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

In the Matter of	)	
	)	
Modernizing Spectrum Sharing for Satellite Broadband	)	SB Docket No. 25-157
	)	

REPORT AND ORDER

Adopted: April 30, 2026 **Released: May 1, 2026**

By the Commission: Chairman Carr and Commissioner Trusty issuing separate statements.

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I. INTRODUCTION

1. As satellite broadband rapidly matures into an integral and integrated communications technology, the Federal Communications Commission (Commission) must aggressively update its rules to ensure Americans reap the abundance of innovation and investment by the space industry.[1] In this Report and Order, we revise the decades-old framework for how Geostationary Orbit (GSO) and Non-Geostationary Orbit (NGSO) systems share spectrum. Our legacy rules have significantly limited the ability of operators to deliver high-speed, low-latency broadband services to consumers. Until now, NGSO operators' power levels have been restricted by Equivalent Power Flux Density (EPFD) limits developed in the late-1990s to protect GSO satellites.[2] Such EPFD limits were based on theoretical designs for NGSO systems of that era, long before modern advancements were developed for the NGSO constellations currently in orbit. The consequence today of applying such EPFD limits in the United States is that operators must overprotect GSO systems. The cost of this government-imposed overprotection is that American households and businesses—most critically in rural and remote areas—do not receive the fastest space-based broadband American innovation has available.

2. The benefits of our changes today may total well over $2 billion,[3] with capacity increases of 100% to 700% possible using the same number of in-orbit NGSO satellites.[4] Allowing for more intensive spectrum use brings satellite broadband providers closer to the milestone of delivering *gigabit* service from space—a feat unimaginable only a few years ago. Such capability will bring greater competition to the broadband marketplace as space-based connectivity reaches speeds and latency similar to that of terrestrial fiber. And by reducing the number of satellites required to cover an area with a given capacity, our new framework will allow for lower unit costs to serve a geographic area, which in turn can reduce the price of broadband to consumers. In short, by removing an enormous regulatory constraint on NGSO systems, the Commission takes another step to unleash the American space industry to deliver for consumers.

3. Specifically, in this Report and Order, we replace the EPFD framework with modern, performance-based GSO protection criteria that take account of the improved spectrum sharing possibilities that modern satellite technology has brought, including through use of adaptive coding and modulation (ACM).[5] As the cornerstone of our new sharing regime, we extend our time-tested framework for good-faith coordination and allow NGSO and GSO operators to bargain for appropriate interference protections through voluntary, private agreement. We adopt the following technical backstops to protect GSO systems when coordination has not been reached:

- A long-term protection criterion of 3% time-weighted average throughput degradation for GSO satellite links using ACM;

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[1] *See* 47 U.S.C. § 157(a).

[2] EPFD represents the total amount of power that an NGSO satellite constellation produces at a receiving earth station or space station in a GSO network, taking into account the antenna characteristics of the receiving antenna. *See* 47 CFR § 25.103.

[3] *See* Appendix D *infra*.

[4] *See* SpaceX Comments at 3; Amazon Comments at 12, Appx.

[5] ACM or link adaptation is a term used in wireless communications to denote the match of the modulation, coding, and other signal and protocol parameters to the conditions on the radio link (e.g., the path loss, interference due to signals coming from other transmitters, the sensitivity of the receiver, the available transmitter power margin). *See* Shami, Abdallah; Maier, Martin; Assi, Chadi (2010-01-23), Broadband Access Networks: Technologies and Deployments, Springer Science & Business Media, at 100.

- A short-term protection criterion of 0.1% absolute increase in link unavailability;
- A supplemental protection criterion of −10.5 dB interference-to-noise (I/N) for 80% of the time for GSO satellite links that do not use ACM, such as point-to-multipoint video transmissions; and
- A supplemental protection requirement for NGSO systems to observe a minimum 3-degree avoidance angle of the GSO arc.[6]

4. Having taken a fresh look at today's satellite technology and operations, these new rules will promote more efficient and effective use of the shared spectrum, and support a more competitive market for satellite broadband and other in-demand services.

II. BACKGROUND

5. *Overview*. The American space sector is booming. In the past few years alone, thousands of broadband-capable satellites have been launched into low-Earth orbit (LEO),[7] connecting Americans with low-latency, high-speed services heretofore unavailable in many rural and underserved areas of the United States.[8] By one estimate, the supply of high-throughput satellite capacity tripled between 2021 and 2023, with NGSO satellites accounting for over 90% of the net supply during that period, and projected to account for 97% of the increase in supply from 2023 to 2028.[9] At the same time, GSO satellite operators have continued to deploy powerful, new satellites with enhanced capabilities.[10] The space sector is helping bridge the digital divide.[11]

6. These broadband satellite services rely on shared spectrum. In the most commonly used frequency bands, between 10.7 GHz and 30 GHz, NGSO systems share primary fixed-satellite service (FSS) allocations with GSO networks, and must also operate compatibly with broadcasting-satellite service (BSS) networks and stations in other services, including terrestrial services.[12] NGSO FSS systems must comply with power limits expressed in EPFD to demonstrate that they meet their broader obligation not to cause unacceptable interference to GSO FSS and BSS networks.[13] NGSO FSS systems must also meet separate power limits expressed in power-flux density (PFD) to protect terrestrial services.[14] Within the 10.7-30 GHz range, EPFD downlink limits apply in the 10.7-12.7 GHz, 17.3-18.6 GHz, and 19.7-20.2

[6] Equivalently, a GSO-arc exclusion zone of 6 degrees.

[7] *See Communications Marketplace Report*, GN Docket No. 24-119, FCC 24-136, paras. 184, 194, 425 (rel. Dec. 31, 2024) (*2024 Marketplace Report*).

[8] *See id.*, paras. 179, 184.

[9] Press Release, Euroconsult, Non-Geostationary Orbit Constellations Redefining the High Throughput Satellites Market Landscape (Apr. 25, 2024), https://www.euroconsult-ec.com/press-release/non-geostationary-orbit-constellations-redefining-the-high-throughput-satellites-market-landscape/.

[10] *See 2024 Marketplace Report*, FCC 24-136, paras. 184, 194, 425.

[11] *See id.*, paras. 3, 185.

[12] *See* 47 CFR § 2.106(a). In addition, NGSO FSS licensees authorized to operate in the 10.7-11.7 GHz band must, prior to commencing operations, successfully coordinate with radio astronomy observatories that use the adjacent 10.6-10.7 GHz band. 47 CFR § 2.106(a), (c)(131). The bands between 17.7 GHz and 20.2 GHz are also subject to coordination with Federal Government users. 47 CFR § 2.106(a), (c)(334).

[13] 47 CFR §§ 25.146(a)(2), (c), 25.289; International Telecommunication Union (ITU) Radio Regulations, Art. 22, Nos. 22.2, 22.5I; *see also, e.g.*, 47 CFR § 2.106(b)(484)(i), (b)(487)(i), (b)(516). In the 18.8-19.3 GHz and 28.6-29.1 GHz bands, EPFD limits do not apply and GSO FSS networks must not cause harmful interference to, or claim protection from, NGSO FSS systems. 47 CFR § 2.106(a), (d)(165).

[14] 47 CFR § 25.146(a)(1).

GHz bands in the United States.[15] Applicants for NGSO FSS space station licenses, and non-U.S.-licensed satellite operators seeking access to the U.S. market, must certify that they will comply with the specified EPFD limits.[16]

7. *EPFD History*. As reviewed in the *Notice*,[17] the current EPFD limits were developed in the late 1990s for the protection of GSO networks from then-proposed NGSO systems. They were adopted by the international community at the International Telecommunication Union's (ITU) World Radiocommunication Conference (WRC) in 2000, and subsequently incorporated into the Commission's rules.[18] In 2019, the international community again considered sharing criteria among GSO and NGSO FSS systems, this time in the higher Q- and V-bands between 37.5 GHz and 51.4 GHz.[19] WRC-19 did not adopt EPFD limits in these bands. Instead, given the expected use of ACM by GSO networks in these bands, it required NGSO FSS systems to meet certain long-term[20] and short-term[21] GSO protection criteria that incorporate a degraded throughput methodology.[22]

8. *Current ITU Work*. WRC-23 considered a proposal from the Inter-American Telecommunication Commission (CITEL)[23] co-signed by ten member states, including the United States, to review the EPFD limits under a future agenda item for WRC-27.[24] While the proposed agenda item was not adopted, WRC-23 invited ITU-R to conduct technical studies on the EPFD limits and to inform

[15] EPFD downlink limits in these bands apply on both a per-system (single-entry) basis and on an aggregate basis (among all operating NGSO FSS systems). In addition to the downlink (space-to-Earth) limits, EPFD limits in the 10.7-30 GHz range also apply to uplink (Earth-to-space) transmissions and inter-satellite transmissions. ITU Radio Regulations, Art. 22, Nos. 22.2, 22.5I, Tables 22-1A, 22-1B, 22-1C, 22-1D, 22-2, 22-3, 22-4A, 22-4A1, 22-4B; ITU-R Resolution 76 (Rev.WRC-23); *see also* 47 CFR § 25.108(c)(3), (8).

[16] 47 CFR §§ 25.114(d)(12), 25.137(b), 25.146(a)(2). Prior to initiating service, NGSO FSS operators' EPFD showings submitted to the ITU must receive a "favorable" or "qualified favorable" finding by the ITU Radiocommunication Bureau (BR). 47 CFR § 25.146(c); *see also* ITU-R Resolution 85 (Rev.WRC-23). The BR uses a software tool to determine conformity with EPFD limits. Recommendation ITU-R S.1503 provides a functional description used in the development of this software tool. For the mission of the ITU Radiocommunication Sector (ITU-R), *see* https://www.itu.int/en/ITU-R/information/Pages/mission-statement.aspx.

[17] *Modernizing Spectrum Sharing for Satellite Broadband, Revision of the Commission's Rules to Establish More Efficient Spectrum Sharing between NGSO and GSO Satellite Systems*, Notice of Proposed Rulemaking, 40 FCC Rcd 3389, 3391, para. 5 (2025) (*Notice*).

[18] *See id.*; 47 CFR §§ 25.146(a)(2), (c), 25.289.

[19] *See* WRC 2019 (WRC-19) agenda item 1.6.

[20] The long-term protection criterion is based on the percentage reduction in time-weighted average spectral efficiency calculated on an annual basis for generic GSO reference links using adaptive coding and modulation. ITU Radio Regulations, Art. 22, Nos. 22.5L, 22.5M. Spectral efficiency is a measure of data throughput per hertz of spectrum. It is determined based on the C/N ratio of GSO reference links, which is converted to spectral efficiency (bit/s/Hz) using formulaic equations, such as those in Recommendation ITU-R S.2131-1.

