaceX).

15 *See Gen2 Order* at ¶ 1 (initially authorizing 7,500 satellites as part of a second-generation NGSO system to complement SpaceX's existing deployment); *Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018) (authorizing SpaceX to construct, deploy, and operate its first-generation NGSO system; *see also Space Exploration Holdings, LLC*, IBFS File No. SAT-AMD-20230207-00021 (filed Feb. 7, 2023) (requesting a modification of SpaceX's second-generation NGSO system authorization to deploy direct-to-cellular mobile satellite service).

multiple, heterogeneous technologies as part of a unified ecosystem for rapidly deploying, enhancing, and securing broadband connectivity. The common denominator in these next-generation network architectures is the increased reliance on satellite networking to facilitate numerous network functions, delivering service to Americans no matter where they are located.

Adequate spectrum access is critical to accomplishing each of these multi-faceted objectives for next-generation networks and technologies. Sufficient satellite spectrum is no longer a standalone objective; satellite access will augment the coverage and capacity constraints of all modern networks—fixed and mobile—to maximize consumer reach and value. Regulators and policymakers have taken necessary initial steps to realize these objectives by exploring expanded co-primary satellite allocations, such as the 17.3–17.8 GHz band, to harmonize with existing international allocations,[16] as well as recognizing emerging ecosystems that can expand the reach of terrestrial networks through direct-to-device communication using the existing flexible-use licenses of the terrestrial operators.[17] These innovative approaches to spectrum access and sharing should continue as next-generation networks and emerging technologies continue to develop.

Satellite operations promote public interest aims. A national spectrum strategy should promote widespread, intensive, and low-cost services; accelerate connectivity for unserved and underserved areas; and enable global interoperability. SpaceX is leading the charge of next-generation satellite operators enhancing urban connectivity, while also reaching the most remote and unserved portions of the country. This includes high-speed, low-latency broadband to numerous tribal lands, including the areas of the Hoh Tribe, Navajo Nation, Cherokee Nation,

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[17] See *Single Network Future: Supplemental Coverage from Space*, FCC Docket No. 23-65 (rel. Mar. 17, 2023).

Choctaw Nation, and working to deploy service to numerous Federally-recognized Tribes in Alaska.[18] SpaceX is also expanding its deployments to schools and libraries around the globe to ensure education is an accessible and attainable opportunity for people everywhere.[19] These services also provide broader connectivity hubs for communities striving to keep pace with the digital world, providing telehealth services that can increase health equity, telework opportunities for the workforce, and business opportunities through participation in the digital economy.[20]

Moreover, next-generation satellite operators like SpaceX are rapidly deploying these cost-effective services without the need to dig trenches or build towers. Rather, SpaceX's densified constellation enables space-based connectivity anywhere, filling critical coverage gaps when natural disasters, energy outages, and other crises render terrestrial networks unavailable. At those critical times, satellite connectivity becomes essential for first responders, law enforcement officials, and military personnel to connect with people who require assistance through critical public safety functions. And because next-generation satellite systems can quickly provide high-quality broadband service to anyone, no matter where they are, they help achieve these public interest aims quickly and efficiently.

Efficiency promoting spectrum sharing designs will best serve consumers. As the past few years have demonstrated, people need ubiquitous connectivity. It has become clear that this level of access will require a wide variety of technologies to address the wide array of

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18 *See, e.g.*, Press Release, Office of Governor Steve Sisolak, Governor Sisolak, Inter-Tribal Council of Nevada Announce $18 Million Award to Expand Internet Access to Nevada Tribal Communities (Aug. 26, 2022); *Cococino County Leads Effort to Bring Starlink to Navajo Nation Students*, SOUTHERN UTAH NEWS (Aug. 3, 2022); Newsletter, Nooksack Indian Tribe, Noocksack Partners with SpaceX's Starlink Program for Community Broadband (Mar. 2021); Michael Kan, *Native American Tribe Gets Early Access to SpaceX's Starlink and Says It's Fast*, PC MAG (Oct. 8, 2020).

19 *See Connecting the Unconnected*, SPACEX (last updated 2023), https://www.starlink.com/connecting-the-unconnected.

20 *Id.*

circumstances people may find themselves in. Many of the next-generation technologies filling those gaps fundamentally depend on spectrum. And those use cases, in turn, require different, and more flexible, regulatory and policy approaches to get the most out of this scarce natural resource.

To these ends, spectrum sharing should encompass all operating scenarios, including satellite uses that operate on shared spectrum allocations. Increasingly, heterogeneous next-generation networks can effectively share without the default to "vacate, compress or repack some portion of their systems or current use."[21] In fact, well-defined sharing rules can maximize efficient frequency use by new entrants while protecting incumbent operators from harmful interference. For example, sophisticated next-generation networks employ mechanisms such phased arrays that employ narrow, steerable beams through advanced beam scheduling protocols. Similarly, the high-gain, narrow propagation characteristics of links in millimeter wave frequency bands, such as E-band, allow terrestrial fixed and satellite operators to coexist within close physical proximity using traditional frequency coordination techniques, maximizing the productive use of the bands.