[21] The short-term protection criterion is based on the percentage increase of the time allowance for the C/N value associated with the shortest percentage of time specified in the short-term performance objective of generic GSO reference links. ITU Radio Regulations, Art. 22, Nos. 22.5L, 22.5M.

[22] *Id.*; ITU-R Resolution 769 (WRC-19); ITU-R Resolution 770 (Rev. WRC-23).

[23] CITEL is an agency of the Organization of American States (OAS) that works to promote telecommunications and information and communication technologies (ICT) in the Americas. https://www.oas.org/ext/en/main/oas/our-structure/agencies-and-entities/citel/Home.

[24] CITEL, Proposals for the Work of the Conference, Document WRC23/44/A27/A4 (June 26, 2023).

WRC-27 of the results of the studies, without any regulatory consequences.[25] These studies are being carried out in ITU-R Working Party (WP) 4A.

9. *Waivers*. On January 9, 2026, the Space Bureau granted SpaceX a waiver of the EPFD limits in the United States to operate pursuant to its satellite configuration used during real-world testing of an Nco of 8 and a GSO-arc avoidance angle of 4 degrees.[26] On February 20, 2026, the Space Bureau granted Amazon a similar waiver for its NGSO system.[27]

10. *Notice*. On April 28, 2025, the Commission launched this proceeding by granting a SpaceX petition for rulemaking to review the decades-old spectrum sharing regime between GSO and NGSO systems in downlink frequency bands between 10.7 GHz and 30 GHz that are subject to EPFD limits, and to amend sections 25.146 and 25.289 of the Commission's rules.[28] The *Notice* sought to develop a substantial technical record concerning modern and efficient spectrum sharing among NGSO FSS systems and GSO FSS and BSS networks in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands, while ensuring that any rule changes do not affect the continued protection of other services.[29] In response to the *Notice*, 38 comments, 23 reply comments, and numerous *ex parte* presentations were filed.[30]

III. DISCUSSION

11. The voluminous record in this proceeding includes rarely available, real-world testing data assessing the impact of EPFD exceedances on operational GSO networks, along with technical and economic analyses and other comments. Based on this record, we conclude that technological advancements in the past three decades and the inherent issues in the EPFD limits themselves warrant the establishment of a new, performance-based spectrum sharing framework between GSO and NGSO systems in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands.[31] Leveraging the latest satellite technology, the U.S. space industry can make better use of spectrum resources to substantially expand and improve the broadband services available in the United States, thereby furthering "the policy of the United States to encourage the provision of new technologies and services to the public."[32]

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[25] Minutes of the Eleventh Plenary Meeting of WRC-23, Document WRC23/526-E, at 5 (Jan. 15, 2024), stating: "WRC-23 invites ITU-R to conduct technical studies on the epfd limits in Article 22, including the epfd limits referred to in No. 22.5K, in order to ensure the continued protection of GSO FSS and BSS networks, and to inform WRC-27 of the results of the studies, without any regulatory consequences. This work should not be submitted under agenda item 9.1."

[26] *Space Exploration Holdings, LLC, Request for Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System, Application for Authority for Modification of the SpaceX NGSO Satellite System*, Order and Authorization, DA 26-36, para. 17 (SB rel. Jan. 9, 2026) (SpaceX EPFD Waiver).

[27] *See* Kuiper Systems LLC, ICFS File No. SAT-AMD-20230329-00067 (granted in part Feb. 10, 2026).

[28] *See Notice*, 40 FCC Rcd at 3389, para. 2 & n.1.

[29] *Id.* at 3398-3403, paras. 19-37.

[30] *See infra*, Appx. D – List of Commenters.

[31] *See, e.g.*, ICLE Comments at 13; PK and OTI Comments at 9-10; CCIA Comments at 8; CCIA Apr. 14, 2026 *ex parte*; ITIF Comments at 2; *see also* OTI and ICLE Feb. 14, 2026 *ex parte* (summarizing recommendations of a LEO Satellite Policy Working Group strongly supporting "modernizing EPFD limits and enacting a framework similar to that governing NGSO/NGSO sharing" which would "require all operators to coordinate in good faith and adopt default interference thresholds that are proxies for actual harmful interference" and suggesting "it would be effective to combine a short-term protection criterion based on an absolute increase in unavailability, such as 0.1% unavailability, with a long-term protection criterion based on 3% degraded throughput for GSO systems using ACM").

[32] 47 U.S.C. § 157(a).

12. As described below, we expect the modernized NGSO-GSO sharing framework to result in substantial benefits for American consumers, by enabling new NGSO systems to use more satellites to serve the same area, at potentially higher power, and over a wider portion of the visible sky. For example, when an NGSO system can employ eight satellites to provide service simultaneously in a given geographic area and frequency band, instead of being effectively limited to one satellite under current EPFD limits, and while continuing to protect GSO networks as supported by real-world testing, it immediately boosts capacity, which translates to faster broadband speeds for American consumers. Increasing the capacity available to any location can improve quality of service or allow competitors to provide the same quality of service with a smaller constellation, which could potentially lower prices to consumers. Expanded, low-latency satellite broadband at lower cost may also increase competition for broadband services in new areas, including some urban areas where prior satellite capacity constraints may have bounded consumers' willingness to switch.[33] This, in turn, results in greater societal welfare benefits, with one study estimating welfare to increase by between $10 billion and $100 billion globally if EPFD limits were widely replaced.[34]

13. We replace the outdated and wooden EPFD limitations with a modern framework that gives NGSO and GSO operators the flexibility to reach protection criteria through good-faith coordination. It is at once a fundamental change in regulatory design, but at the same time consistent with the primacy we place on good-faith coordination across many other contexts. As the Commission has emphasized, private coordination among satellite operators, based on real-world operating parameters, offers the best opportunity for efficient spectrum sharing.[35] The current EPFD limits do not accommodate such coordination because they must be met regardless of any agreements between particular NGSO and GSO satellite operators. Our approach not only encourages good-faith coordination efforts; it requires them. And the new, performance-based protection criteria focus on what matters (i.e., delivered service), allowing innovation in NGSO system designs which respect the new limits. Whereas EPFD limits categorically restricted an input, the approach we adopt today gives parties the flexibility to negotiate a more efficient outcome.[36]

14. As a backstop to good-faith coordination, we adopt GSO protection criteria that take account of the improved spectrum sharing possibilities that modern satellite technology has brought, including through use of ACM. Specifically, we require NGSO satellites transmitting in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands to protect co-frequency GSO networks using a long-term protection criterion of 3% time-weighted average throughput degradation. We adopt a short-term GSO protection criterion of 0.1% absolute increase in link unavailability. For GSO satellite links that do not use ACM, we adopt a long-term protection criterion of −10.5 dB I/N for 80% of the time. As an additional measure of protection for GSO networks, we require NGSO systems to observe a minimum 3-degree avoidance angle of the GSO arc. We decline to establish aggregate limits or other limits on NGSO systems at this

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[33] In this way, satellite broadband capacity increases enabled by a modernized NGSO-GSO sharing framework may make demand in some areas more elastic, potentially lowering prices that consumers pay.

[34] *See* Harold Furchtgott-Roth, The Economic Benefits of Updating Regulations that Unnecessarily Limit Non-Geostationary Satellite Orbit Systems, Furchtgott-Roth Econ. Enter., 8 (Aug. 11, 2023) (Furchtgott-Roth Econ. Study I), https://allianceforsatellitebroadband.org/wp-content/uploads/2023/10/The-Economic-Benefits-of-Updating-Regulations-that-Unnecessarily-Limit-Non-Geostationary-Satellite-Orbit-Systems.pdf; *see also* Harold Furchtgott-Roth, The Economic Benefits of Updating Regulations that Unnecessarily Limit Non-Geostationary Satellite Orbit Systems: Part II, (Nov. 2023) (Furchtgott-Roth Econ. Study II), https://allianceforsatellitebroadband.org/wp-content/uploads/2023/12/SSRN-id4649941.pdf; ICLE Comments at 12-13.

[35] *See, e.g.*, *Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, Report and Order and Further Notice of Proposed Rulemaking, 38 FCC Rcd 3699, 3706, para. 20 (2023) (*NGSO FSS Inter-Round Sharing First Report and Order*).

[36] In contrast, EPFD limits prohibit some beneficial gains from exchange.

time. These new backstop provisions will ensure that NGSO broadband services can reap the benefits of significantly more efficient spectrum sharing while ensuring that NGSO systems continue not to cause "unacceptable interference" to GSO FSS and BSS networks.[37]

15. Below, we outline the public-interest benefits of our decision, based on the extensive record in this proceeding. We then explain why the purported costs of modernizing our sharing rules are overstated, speculative, and, in any case, mitigated by the suite of additional protections we adopt today. Finally, we resolve assorted issues of implementation and compliance.

A. Benefits of Modernized Sharing Rules

16. Dramatically boosting the capacity of NGSO broadband systems serves the public interest. Adding more system capacity is the most impactful way for NGSO operators to address their most acute and recurring technical challenge: providing 5G-quality data rates to a growing number of users during periods of peak congestion, without sacrificing on signal reliability. Enabling that level of performance makes satellite broadband a more compelling alternative for consumers in areas with limited competitive options. And it lowers barriers to entry and potentially stranded investments by reducing the need for new satellite launches and expensive infrastructure builds.

17. The record unambiguously demonstrates that legacy EPFD restrictions present perhaps the largest regulatory constraint on NGSO systems to deliver more capacity to consumers. As discussed below, we find that modernizing our NGSO-GSO sharing framework to boost NGSO capacity and reduce the necessary size of NGSO constellations will bring substantial public-interest benefits. We also note the broader macroeconomic benefits across America. One study, for example, has indicated that increases in NGSO system capacity of 74% to 180% could reduce average costs per unit of capacity of between 43% and 64%.[38] The study further estimated increases in consumer welfare ranging from 11%, given a 10% reduction in price and a 25% increase in capacity, to 113%, assuming a 50% reduction in price and a 250% increase in capacity.[39] And if revisions to the EPFD regime were adopted globally, they could result in welfare benefits to all customers ranging from $10 billion to $100 billion.[40]

1. Boosting Capacity and Speeds

18. The ability of surging NGSO satellite deployments to meet the needs of Americans on the wrong side of the digital divide is limited by the design and operational restrictions placed on NGSO systems by the need to comply with EPFD limits.[41] To meet these limits, NGSO operators have three primary strategies.[42] First, NGSO operators limit the number of satellite beams that can serve any given

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[37] *See* 47 CFR § 25.289.

[38] Furchgott-Roth Econ. Study I, Appx. B at B-1; *see also* ICLE Comments at 7 (citing same). The study also noted that a modernized NGSO-GSO sharing framework could ultimately benefit consumers by increasing the capacity of NGSO FSS systems of a given size; reducing the number of satellites necessary for an NGSO FSS system to provide a certain capacity of service to a certain geography or population; facilitating entry and enhancing competition for services from LEO-satellite systems; reducing prices for services from LEO-satellite systems; and increasing elasticity of demand. *Id.*, Appx. B at B-1 to B-2. While this study generally considered changes to the current EPFD framework at an international level, the analysis is illustrative of the relationship between NGSO capacity, cost, and consumer welfare.

[39] *Id.*, Appx B. at B-2.

[40] *Id.* at 2.

[41] *See* Amazon Comments at 9-10; Amazon Reply at 6-8; *see also, e.g.*, SOAR Comments ("Modernizing the EPFD framework is essential to unlocking the economic potential of rural and underserved populations."). For example, SpaceX's Starlink constellation was initially required to operate with only one satellite serving the same area in the same frequency band at the same time to ensure compliance with EPFD limits. *See* SpaceX EPFD Waiver, DA 26-36, para. 19. Under the revised rules we adopt today, SpaceX could operate with up to eight co-frequency satellites in the same area simultaneously. *See* SpaceX Comments at 4.

location simultaneously using the same frequencies (i.e., the number of co-frequency beams or Nco), limiting spectrum reuse and capacity.[43] Second, NGSO operators implement wide "avoidance angles" of the GSO arc, which restrict satellites from transmitting when they are within a certain-degree separation from the transmission path of a GSO satellite.[44] This technique increases the number of satellites NGSO operators need to provide full coverage and causes less efficient rerouting of network paths, which further reduces performance and increases latency.[45] Third, NGSO operators reduce their power levels even outside the GSO-arc avoidance angle to ensure off-axis emissions remain below the EPFD limit, with lower power levels reducing data rates and leading to less robust connectivity for end users.[46] In total, compliance with the current EPFD limits directly degrades the efficiency of spectrum use by NGSO systems.[47]

19. The EPFD limits are coupled with the ITU's software and methodology for assessing compliance with those limits, which can further restrict real-world NGSO operations.[48] For example, the ITU software considers a relatively sensitive reference antenna pattern for GSO earth stations, resulting in a greater calculated EPFD into GSO earth stations and therefore greater restrictions on NGSO operations to fall below the EPFD limits as calculated with reference to this antenna pattern.[49] In addition, the ITU software uses a worst-case geometry selection algorithm when choosing among available NGSO satellites to transmit to a given location.[50] This assumes that the NGSO operator will always select the satellite

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[42] *See* Amazon Comments at 9-10; *see also Notice*, 40 FCC Rcd at 3394, para. 11 (noting NGSO systems may also adjust a fourth operational parameter to comply with EPFD limits—employing higher earth station antenna minimum elevation angles).

[43] Amazon Comments at 9.

[44] *Id.* The GSO-arc avoidance angle is one half of the angle defined as the GSO exclusion zone. *See, e.g.*, Recommendation ITU-R S.1325-2 at 11.

[45] Amazon Comments at 9.

[46] *Id.* at 9-10; *see also* Furchgott-Roth Econ. Study I at A-1 (noting that limiting power, avoiding the GSO arc, and limiting simultaneous satellite transmission to earth stations "have severe effects on NGSO FSS system performance and cost").

[47] Working Document Towards A Preliminary Draft New Report [Article 22 Epfd Limit Studies], United States Contribution to Working Party 4A, Document 4A/84, at 1 (Apr. 19, 2024) (U.S. WP 4A Contribution). SES states that NGSO operators can satisfy EPFD limits without significant NGSO performance loss through use of satellite selection, beam forming, adaptive power control, and/or inter-satellite traffic routing. *See* SES Reply at 25-26. It provides no supporting studies on these effects, however. Viasat also claims that "the EPFD framework is not a limiting factor with respect to NGSO system throughput" and that "[t]o the extent NGSO system throughput is constrained, those constraints are imposed by a number of other factors—including the number of available satellites and beams, deployment of very small terminals, and the ability of those terminals to discriminate between the many beams of the very NGSO system with which they operate—as well as the fact that NGSO systems distribute capacity inefficiently, without regard to variations in demand across the relevant coverage area." Viasat Comments at 23-24; *see also id.*, Exh. G. Yet, the number of available satellites and beams in a given area is limited by Nco, which is largely driven by the need to comply with EPFD limits. And the supposed protection of very small terminals of *GSO* networks in upper Ka-band imposes the most restrictive EPFD limits on NGSO systems. Other NGSO system changes, such as adding more satellites to increase capacity while meeting EPFD limits, can result in per-unit cost increases for consumers. And, some NGSO systems already incorporate advanced beam-forming technologies yet are still restrained by the need to meet EPFD limits. *See, e.g.*, Amazon Comments at 4; SIIA Comments at 4.

[48] *See* Amazon Comments at 6-7.

[49] *See id.* Amazon estimates that the earth station reference antenna patterns exaggerate side-lobe EPFD by 7.7 dB. *Id.*

[50] *See id.* at 7. Commenters dispute whether the use of worst-case geometry in fact inhibits NGSO capacity—variously arguing that it overestimates interference (and therefore further restricts NGSO operating parameters

(continued….)

with the worst-case geometry (often, the satellite closest to the GSO arc), although it is unlikely that an operator would rely on such an algorithm to conduct actual operations.[51] Rather, satellite operators rely on a complex, global resource management system for assigning satellite capacity to their customers.[52] In total, according to one study, the assumed EPFD of an NGSO system was substantially below the maximum allowed EPFD in Ka-band at almost all points when using the ITU methodology, and up to 30 dB below the limits for short-term interference in the upper portion of the Ka-band specifically.[53] By restricting EPFD below even the limits themselves, NGSO capacity, coverage, and service are further reduced. Beyond stating that EPFD limits rely on conservative or disputed assumptions, commenters also argue the current ITU process invites "regulatory gamesmanship."[54]

20. In contrast to legacy EPFD regulations, the record demonstrates substantial potential for enhanced NGSO service offerings under a modernized NGSO-GSO sharing framework. Analyses for current and planned Ku-band and Ka-band NGSO systems indicate that modernized sharing rules could deliver increases in NGSO system capacity of 100% to 700% in a given area in the United States, because NGSO operators would be able to increase the number of satellites operating simultaneously in a given area and a given frequency band from one to as many as eight.[55] At the same time, a reduction in the GSO-arc avoidance angle would increase the number of satellites available to serve an earth station location and thereby increase coverage, potentially reducing the size and cost of NGSO systems.[56]

a. Real-World Measurement Campaigns

21. This rulemaking has benefitted from rarely available, real-world measurement campaigns, which assessed the impact of the SpaceX Starlink NGSO system in different operational configurations on typical GSO network mass-market terminals. These real-world test results demonstrate

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below the EPFD limits themselves), *see id.*, or might underestimate interference (thereby allowing greater NGSO operations within the assessed limits), *see generally* Viasat Comments at 26-27, Exhs. C, H. We need not definitively resolve the ongoing dispute in ITU-R WP 4A regarding worst-case geometry to conclude that it may contribute to the overestimation of interference into GSO networks, and associated restrictions on NGSO operational configurations and capacity, and that it reflects a widely criticized limitation of the current EPFD assessment.

[51] *See* Amazon Comments at 7.

[52] *See id.*

[53] Amazon Comments at 7-8; Amazon Reply at 9; *see also* CSF Comments at 3 ("Technical analyses and operator filings show that NGSO systems may operate 5 to 13 dB below the short-term EPFD mask, simply to comply with outdated constraints, rather than for actual needed GSO protection.").

[54] ICLE Comments at 9; *see also* Viasat Comments at 25 (stating the ITU's methodology is "flawed" with "myriad other issues" that results in operators attempting to "game" the EPFD regime, for example by relying on multiple ITU filings that do not fully capture the complete NGSO FSS system or its impact on GSO networks); *id.* at 25-27. Notwithstanding the issues identified with the ITU validation methodology and software, the FCC developing its own software to assess compliance with ITU EPFD limits would be costly, time-consuming, at least partially duplicative, lead to potentially conflicting determinations of compliance with the same underlying EPFD limits, and would not address concerns about the EPFD regime itself.

[55] *See* SpaceX Comments at 3; Amazon Comments at 12, Appx.

[56] *See* Amazon Comments at 9-10. As an example of this impact on a global scale, one study has indicated that reducing the GSO-arc avoidance angle of a system of 425 satellites operating at an altitude of 700 km from 16 degrees to 6 degrees would reduce the loss of global coverage from 30% to 10%. U.S. WP 4A Contribution at 18; *see also* Furchgott-Roth Econ. Study I at 8. *But see, e.g.*, NAB Reply at 5 (expressing concern that "[a]ny changes in the existing Ku-band sharing framework are likely to result in more Ku-band NGSO satellites in the sky"). Another study indicated that eliminating the GSO-arc avoidance angle would result in only a small increase in the number of service-eligible NGSO satellites within the field of view of relevant earth stations. *See* Viasat Reply at 23; *see also* Viasat Comments, Exh. G.

the potential for enhanced NGSO operations, in excess of current EPFD limits, and the resulting impacts on typical GSO service links.[57]

22. In one set of testing, SpaceX operated the Starlink system with GSO-arc avoidance angles resembling typical GSO separation arcs in Ku-band and Ka-band, e.g., 2, 3, 4 and 6 degrees.[58] The test setup included a high-precision spectrum analyzer connected to a mass-market GSO terminal from a major GSO operator.[59] The average de-sense[60] to the GSO link resulting from eight co-frequency beams with an avoidance angle of 4 degrees from the GSO arc was less than 0.1 dB, which translates to a degraded throughput of less than approximately 0.7%.[61] In another set of testing, using a different location and GSO network, SpaceX demonstrated that, for the Starlink system similarly configured to use eight co-frequency beams and a 4-degree GSO-arc avoidance angle, the long-term de-sense of the GSO link was negligible and the increase in short-term link unavailability was approximately 0.05%.[62] In two other sets of testing, with different locations and GSO networks, operating the Starlink system with up to eight co-frequency beams and a 4- or 4.5-degree GSO-arc avoidance angle similarly showed minimal long-term signal de-sense (and associated degraded throughput) to the GSO links.[63] And a fifth set of testing provided similar results.[64] Further, the increase in absolute unavailability in a test using a very small, 35 cm user terminal was 0.0005%.[65] Notably, SpaceX has conducted measurements in Jordan with a GSO-arc avoidance angle of 3 degrees and an Nco of 6 for a 60 cm earth station receiving antenna.[66]

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[57] *See* SpaceX Comments at 3; SpaceX Reply at 4-5; SpaceX Oct. 28, 2025 *ex parte* at 1-2, n.3 (describing test reports from Romania, Columbia, Nigeria, Jordan, and Botswana).