A new national spectrum policy should push past outdated, inefficient, and inflexible constraints, such as command-and-control regulatory regimes that stifle the ability to rapidly innovate and improve service for consumers. For example, for satellite operations, the equivalent power flux-density limits between NGSO and GSO networks exemplify these constraints and have been repeatedly shown to be inefficient and overly conservative, imposing needlessly rigid restrictions on next-generation satellite services and negatively impacting the ability to serve consumers. Satellite systems are vastly different in design and operational capabilities than the systems that were considered when these EPFD limits were developed nearly twenty-five years

21 *See* NTIA RFC at 16,246.

ago. Technological innovation has culminated in systems with smaller spot beams, adaptive modulation, and frequency re-use that enable more efficient utilization of shared frequency bands and more resilience to both co-channel and adjacent band interference. These efficiencies present an opportunity to establish policies and regulations that are as innovative as the technologies they govern. In particular, EPFD limits can be updated to reflect modern operating circumstances to increase competition and service quality for consumers of NGSO operators, while maintaining protections for GSO operators. ITU proceedings for the Q- and V-bands have provided a roadmap for new policies that strike the right balance, and can be tailored for other bands such as the Ka- and Ku-bands.[22]

Additionally, policies and regulations can create incentives for operators to implement spectrally efficient designs that optimize co-frequency operations between different services, as well as among operators of the same service. One mechanism to drive this race to the top for spectral efficiency is to prioritize spectrally efficient systems in accessing available spectrum or in resolving interference disputes. By incentivizing systems to accommodate sharing with other operations and commit to maximizing use of scarce spectral resources, regulators and policymakers can facilitate more robust federal and non-federal sharing arrangements. These efficiency-enhancing aims extend to federal systems, where spectrally efficient designs can enhance data capacity for federal users while ensuring adequate protection from commercial uses designed for co-existence.

[22] *See* ITU, Resolution 770, *adopted at* ITU-RR 22.5M; *see also* Recommendation ITU-R S.2131-1 (2022); Recommendation ITU-R S.1323-2 (2002).

II. By Embracing Technological Neutrality, Long-Term Spectrum Plans Can Best Serve Consumers

The Spectrum Coordination Initiative presents a unique opportunity to harmonize strategy for long-term spectrum planning. The public and private sector are utilizing wireless technologies in ways never envisioned even a few years ago. Meanwhile, several promised use cases have failed to materialize as certain aspirational claims by industry have failed to translate into actual capabilities. This dichotomy should serve as a point of reference for long-term spectrum planning, demonstrating that committing to a single path may needlessly restrict innovation, lead to under adoption or, even worse, contribute to sub-optimal technological lock-in. Instead, federal and non-federal stakeholders should embrace technology-neutral policies that allow consumers to decide for themselves what technology best meets their needs.

Recent business and policy decisions illustrate the need to focus on long-term spectrum planning around consumers. For example, recent actions have focused entirely on uplink speeds that consumer applications do not require, while ignoring opportunities to encourage more dynamic infrastructure that enhances consumer access to high-speed broadband. Similarly, while operators and vendors long focused on a ubiquitous ecosystem of connected things, this emphasis overlooked a major consideration—coverage range. By transitioning to a consumer-first approach, these pitfalls can be avoided so that opportunities never before imagined in previous network generations can rise to the fore.

Locating adequate spectrum to facilitate these innovations will be a continuous process as America's technological and policy objectives develop over the next decade. As a starting point, frequencies for some legacy wireless technologies should be examined to determine if they can be repurposed for more efficient next-generation technologies, as was the case with 2G and 3G spectrum now supporting 4G, 5G and even 6G plans. Additionally, operators and federal users alike should demonstrate and confirm that prior claims of spatial, temporal, or frequency reuse capabilities are both being employed and have merit.[23] Operators should also confirm that they are in fact building out the services as they said they would and that they are making capital investments needed to transform theoretical claims into practical service realities. And finally, all users should demonstrate efficient adjacent band operations, including maintaining adequate receiver and antenna standards as part of modern network deployments.[24] Together, these considerations will provide a fruitful foundation for identifying additional allocations and capabilities to enhance the consumer experience for broadband over the next decade and beyond.