[58] SpaceX, Doc. 4A/343, Real-World Interference Measurements in Support of Studies on EPFD Limits (Apr. 23, 2025).

[59] *Id.*

[60] "De-sense" (desensitization) refers to a radio interference problem where a strong, nearby signal overloads a receiver, making it temporarily unable to detect weaker, desired signals, often causing static or distorted reception. While Viasat criticizes SpaceX's evaluation of de-sense, in particular as related to GSO service-level agreements, *see* Viasat Feb. 26, 2026 *ex parte* at 3-4, we address such agreements elsewhere and note that the de-sense describes the difference between the carrier-to-noise ratio for a baseline link and the baseline link plus an interferer (C/(N+I)), that the test reports also provide the C/N and C/(N+I) plots, that the relevant interference metrics can be extracted from those plots, and that as with other methodological questions the results of the real-world testing campaigns generally support the conclusion that substantially greater NGSO operations are possible without causing harmful interference to GSO networks. *See* SpaceX Mar. 5, 2026 *ex parte* at 3.

[61] *Id.* A 0.7% throughput degradation is lower than the 3% degraded throughput threshold proposed on the record and applied internationally to the protection of GSO ACM networks in Q- and V-bands and domestically to NGSO ACM systems in bands including the Ku- and Ka-bands. *See* ITU Radio Regulations, Art. 22, No. 22.5L; 47 CFR § 25.261(d).

[62] *See* SpaceX Reply, Technical Supplement – Colombia EPFD Test Report; Colombia, SpaceX, Doc. 4A/662-E, Interference Measurement Campaign on EPFD Limits in Colombia (Oct. 14, 2025).

[63] *See* Jordan, SpaceX, Doc. 4A/604, Interference Measurement Campaign on EPFD Limits in Jordan (Oct. 3, 2025) (SpaceX Jordan Test); SpaceX, Doc. 4A/624-E, Interference Measurement Campaign on EPFD Limits in Botswana (Oct. 7, 2025).

[64] *See* Nigeria, SpaceX, Doc. 4A/598-E, Interference Measurement Campaign on EPFD Limits in Nigeria (Sep. 29, 2025).

[65] SpaceX Dec. 16, 2025 *ex parte* at 4. An analysis of the availability impact that the same test data would have on a 60 cm user terminal indicated that there would have been zero instances (0%) of link unavailability that would have resulted from NGSO interference during the multiple weeks of testing. *Id.*

[66] *See* SpaceX Oct. 28, 2025 *ex parte* at 1; SpaceX Jordan Test at 12, 14-15.

The average co-polarized de-sense from this test was approximately 0.17 dB,[67] which corresponds to an I/N of approximately −13.9 dB.[68]

23. The results of these five extensive, months-long test campaigns offer direct, real-world evidence that a currently operating NGSO system could, in comparison with its configuration needed to meet current EPFD limits, increase by 700% its number of satellites (i.e., from 1 satellite to 8 satellites) operating simultaneously co-frequency in the same area while reducing its GSO-arc avoidance angle by 60%—from 10 degrees[69] to 4 degrees—with resultant effects on typical GSO networks of less than 3% degraded throughput and 0.1% absolute increase in unavailability. While commenters note certain limitations of the SpaceX real-world testing—that it was only conducted in the Ku-band; that it does not reflect year-long rain fade effects; and that tested interference to a GSO earth station located in the center of the GSO beam, where the desired signal is strongest, would be lower than the interference to a GSO earth station located at the edge of the GSO beam, where the desired signal is weakest[70]—no other commenter has presented alternative interference measurements on the record for consideration.[71]

b. Simulations

24. Technical studies containing simulations further support the conclusion that NGSO systems could significantly improve capacity and coverage with limited effects on GSO networks. In one scenario analyzed for the Amazon system, for example, the NGSO system could operate at increased power levels, reduce its GSO-arc avoidance angle from 18 degrees to 3 degrees, and operate at an Nco of 4 (quadrupling its capacity in any given area), and the largest increase in unavailability for all ten studied

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[67] *Id.*

[68] An I/N of −13.9 dB is more protective than the −12.2 dB I/N protection criteria for FSS cited by SES from Recommendation ITU-R S. 1323, last updated in 2002. *See* SES Reply at 11; Recommendation ITU-R S.1323-2. It is also more protective than the −10.5 dB I/N protection criteria for FSS and BSS used during studies for WRC-19. *See* Reply Liaison Statement from Working Party 4A to Task Group 5/1, WRC-19 agenda item 1.13 (IMT), Doc. TG5.1/411 (TG 5/1 Liaison).

[69] *See Space Exploration Holdings, LLC, Request for Orbital Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System*, Order and Authorization, 37 FCC Rcd 14882, 14907, para. 35 (2022).

[70] *See* DIRECTV Jan. 16, 2026 *ex parte* at 4; *see also* DIRECTV Feb. 9 *ex parte* at 2-3, Annex; Viasat Feb. 26, 2026 *ex parte* at 3. While SpaceX testing did not occur over the span of an entire year to experience average rain fade effects, we do note that the testing has been conducted in varying geographies in Romania, Colombia, Jordan, Nigeria, and Botswana. Further, even DIRECTV recognizes the utility of the SpaceX testing and argues that SpaceX's real-world results "validate" DIRECTV's simulations. *See id.* at 4, Attach. A at 11. And although DIRECTV urges the Commission to conduct "independent testing" of EPFD exceedances "to ensure that the results of the testing are fairly and accurately presented," DIRECTV Feb. 9, 2026 *ex parte* at 3, DIRECTV does not indicate that it was among the GSO satellite operators cooperating with the SpaceX real-world testing or that it offered such cooperation, and Commission-led testing would be time-consuming and burdensome on limited Commission resources without necessarily leading to different results. In addition, while Viasat states that SpaceX should have conducted additional testing with earth stations that have high availability requirements, *see* Viasat Mar. 9, 2026 *ex parte* at 5, the SpaceX tests focused on the smaller, more sensitive earth station terminals that are expected to receive more interference and drive the NGSO operating parameters needed to satisfy the protection criteria for all links. High-availability links using more robust earth station equipment will experience less interference than consumer-grade terminals. *See* SpaceX Mar. 5, 2026 *ex parte* at 3-4; *see also generally id.* at 3 ("These tests were not intended to cover every scenario or lock NGSO systems into specific operating parameters. Rather, the tests were designed to (a) demonstrate that NGSO systems can operate far beyond the bounds of current EPFD restrictions while satisfying the proposed protection criteria and causing no harmful interference to GSO systems, and (b) validate SpaceX's modeling of NGSO-GSO interference based on real-world operations.").

[71] We note, for example, that SES and Eutelsat operate their own NGSO systems—O3b (call sign S2935) and OneWeb (call sign S2963), respectively—that could have been used to generate alternative measurement data.

GSO links would be 0.000000073%.[72] The largest decrease in throughput was 1.27% for a customer terminal, with half of the ten links studied showing a decrease of 0.00956% or less.[73] In another scenario analyzed for the Amazon system, the NGSO system could maintain its lower power level, reduce its GSO-arc avoidance angle to 2 degrees, and operate at an Nco of 8 (octupling the capacity), and the largest increase in unavailability would be 0.000001756%.[74] At most, Amazon estimated GSO operators would experience a loss of 2.72% in throughput, with half of the ten links studied showing a throughput decrease of 0.175% or less.[75] For SpaceX's Starlink, simulations of interference from the NGSO system into a 46 cm Ku-band user terminal in Oregon showed an absolute increase in unavailability of 0.0047%, assuming an Nco of 15 and a GSO-arc avoidance angle of 18 degrees, and a 0.0251% increase if the avoidance angle were reduced to 4 degrees.[76] Another simulation attempted to replicate the results of the SpaceX real-world testing in Bogota, Colombia and found compliance with a 0.1% absolute increase in unavailability limit.[77]

25. Simulations on the record assessing the capacity gains of degraded throughput rely on varying assumptions, which we examine later from a GSO coexistence perspective.[78] For present

[72] Amazon Comments at 11, Appx. For eight of the ten GSO links, any increase in unavailability was undetectable. *Id.*

[73] *Id.* at 11.

[74] *Id.* at 12. Any increase in unavailability for five of the other links was undetectable. *Id.* Assuming a minimum earth station antenna angle of 35 degrees for an earth station in Kansas City operating with the Amazon system, a decrease in the GSO-arc avoidance angle from 18 degrees to 2 degrees would increase the average number of eligible satellites from 12.8 to 16.3, representing a 27% increase. *Id.* at 12 n.41.

[75] *Id.* Some commenters question the assumptions used in the Amazon simulations and their results accordingly. *See* Eutelsat et al. Reply at 11, Annex 1; SES Reply, Appx. B; EchoStar Reply at 8-9; Viasat Reply at 12-13. While simulations on the record reflect potential NGSO system configurations, actual operations will be based on interference assessments using the set of GSO reference links we are adopting, as may be updated in the future. *See infra* section III.B.6. GSO operators may share the most accurate, up-to-date information regarding their operations in the United States during coordination discussions with NGSO operators.

[76] DIRECTV Comments, Attach. 1 at 3, 5-6; DIRECTV Reply, Attach. 1 at 6-7.

[77] DIRECTV Dec. 8, 2025 *ex parte*, Attach. B at 8; DIRECTV Jan. 16, 2026 *ex parte*, Attach. A at 8-9; *see also* DIRECTV Feb. 9, 2026 *ex parte*, Annex. Based on these studies, however, DIRECTV argues that the issue of "crossing events" requires further study because its simulation mimicking a SpaceX real-world test indicated more such events than were indicated during testing. DIRECTV Dec. 8, 2025 *ex parte* at 2, Attach. B at 15; *see also* DIRECTV Feb. 9, 2026 *ex parte* at 2-3, Annex at A-3. *But see* SpaceX Dec. 16, 2025 *ex parte* at 4-5 (noting that DIRECTV assumed a Starlink satellite selection strategy that always selected the satellite with the highest elevation angle relative to the user terminal, which does not reflect actual Starlink operations but which does produce the highest possible number of crossing events at equatorial latitudes such as the locations included in the study). *See also* DIRECTV Jan. 16, 2026 *ex parte*, Attach. A (presenting more refined simulations based on feedback from SpaceX); *see also* DIRECTV Feb. 9, 2026 *ex parte*, Annex at A-4 through A-6 (arguing that DIRECTV's simulations are more closely aligned with SpaceX's measurements than SpaceX's simulations). *But see* SpaceX Jan. 29, 2026 *ex parte* at 2. To the extent that the simulations attempt to re-create the results of real-world testing and reach contrary conclusions, we are inclined to believe the real-world testing is more reflective of actual operational impacts because it is less susceptible to variation due to assumptions that may prove unrealistic. In any event, compliance with the new NGSO-GSO sharing framework will be assessed on the basis of coordination certifications and/or technical demonstrations using the set of GSO reference links that we are adopting, as may be revised in the future, not based on particular tests or simulations on the record in this proceeding, which reflect the potential for enhanced NGSO operations and resultant real-world or simulated impacts on the particular GSO links studied.

[78] There is also variation among simulation results considering the same interference scenario performed by the same company. For example, an initial set of results for interference into a Ka-band earth station in Oregon from the Starlink system, assuming an Nco of 40 and GSO-arc avoidance angle of 4 degrees, found an absolute increase in unavailability of 0.0833%, while a revised simulation for this scenario found an impact of 0.03%. *Compare*

(continued….)

purposes, the simulations presented support the conclusion that the EPFD limits greatly constrain NGSO capacity. We disagree with suggestions that the combined record of rarely available, real-world measurement data and numerous simulations is an insufficient technical basis on which to adopt a degraded throughput methodology aligned with the Commission's NGSO-NGSO sharing framework and the international NGSO-GSO sharing framework in Q- and V-bands.[79] As the studies show, even a simple change of Nco from one to two could double the capacity available in a given area, while meeting GSO protection criteria proposed on the record.

2. Connecting the Unconnected

26. Satellite connections have long been a lifeline for Americans in rural and remote areas, where rugged terrain, sparse population, and economic realities have often kept terrestrial networks out of reach. Today, satellites are an increasingly powerful tool in the combined efforts to close the digital divide.[80] The Federal Government has directed billions in funding for broadband deployment and adoption, culminating in the $65 billion investment in the 2021 Bipartisan Infrastructure Law.[81] Yet, in 2024, more than one third of Americans had only one provider of high-speed broadband or lacked access altogether.[82]

27. This rulemaking has benefitted from the views and experiences of Americans living and working in rural and underserved areas, and those who advocate on their behalf, on the impact that modernization of the NGSO-GSO sharing framework could have for Americans on the wrong side of the digital divide.[83] These citizens and non-profits note that in their communities, as in many rural areas, NGSO FSS satellites may offer the only viable broadband solution,[84] enabling access to telehealth services, remote learning, digital job training, remote work opportunities, and emergency communications.[85] These commenters argue that modernizing the NGSO-GSO sharing framework will

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DIRECTV Comments, Attach. 1 at 11 *with* DIRECTV Reply, Attach. 1 at 15. Modeling of the NGSO system also plays an important role. For example, one analysis of the Starlink system found more than double the short-term impact when assuming a highest elevation satellite tracking strategy compared with either a random satellite tracking strategy or longest-hold tracking strategy. DIRECTV Jan. 16, 2026 *ex parte*, Attach. A at 10.

[79] *See* EchoStar Reply at 4-5.

[80] *See 2024 Marketplace Report*, FCC 24-136, paras. 3, 85.

[81] *See id.*, para. 3; *see also* National Telecommunications and Information Administration Broadband Equity Access and Deployment (BEAD) Program, https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program. Under BEAD, LEO systems must meet 100/20 Mbps in funded areas. Revised NGSO-GSO sharing rules could allow LEO satellite operators to meet the program's conditions, which would facilitate investment in systems that can connect remote, unserved locations at a fraction of the cost compared to fiber.

[82] *2024 Marketplace Report*, FCC 24-136, para. 3.

[83] *See* SOAR Comments; Napoleon Hill Foundation Comments; Appalachian Broadband Innovators Comments; The Health Wagon Comments; Tlingit and Haida Indian Tribes Comments; Jack Kennedy Comments; Sabrina Mullins Comments; Dezarah Hall Comments; Billy Markham Comments; Brandi Cole Comments; Sonya Cox Comments; James Lawson Comments.

[84] *See, e.g.*, SOAR Comments; Jack Kennedy Comments at 2.

[85] *See, e.g.*, Jack Kennedy Comments at 1 (stating "[f]rom enabling students in coalfield communities to participate in online learning to empowering elderly patients to consult with specialists remotely," NGSO FSS satellites have "bridged a gap that no other system has yet been able to cross"); Appalachian Broadband Innovators Comments at 2 ("Few other technologies in our time can offer such immediate, measurable improvements in equity, opportunity, and well-being as LEO-based satellite broadband.") Dezarah Hall Comments at 3 ("[M]odernizing the EPFD rules is not only a matter of technical policy—it is a matter of justice, equity, and public service."); SOAR Comments; Tlingit and Haida Indian Tribes Comments; Billy Markham Comments at 3; Sonya Cox Comments at 1; James Lawson Comments at 2.

enable NGSO providers to expand capacity, increase speeds, and improve service reliability,[86] which are "transformational improvements for the communities we serve."[87] Rural voices on the record uniformly urge us to update the NGSO-GSO spectrum sharing rules, without delay.[88]

28. NGSO satellite operators are investing heavily as uptake grows, and the potential for low-latency, gigabit satellite broadband is on the horizon.[89] High-throughput satellite capacity has been forecast to grow nine-fold between 2023 and 2028, with NGSO constellations driving 97% of the net increase.[90] And new NGSO satellite capacity is already being put to significant use—not only offering high-speed, low-latency broadband in rural areas, but also supporting critical industries, from aviation and shipping to manufacturing and agriculture, and providing network resiliency, delivering robust connectivity capable of supporting life-saving real-time communications.[91] Yet supply constraints remain.[92] It is imperative that we look at new ways to leverage the exploding growth of NGSO systems to aid the combined effort to expand access and competition in broadband and other services in the United States—starting with the most constraining regulatory requirement on NGSO broadband systems today.

3. Fostering New Competitive Entry

29. Modernizing the NGSO-GSO sharing regime would also bring particular benefits for new entrant LEO-satellite systems.[93] With greater operational flexibility under revised sharing rules, new LEO systems would need smaller constellations and still have greater capacity to reach more customers, which would reflect a substantial reduction in launch costs, satellite costs, and costs of a new LEO constellation.[94] For example, one analysis indicates that a constellation that would require 462 LEO satellites under existing EPFD rules to have a certain coverage could obtain the same coverage with updated rules with only 360 satellites.[95] ICLE argues the EPFD limits impose "significant market distortions" that "translate directly into higher costs per unit of capacity delivered to consumers, as operators must deploy more satellites and infrastructure to achieve the same service levels."[96] Lower costs from a revised NGSO-GSO sharing framework would encourage new entry as well as lower prices

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[86] *See* Tlingit and Haida Indian Tribes Comments; SOAR Comments.

[87] *Id.*

[88] *See, e.g.*, *id.*; Tlingit and Haida Indian Tribes Comments; Sabrina Mullins Comments at 2; Ronald Norris Comments at 2; Sonya Cox Comments at 2; James Lawson Comments at 2.

[89] *See 2022 Communications Marketplace Report*, 37 FCC Rcd 15514, 1574, para. 400 (2022); CNET, SpaceX's New V3 Starlink Satellites Bring Gigabit Internet Speeds for the First Time, Oct. 15, 2025, https://www.cnet.com/home/internet/spacexs-new-v3-starlink-satellites-bring-gigabit-internet-speeds-for-the-first-time/.

[90] Novaspace, *Non-geostationary orbit constellations redefining the High Throughput Satellites market landscape* (Apr. 25, 2024), https://nova.space/press-release/non-geostationary-orbit-constellations-redefining-the-high-throughput-satellites-market-landscape/.

[91] *See, e.g.*, SpaceX Comments at 1-2; *see also* Furchtgott-Roth Econ. Study I at 4-5.

[92] *See* SpaceX Comments at 2 (noting "consumer demand for high-speed, low-latency satellite broadband continues to outpace spectrum supply in workhorse satellite spectrum bands including the Ku- and Ka-bands").

[93] Furchgott-Roth Econ. Study I at 8.

[94] *See, e.g.*, *id.* (stating that a "constellation that would require 462 LEO satellites under existing [EPFD] rules to have a certain coverage could obtain the same coverage with updated rules with only 360 satellites").

[95] *See id.*

[96] *See* ICLE Comments at 6-7.

for customers.[97] In addition, greater capacity would make LEO broadband more competitive vis-à-vis fixed broadband and bring greater choice to consumers.

4. Maximizing Efficient Spectrum Use

30. In modernizing the spectrum sharing framework between GSO and NGSO satellite systems, we seek to achieve abundance and reject technically unnecessary restrictions borne from a zero-sum mindset. We are guided by the Commission's policy statement on spectrum management in doing so.[98] This policy, when applied to the current rulemaking, favors efficiency over absolute protection guarantees.[99] As most pertinent to this rulemaking, the Commission noted that:[100]

- The electromagnetic environment is highly variable, and zero risk of occasional service degradation or interruption cannot be guaranteed.
- Services should plan for the spectrum environment in which they intend to operate, the service they intend to provide, and the characteristics of spectrally and spatially proximate operations. Planning should be ongoing and account for changes in spectrum operating environments.
- Radio transmitter and receiver system operators and equipment manufacturers should plan for and design error tolerant systems, using good engineering practices, to mitigate degradation from interference.
- Quantitative analyses of interactions between services that are fact-and evidence-based, sufficiently robust, transparent, and reproducible are needed to better inform spectrum management decision-making.