III. Straightforward Spectrum Access Designs, Such as Light-Licensing, Can Optimize Co-Existence of Next-Generation Services for Consumers

Different spectrum bands enable different regulatory frameworks to expand the capacity and usability of limited frequency resources. While dynamic and predictive sharing models may eventually prove fruitful for managing low-band frequencies, operations in higher frequency bands enable simpler sharing frameworks that are already succeeding and can be extended. In many satellite bands, particularly frequencies above 30 GHz, rules that allow all operators—irrespective to technology—to coordinate through a common, self-coordinated sharing framework can ensure rapid deployment of, and efficient co-existence between, co-primary broadband services.

Dramatic innovations in satellite technology now allow next-generation satellite operators to plan systems of scale that dramatically increase broadband capacity, while implementing

[23] *See, e.g.*, DISH Network Corp., *DISH Network Corporation 5G Buildout Status Report*, WT Docket No. 22-212, 6-7, Attachment A (filed July 14, 2022), *available at* https://www.fcc.gov/ecfs/document/10714418910058/1; *see also* Mitchell Clark, After Three Months, *Dish's 5G Service Still Feels Like a Beta*, The Verge (Sept. 27, 2022), https://www.theverge.com/2022/9/27/23373064/dish-project-genesis-5g-accounts-service.

[24] *See Promoting Efficient Use of Spectrum through Improved Receiver Interference Immunity Performance*, FCC Docket No. 22-137, Policy Statement, FCC-CIRC2304-01 (circulated Mar. 30, 2023).

cutting-edge, spectrally efficient designs to achieve intensive frequency reuse. SpaceX is setting the industry standard through independently steerable spot beams and satellite diversity to promote flexible co-existence with other uses, even in crowded spectrum settings. These efficiencies are particularly pronounced in upper frequencies that are defined by high-gain directional links, where the long-standing view has been that the public interest is served through efficient, automated processes for licensing.[25] Spectrum access regimes that reaffirm this versatility through simple, technology neutral, and administratively efficient licensing designs can reduce barriers to deployment of spectrally efficient services that enhance the consumer experience.

To maximize spectrum efficiency, the FCC's "light-licensing" system should be expanded to encompass a broader array of services, including individually licensed earth stations and fixed links for satellite operations.[26] For example, a unified regime in the 70/80 GHz band that employs database-assisted, light-licensing for terrestrial and satellite services will maximize value of these frequency bands for consumers. A unified design that uses software-defined, technology neutral, and semi-automated processes will enable a light-touch approach to spectrum management that facilitates faster deployments of welfare enhancing services, while maintaining adequate interference protections for existing operations that consumers rely on. This design can also be extended to nearby high-frequency bands that operators will access by employing "pencil beam" links through modern antenna architectures.[27]

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[25] *See Allocations and Service Rules for the 71–76 GHz, 81–86 GHz, and 92–95 GHz Bands*, 18 FCC Rcd 23318, ¶¶ 44-45 (2003).

[26] *See Allocations and Service Rules for the 71–76 GHz, 81–86 GHz, and 92–95 GHz Bands*, 20 FCC Rcd 4889, ¶ 19 (2005); *see also Modernizing and Expanding Access to the 70/80/90 GHz Bands*, 35 FCC Rcd 6039 (2020).

[27] *See, e.g.*, Comments of Space Exploration Technologies Corp., WT Docket Nos. 20-133 and 10-153, at 1-3 (Dec. 2, 2021).

In a light-licensing model, both fixed service installations and individually licensed earth stations share a common, public database of installations, featuring the technical parameters of each deployment. All licensees would register links or non-terrestrial gateways on a first-come, first-served basis, subject to a common fee structure. Using this database, each new applicant could input the technical specifications of its proposed installation and, through rapid, semi-automated interference analysis, determine whether it will cause harmful interference to existing stations or can proceed with registration. This simplified registration process would avoid unnecessary complexities, while enabling next-generation satellite operators to quickly deploy and maximize co-existence with other co-primary services.

A unified design can also accommodate and protect federal uses, facilitating more rapid federal coordination between proposed installations and co-frequency federal operations, such as radio astronomy sites and military installations. To speed coordination, a unified database could expand the existing "green light" / "yellow light" checks against the NTIA database to incorporate satellite gateway earth stations.[28] Again, this design would provide instant certainty, expediting deployment for motivated next-generation satellite systems and reducing administrative burdens for staff that review applications.

CONCLUSION

A well-designed national spectrum strategy will support continued and emerging wireless technologies over at least the next decade. Next-generation satellite networks will be central to these objectives and should be treated as a comprehensive and robust service as NTIA evaluates its proposed pillars for spectrum access, management, and protection. SpaceX looks forward to

[28] *See* 47 C.F.R. §101.1523; *see also* Developing a Sustainable Spectrum Strategy for America's Future, 83 Fed. Reg. 65,640 (Dec. 21, 2018).

continued engagement with NTIA, the FCC, and other federal partners, as well as non-federal stakeholders to transform these policy objectives into service deployments that benefit the American people.

Respectfully submitted,

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April 17, 2023