31. Our decision making in this proceeding squarely aligns with these principles and is supported by the best-available, real-world data presented in the record as set forth below. Further, when considering more intensive use of spectrum for new and innovative services, we are acutely aware that "[a] uniform or absolute expectation of service availability could preclude the introduction of valuable new services in the RF [radiofrequency] environment and undermine the efficient use of spectrum resources."[101] And we continue to expect proponents of interference claims "to supply sufficiently complete, transparent, and reproducible quantitative analytical models of the interactions between radio services, with respect to transmitter and receiver performance characteristics and the RF environment."[102]

32. Even when considered in their own right, the current EPFD limits have raised significant concerns as to whether they constitute an efficient spectrum sharing regime for GSO and NGSO systems in the 10.7-12.7 GHz, 17.3-18.6 GHz, and 19.7-20.2 GHz bands. Most starkly, the differing treatment of Ka-band frequencies—where the EPFD limit in the upper portion of the band is substantially more restrictive than the EPFD limit in the lower portion of the band—is widely criticized in the record as technically unjustified.[103] In addition, the overall methodology used to derive the current EPFD limits has

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[97] *Id.*; *see also id.* at 10 (arguing the "conclusion that a degraded throughput methodology is more appropriate for GSO operations that use ACM is economically sound").

[98] *See Principles for Promoting Efficient Use of Spectrum and Opportunities for New Services, Promoting Efficient Use of Spectrum Through Improved Receiver Interference Immunity Performance*, Policy Statement, 38 FCC Rcd 3682 (2023).

[99] *See id.*, para. 17.

[100] *Id.* at 2-3. While the Policy Statement generally addresses adjacent band issues, it notes that many of the technical and policy principles could be applied in co-frequency spectrum sharing as well. *Id.* at 1 n.1.

[101] *Id.*, para. 17.

[102] *Id.*, para. 41.

[103] *See, e.g.*, Telesat Comments, Annex 1 ("There is no valid technical reason for the bands to have different limits."); SES Comments at 17-18; Amazon Comments at 6; CSF Comments at 4; NetChoice Comments at 3.

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been called into question, including the use of methodologies designed to address short-term interference to develop long-term EPFD limits, overly conservative modeling of rain attenuation, and the inclusion of a large number of unstable links with negative link margin values in the set of GSO reference links used to derive the EPFD limits.[104]

33. Compliance with the current EPFD limits results in spectrally inefficient, overprotection of modern GSO networks that exceeds the protection GSO operators afford each other. Indeed, the comparison with GSO-GSO protection is illustrative. As GSO satellites operate from fixed locations along the 360-degree GSO arc, a primary strategy for managing potential GSO-GSO interference is through orbital separation.[105] Internationally, the GSO orbital separation provisions in the ITU Radio Regulations presume negligible interference beyond orbital separation of 6 degrees in the Ku-band and 8 degrees in Ka-band.[106] The Commission's own orbital spacing policy for GSO FSS networks in these bands is based on two-degree spacing.[107] Yet, as noted in one U.S. study submitted to ITU WP 4A, maintaining a level of GSO-GSO protection equivalent to the ITU EPFD limits would require significantly larger orbital separations—estimated as at least 25 and 46 degrees in the Ku- and Ka-bands, respectively.[108] Thus, the ITU EPFD limits are 4 to 5 times more restrictive than equivalent GSO-GSO protections that guard against all but negligible levels of interference—and 12 to 23 times more restrictive than the Commission's equivalent separation rules.[109]

34. Analyses on the record further quantify these current protection levels. According to one study modeling an NGSO system operating under current EPFD limits, short-term interference to a set of ten GSO reference links resulted in undetectable increases in absolute unavailability in both the lower and upper Ka-bands, while the maximum decrease in throughput in the lower Ka-band was 0.162%.[110] Five of the other links showed throughput decreases of 0.0011% or less.[111] In the upper Ka-band (where EPFD

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Viasat states that the EPFD limits in the upper Ka-band "were developed based on consideration of the prime usage of the frequency bands expected at the time, which included small, high-density user terminals" and presents an EPFD analysis of a 24 cm antenna using assumptions related to the "reserve capacity" concept. Viasat Comments at 10 n.24; *see also id.*, Exh. F. However, in the United States, GSO network user terminals may be deployed in both the lower and upper portions of the Ka-band. *See, e.g.*, 47 CFR § 25.115(c)(3). And, as noted by other commenters, the concept of reserve capacity is ill-defined and does not reflect how modern Ka-band satellite networks operate. *See* SES Comments at 18-19; Amazon Reply at 31. In addition, Amazon notes that "no real-world NGSO constellation can precisely map onto the ITU EPFD limits" and that "an NGSO operator must limit its design and operations 100% of the time to meet the limits for only one point for one of the sets of EPFD limits for any given band—and operate with EPFD levels below those limits in all other cases." Amazon Comments at 6-7.

[104] *See* SpaceX Oct. 29, 2025 *ex parte* at 2; *see also* SES Comments at 18-19 ("When developing the Ka-band EPFD limits, the Ka-band GSO parameters were not well known. Additionally, different methodologies, including ill defined 'reserved capacity' concepts, were used and are inconsistent with today's Ka-band GSOs."). *But see* Viasat Comments at 9 n.21, Exh. D (arguing that studies conducted during the WRC-2000 study period to develop the EPFD limits, which included "reserve capacity" concepts, were appropriately structured). The continuing questions regarding the derivation of the EPFD limits further support our decision to adopt performance-based GSO protection criteria, in light of subsequent technological advancements and new technical studies.

[105] Amazon Comments at 5.

[106] *See* ITU Radio Regulations, Appendix 5, Table 5-1 (Rev.WRC-23) – Technical conditions for coordination.

[107] *See, e.g.,* 47 CFR § 25.103 (defining "two-degree-compliant space station").

[108] Amazon Comments at 5 (citing U.S. WP 4A Submission at 15-17).

[109] While it is true that NGSO satellite interference is time varying while GSO satellite interference is essentially static, Viasat Comments at 24 n.57, Viasat Reply at 15 and Viasat Mar. 9, 2026 *ex parte* at 7, the comparison is illustrative because of the scope of the difference in protections. *See also* SpaceX Mar. 21, 2026 *ex parte* at 3-4.

[110] Amazon Comments at 8-9.

limits are significantly more restraining) the maximum decrease in throughput was 0.0148% with five of the other links having decreases of 0.000012% or less.[112]

5. Encouraging Good-Faith Coordination

35. Beyond the improvements in technical efficiency of NGSO operations and attendant lower costs for consumers, a modernized NGSO-GSO sharing framework can encourage private negotiations where the current EPFD regime has prevented beneficial bargaining.[113] While ITU Radio Regulations explicitly permit EPFD limits to be exceeded on the territory of an administration that so agrees, coordination between any particular NGSO and GSO operator does not affect the NGSO operator's obligation to demonstrate adherence to the EPFD limits at the ITU. Under revised NGSO-GSO sharing rules, private bargaining among GSO and NGSO operators will have greater relevance. And these benefits will be added to the significant improvements in NGSO system capacity and efficiency, with limited impact on GSO operations, and will combine with the explosive growth of the NGSO satellite industry (which further increases the benefits of efficiency gains) in comparison with the relatively stable, or declining, rate of growth of many GSO operations.[114]

36. Other Commission precedent supports a requirement of good-faith coordination backstopped by performance-based interference metrics in the NGSO-GSO sharing context. Indeed,

(Continued from previous page)
[111] *Id.* at 9.

[112] *Id.* While SES agrees that the EPFD limits in the upper Ka-band are overprotective, it argues that the aggregate EPFD limits in lower Ka-band and Ku-band approximately correspond to an I/N value of −12.2 dB, which is an interference metric for FSS networks used in Recommendation ITU-R S.1323-2 that was last updated in 2002. *See* SES Comments at 13-14, 17-18. This analysis, however, does not address actual performance impacts to GSO networks (for example, increase in unavailability or degraded throughput for ACM links). In addition, as noted above, in reality NGSO systems must operate significantly below EPFD limits in most cases due to conservative assumptions in the compliance assessment and given that an NGSO system cannot realistically match its operations to the EPFD curves and must instead set its configuration to meet the limits at their most restrictive point. Amazon points to Recommendation ITU-R S.1432, which provides that FSS system interference should be no more than 25% of the clear sky system noise, equating to a −6 dB I/N limit. *See* Amazon Comments at 6. Amazon states that applying the ITU's EPFD limits in Ku-band yields limits that are 3.5 to 12 times more restrictive than this I/N limit. *Id.*; *see also generally* EchoStar Comments at 7 (generally supporting retention of current EPFD limits but terming them "prophylactic"); CSF Comments at 2 (arguing the EPFD limits are "overly protective, effectively relegating NGSOs to a lower status than secondary service"). *But see* Viasat Reply at 12-13 (stating the −6 dB I/N value in Recommendation ITU-R S.1432 includes noise generated from all FSS systems, including other GSO networks).

[113] *See* ICLE Comments at 7 ("By imposing rigid technical constraints that cannot be adjusted through market mechanisms, however, the current EPFD rules prevent negotiations that would lead to efficient solutions that balance interference protection with spectrum utilization. This represents a fundamental misalignment between regulatory structure and the principles of economic efficiency."); *see also, e.g.*, PK and OTI Comments at 6 ("[T]he current rules create a strong incentive for incumbent GSO operators *not* to coordinate in good faith with NGSO systems.") (emphasis in original). Thus, we disagree with analyses which suggest that the current EPFD limits function like Coasean property rights in a commons, without offering any evidence of such successful negotiations. *See* Viasat Comments, Appx. A at 7. In addition, economic analyses which assume that "GSO operators would incur significant costs if NGSO systems were permitted to generate additional interference" above current EPFD levels, *id.*, Appx. A at 12, ignore the comprehensive and repeated real-world testing of exceedances of the EPFD limits on currently operating GSO networks and the near-unanimous view that EPFD limits in the upper Ka-band are unjustifiably stringent on a technical level. *See, e.g.*, Telesat Comments, Annex 1; SES Comments at 17-18; Amazon Comments at 6; CSF Comments at 4; NetChoice Comments at 3. We perform a thorough benefit and cost analysis and consider related economic arguments in Appendix D *infra*.

[114] *See, e.g.*, Phoenix Center Reply, Attach. at 8 (noting projections that NGSO satellite revenues will overtake traditional GSO satellite revenues by 2028 while growing at 27% annually compared to just 3.6% for GSO services and that "meaningful cost reductions for widely used and growing services will typically outweigh small cost penalties applied to stagnant or declining networks").

when recently considering protection requirements between NGSO FSS systems, which universally incorporate ACM, the Commission adopted a long-term protection criterion of 3% degraded throughput, and a short-term protection criterion based on the absolute increase in link unavailability (0.4%), and it declined to create aggregate limits on NGSO interference into other NGSO systems.[115] Importantly, the Commission explained that notwithstanding its newly adopted default protection requirements, coordination among satellite operators in the first instance "offers the best opportunity for efficient spectrum sharing."[116] Similarly, when the Commission revised its two-degree orbital spacing rules for GSO satellites in 2015 it explicitly acknowledged the value of coordination agreements reached between GSO satellite operators and offered continued protection of coordinated operations even when they did not comply with default, two-degree spacing rules.[117] In addition, there is no conflict between the comprehensive update to the NGSO-GSO sharing framework undertaken in this rulemaking based on a substantial technical record and the previous adoption—in the absence of any well-developed alternative—of ITU EPFD limits, including in the 17.3-17.8 GHz band, which reflected prior domestic alignment with ITU rules before a compelling reason to depart from those rules was developed.[118]

37. We re-emphasize this fundamental principle—that private agreements, not heavy-handed regulation, lead to the most efficient satellite spectrum sharing outcomes—and firmly incorporate it into NGSO-GSO sharing in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. Unlike compliance with EPFD limits, which is assessed by the ITU BR and effectively replaces any coordination among GSO and NGSO operators in bands subject to EPFD limits, our default GSO protection criteria and framework will explicitly recognize and require good-faith coordination.[119] This is facilitated by the fact that, while we adopt a default set of GSO reference links below to facilitate technical showings of compliance with the GSO protection criteria by NGSO applicants, the particular reference links are taken from particular satellite networks.[120] We believe interference protections should ultimately be rooted in real-world interference realities. So when an NGSO operator completes coordination with a particular GSO network serving the United States, we will permit the NGSO operator to revise its technical compatibility showing by omitting the links of the GSO network with which coordination was completed.[121] By doing so, we

[115] *See Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, Second Report and Order and Order on Reconsideration, 39 FCC Rcd 12656, 12657, para. 1 (2024) (*NGSO FSS Inter-Round Sharing Second Report and Order*).

[116] *NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 13173, para. 20.

[117] *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Second Report and Order, 30 FCC Rcd 14713, 14752-53, paras. 108-110 (2015) (*Part 25 Second Report and Order*).

[118] *See, e.g., Amendment of Parts 2 and 25 of the Commission's Rules to Enable NGSO Fixed-Satellite Service (Space-to-Earth) Operations in the 17.3-17.8 GHz Band*, 39 FCC Rcd 11156, 11156-57, para. 1 (2024). *But see* Viasat Comments at 6-7.

[119] *See NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 13173, 13175-76, paras. 21, 24-25 (discussing good-faith coordination requirements). While SES questions the prospect of NGSO-GSO coordination as "require[ing] constant renegotiation as the interference environment evolves," it does not explain why similar changing interference environments would not prevent stable coordination agreements in the GSO-GSO context, NGSO-NGSO context, or NGSO-GSO context in the 18.8-19.3 GHz and 28.6-29.1 GHz bands in which NGSO FSS systems have a primary designation over GSO FSS networks. *See* SES Reply at 18 n.58; 47 CFR § 2.106(d)(165). In addition, while as a practical matter coordination may not be pursued by parties if the NGSO satellite operator decides not to avail itself of the revised NGSO-GSO sharing framework adopted here and instead complies with existing ITU EPFD limits in the United States, we will generally require good-faith coordination discussions among GSO and NGSO operators in these bands, should either party wish to raise concerns or reach a more efficient sharing solution. *But see* Telesat Apr. 23, 2026 *ex parte* at 1.

[120] *See* Appendix B, *infra*.

[121] We will also consider other requests from NGSO operators to update their technical showings on the basis of coordination agreements with GSO operators.

avoid the intractable barriers to coordination under the current regime while offering a transparent means for agreements between NGSO and GSO operators to be reflected in the authorized operating parameters of the NGSO system.[122]

6. Keeping Pace with Technological Advancements

38. Satellite technology has advanced profoundly since EPFD limits were developed in the 1990s.[123] Analog satellite transponders have been replaced by digital systems with onboard processors. Large, fixed beams have given way to smaller, steerable beams using phase array antennas.[124] Adaptive coding and modulation techniques allow satellite links to be maintained despite interference (such as adverse weather) by varying throughput.[125] Operators have incorporated dynamic beam pointing, uplink and downlink power control, and network protocols that provide greater resilience to environmental effects and interference.[126] And on the earth station side, large dishes have given way to very small aperture terminals that allow for widespread, cost-effective connectivity.[127]

39. These technological developments both allow NGSO systems to better control and limit interference into GSO networks and strengthen GSO operations' ability to adapt to changing interference environments.[128] Fundamentally, they have enabled more intensive, compatible shared use of the spectrum. Indeed, the availability of ACM with expected GSO networks in the Q- and V-bands was a significant factor that led the international community to decline EPFD limits in the Q- and V-bands and instead adopt an NGSO-GSO sharing framework incorporating a long-term GSO protection criterion of 3% degraded throughput.[129]

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[122] Consistent with our approach requiring good-faith coordination among NGSO operators, we will not mandate specific formats or means of the appropriate data sharing, as doing so may be unduly prescriptive or burdensome. *See* 47 CFR § 25.261(b); *see also* 47 CFR § 25.146(e). *But see* EchoStar Comments at 15. We also note that information sharing during good-faith coordination can include relevant and accurate information on NGSO system implementation to model typical and maximum operations in terms of interference potential. *See* EchoStar Reply at 12.

[123] *See* Amazon Comments at 4; SIIA Comments at 4-6; *see also* CCIA Comments at 11; Lexington Institute Comments at 2; SES Comments at 16-17 (noting "the Ka-band EPFD limits were developed before any commercial Ka-band GSO satellites were in orbit").

[124] *See* SIIA Comments at 4 (arguing that steerable, highly focused spot beams are the "biggest change," noting they "can perform null-steering, which enables tuning the phased array to null or eliminate interference in a specific direction . . . allow[ing] the interference of an NGSO satellite to effectively become invisible to signals for a protected GSO system"); *see also* Lexington Institute Comments at 2.

[125] *See* PPI Comments at 2 (calling ACM a "game-changer"); *see also* SIIA Comments at 5. Telesat indicates that ACM adoption among GSO networks nears 100% in Ka-band, is about 50-60% in Ku-band, and is non-existent in Ku-band BSS. Telesat Comments at 5; *see also* Amazon Comments at 4; CSF Comments at 3.

[126] *See* Amazon Comments at 4.

[127] *See id.*

[128] *See, e.g.*, Furchtgott-Roth Econ. Study I at 6 ("The 1997 [EPFD] limits are outdated because they fail to account for technological changes that reduce the likelihood of interference including the following: smaller, steerable spot beams for NGSO FSS systems; improved NGSO constellation geometry and design; adaptive coding and modulation technologies for GSO networks to maintain their links against naturally occurring degradation; and improved earth station equipment for both GSO networks and NGSO FSS systems.") (internal citations omitted); CSF Comments at 3 ("Under current rules, EPFD limits fail to reflect how modern GSO systems operate or how they respond dynamically to short-term fluctuations in link quality. For GSO networks using ACM, a metric like throughput degradation would be more appropriate.").

[129] *See* ITU Radio Regulations, Art. 22, No. 22.5L; ITU-R Resolution 770 (Rev. WRC-23); *see also, e.g.*, Telesat Comments at 4 ("The degraded throughput standard is especially appropriate for ACM systems.").

7. Promoting U.S. Leadership Globally

40. In launching the Notice of Proposed Rulemaking in this proceeding, we concluded it was appropriate to begin our domestic review of the NGSO-GSO sharing regime without awaiting the outcome of ongoing deliberations at the ITU.[130] Experience to date has reinforced that judgment. While individual member states, including the United States, have continued to contribute to the ongoing technical studies on the current Article 22 EPFD limits in ITU WP 4A, needless procedural roadblocks and delay tactics have repeatedly ground international technical discussions to a halt.[131] Although some stakeholders have suggested deferring domestic action pending further ITU developments,[132] we believe it is important to move forward in a timely manner to provide regulatory clarity and support connectivity for millions of Americans, even as the ITU process continues toward WRC-27.[133]

41. At the same time, we believe our approach can promote global collaboration toward spectrum harmonization. We anticipate that the record developed in this proceeding, including technical analyses and, over time, real-world implementation outcomes, may serve as a useful reference point for the ITU's ongoing work. We also hope that the Commission's policy framework can contribute constructively to discussions leading up to WRC-27, as the international community explores approaches to NGSO-GSO sharing that enhance broadband performance, expand access in rural and remote areas, promote competition, and ultimately benefit consumers worldwide.[134]

42. As we originally anticipated, this rulemaking has compiled an exceptional technical record—including real-world measurements and additional, detailed technical simulations not submitted to international fora—that enable us to make a forward-looking decision now in the best interests of Americans.[135] While international deliberations may—and should—converge on a similar revision to the EPFD framework in the future, the ITU Radio Regulations explicitly recognize administrations' rights to exceed EPFD limits on their own territory in the meantime.[136] And such exceedances are technically feasible without altering EPFD compliance in neighboring countries with use of narrow, spot beams and

[130] *Notice*, 40 FCC Rcd at 3396-97, para. 14.

[131] *See, e.g.*, Chair's Report on the Meeting of Working Party 4A (5-16 May 2025) at 19 (summarizing that at the May 2025 meeting of WP 4A, nine input contributions were received related to the compiled document on EPFD studies, yet only 4 sessions were agreed to be allocated to the group and 3 of these sessions were used just to introduce contributions with limited discussions on each contribution. "Therefore, due to lack of time, the compiled documents containing all contributions since the beginning of the study cycle was not discussed and not reviewed at this meeting. It was even not possible to find an agreement on the title of the document.").

[132] *See, e.g.*, DIRECTV Comments at 3-4; Eutelsat et al. Comments at 9-10; SES Comments at 6-8; Viasat Comments at 17-22.

[133] *See also, e.g.*, Rebecca Grant Comments at 2 (arguing the ITU process does not always serve U.S. domestic policy goals).

[134] *See* FCC, United States Federal Communications Commission Contribution to the 2026 Global Symposium for Regulators Consultation at 3 (2026), https://www.itu.int/itu-d/meetings/gsr-26/wp-content/uploads/sites/45/2026/04/GSR-26_Contribution_USA-FCC.pdf.

[135] *See, e.g.*, CSF Comments at 2 ("By implementing reforms now rather than waiting for the long drawn out process that occurs every four years through the Worldwide Radiocommunication Conference (WRC), the Commission ensures that U.S. citizens can realize the benefits of greater satellite connectivity as soon as possible."); NetChoice Comments at 2 (noting that the Commission's actions "would give the rest of the world the signal it needs to start opening up their own regulatory environments—prioritizing people over protecting incumbents"); PK and OTI Comments at 4 ("Six years is far too long for American industry and consumers to wait.").

[136] ITU Radio Regulations, Art. 22, No. 22.5CA.

other modern NGSO satellite technologies.[137] Our action will promote American leadership at a time of increasing global competition.[138]

B. Modernized Sharing Rules for NGSO-GSO

1. Coordination Default and Degraded Throughput Backstop

43. We consider and ultimately reject countervailing arguments in favor of retaining the current EPFD limits. One argument is that GSO operations are uniquely prone to interference. SES, for example, asserts that the "EPFD framework is necessary because GSO satellites operate at fixed orbital positions in a specific orbital arc and cannot maneuver or switch satellites to mitigate the interference caused by NGSO systems operating in shared frequency bands."[139] However, the EPFD limits are not the only way to protect GSO networks from unacceptable interference, as shown by the international adoption of the degraded throughput methodology to protect GSO networks in Q- and V-bands.[140] Eutelsat argues that EPFD limits are uniquely suited to protecting GSO operations, because "EPFD limits mitigate [the] risks [of dynamic, time-varying interference caused by NGSO systems] by placing strict bounds on both peak and aggregate interference levels" and "appropriately protect high-value links to support diverse applications by differentiating EPFD limits according to terminal characteristics."[141] However, the degraded throughput methodology also limits peak and aggregate interference (or short-term and long-term interference, in the terminology of a degraded throughput analysis) and accounts for differing terminal characteristics through a set of GSO reference links.[142]

[137] While other administrations are sovereign in making spectrum management decisions within their own jurisdictions, to the extent that NGSO-GSO sharing reform creates a "patchwork" of regulatory requirements in different countries, any additional burdens on satellite operators in navigating country-specific rules are outweighed by the significant corresponding benefits that updated rules would bring to the American public. *But see* SES Comments at 7; Viasat Comments at 18-19; Telesat Reply at 3; Avanti Reply at 6-7. In addition, while SES raises concerns about wide GSO satellite *receiving* beams covering multiple countries, SES Comments at 7, this proceeding addresses only downlink interference cases, i.e. when the receiving station of the GSO network is an earth station in the United States, not a space station on the GSO arc.

[138] *See, e.g.*, Lexington Institute Comments at 1 ("Action now by the FCC can help deter China from creating a viable space-based 'Belt and Road' broadband service."); *see also* ICLE Comments at 13; CCIA Comments at 4; SIIA Comments at 7-8.

[139] SES Comments at 5; *see also* Viasat Reply at 15-16.

[140] *See* ITU Radio Regulations, Art. 22, No. 22.5L.

[141] Eutelsat et al. Comments at 7. Telesat also argues that revised EPFD limits are preferable to a degraded throughput methodology because EPFD limits accommodate both ACM and non-ACM systems, and because of the benefits of international harmonization, considering that the international community has experience in, and a level of comfort with, applying EPFD methodology. Telesat Reply at 3. However, the international community has also adopted the more efficient, degraded-throughput methodology for the protection of GSO networks from NGSO systems in Q- and V-bands, *see* ITU Radio Regulations, Art. 22, No. 22.5L, we have adopted a domestic implementation of this methodology in the NGSO-NGSO sharing context, *see* 47 CFR § 25.261(d), and we can readily supplement the methodology with a −10.5 dB I/N limit for non-ACM systems that has also been used internationally. *See* TG 5/1 Liaison.

[142] *See* Amazon Reply at 16. Thus, EPFD limits are not the only means to ensure "certainty and stability" of both GSO and NGSO operations, even in the absence of coordination. *But see* Viasat Comments at 4-6. Indeed, like EPFD limits, the degraded throughput methodology establishes "outer limits" for NGSO operation—based on actual GSO network performance—which accommodates the continued evolution of GSO satellite services and which is demonstrated *ex ante*—in an NGSO space station license application, prior to commencement of operations. *But see id.* at 8; *see also* DIRECTV Feb. 9, 2026 *ex parte* at 3-4.

44. In addition, while Viasat argues that alternatives to EPFD limits are a hinderance to innovation by GSO operators,[143] the degraded throughput methodology will allow continued innovation by protecting GSO operators from actual, unacceptable interference, as demonstrated by the NGSO applicant, while also significantly improving the efficiency of the NGSO system and use of the spectrum overall.[144] Viasat also argues that calls for reform of the NGSO-GSO sharing framework are merely "calls to hobble competition" as they rest on "deeply flawed claims that eliminating the EPFD limits would not expose existing and future GSO operations to unacceptable levels of interference."[145] While it is unclear what level of interference Viasat would deem "acceptable," especially considering its support of the extremely restrictive upper Ka-band EPFD limits, the repeated, months-long, real-world measurements submitted by SpaceX have demonstrated that EPFD limits can be exceeded without significant impact to currently operating GSO networks.[146] Viasat further claims that any reforms to the NGSO-GSO sharing framework "would frustrate efforts by GSO operators to introduce innovative service offerings."[147] To the extent this means the future deployment of earth station terminals particularly susceptible to interference that require the levels of protection offered by the upper Ka-band EPFD limits, the burdens on NGSO systems from such unequal spectrum sharing have not been justified.[148] Viasat and other commenters also argue that the significant recent growth in NGSO systems is proof that EPFD limits are not unduly constraining.[149] But the fact of such growth—spurred by technological advances and the inherent benefits of lower latency and potentially broader coverage derived from NGSO satellite constellations, especially in LEO—does not negate any of the benefits of NGSO-GSO sharing reform.[150]

45. SES argues that eliminating EPFD protections would shift the burden of interference mitigation onto GSO operators and the Commission in administering a new framework.[151] However, NGSO operators would still have a unilateral requirement to protect GSO networks under a degraded throughput framework the Commission is already administering in the NGSO-NGSO sharing context.[152] SES also raises concerns that, without EPFD limits in place, NGSO operators may tilt the competitive landscape in their favor and eventually monopolize shared spectrum bands.[153] Yet as long as NGSO

[143] *See* Viasat Comments at 8-9.

[144] *See* Amazon Reply at 15-16.

[145] Viasat Comments at 8-9.

[146] *See* section III.A.1.a. *supra*.

[147] Viasat Comments at 13; *see also id.*, Exh. E.

[148] Viasat separately argues that the Commission's two-degree spacing rules for GSO-GSO compatibility unduly hamper its ability to deploy even smaller earth station terminals. *See id.* at 13, 30. And while Viasat states that NGSO operators are not similarly limited in the size of earth stations they can deploy, *see, e.g.*, Viasat Feb. 26, 2026 *ex parte* at 4, we note that all NGSO system earth stations operating in these bands do so on an unprotected basis vis-à-vis GSO satellite networks.

[149] *See, e.g.*, Viasat Comments at 1-2, 22; Eutelsat et al. Comments at 4; SES Comments at 5-6.

[150] In addition, while Viasat notes that the EPFD regime has been in place for decades, it omits that, for most of that period, there were few or no operational NGSO systems subject to the EPFD limits and that only recently have the inefficiencies of the regime become a real-world constraint on modern LEO systems. *See* Viasat Comments at 10. In addition, Viasat's argument that current NGSO systems have not "com[e] close to exhausting the 'head room' permitted by their existing authorizations and the existing [EPFD] GSO-NGSO spectrum sharing framework" is contradicted by the technical record indicating that, but for current EPFD limits, NGSO systems could significantly increase their operations. *Compare id.* at 1-2 and Exh. G *with* sections III.A.1 and III.A.4. *supra*.

[151] *See* SES Reply at 4.

[152] *See* 47 CFR § 25.261(d).

[153] *See* SES Reply at 4; *see also* Viasat Comments at 16-17.

systems have a one-way requirement to protect GSO networks, and not claim protection from them, it is impossible for NGSO systems to monopolize the shared spectrum.[154] SES further argues that moving away from the EPFD regime would devalue GSO service assets potentially to the point of stranding those assets, and discourage future GSO investments and innovation.[155] SES provides no economic evidence in support of this strong claim, nor does it contend that the use of the degraded throughput methodology in Q- and V-bands has foreclosed future GSO use of those bands. We believe that under appropriate protection criteria in a degraded throughput framework GSO networks can continue to grow and provide valuable services.

46. Commenters also present technical simulations showing exceedances of proposed protection criteria.[156] For example, analyses of the Amazon system assuming an Nco of 16 and a GSO-arc avoidance angle as low as 2 degrees indicate exceedances of the proposed threshold limits at certain locations.[157] An analysis of the Starlink system at a GSO network earth station in Lima, Peru, assuming an Nco of 8 and a GSO-arc avoidance angle of 4 degrees, also indicates exceedances of a 0.1% absolute increase in unavailability.[158] Additionally, Eutelsat presents simulations in which the Starlink system, when using an EPFD-compliant configuration of an Nco of 1 and a GSO-arc avoidance angle of 18 degrees, would nonetheless exceed the thresholds of 3% degraded throughput and 0.1% absolute increase in unavailability for the four analyzed GSO links in Ku-band—thus indicating that the current EPFD limits may be *less* protective than the proposed new protection criteria, a conclusion not suggested by any other commenter and contrary to the real-world testing summarized above.[159] Ultimately, compliance with the GSO protection criteria we are adopting must be demonstrated by the NGSO applicant. If certain NGSO operational parameters are not currently feasible while meeting those criteria for the set of GSO reference links, then they will not be permitted. Thus, simulations showing exceedances for certain NGSO operational parameters at certain locations do not undermine our conclusion that significant capacity and service improvements are possible under performance-based GSO protection criteria, as demonstrated by real-world testing and technical simulations.

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[154] We also do not agree that revising the NGSO-GSO sharing framework "would make it even easier for large NGSO operators to overconsume available spectrum and orbital resources," Viasat Comments at 16, given that NGSO operators would still have a one-way obligation to protect GSO networks under reasonable protection limits. In addition, while Viasat argues that adopting performance-based protection criteria for GSO operations would "generate negative externalities that disproportionately impact GSO operators," Viasat Comments at 16, it advocates maintaining the stringent EPFD limits on NGSO operations in the upper Ka-band to protect deployments of even the smallest (and most sensitive) GSO network user terminals, *see* Viasat Comments at 13, Exh. F, which significantly impact NGSO system capacity and efficiency. *See* section III.A.1. *supra*.

[155] *See* SES Reply at 23. Similarly, SES argues that the Ku-band EPFD limits should be retained because existing "satellites and services were designed and launched with the expectation that the EPFD limits would remain to protect GSO satellites from NGSO interference," while at the same time supporting review towards potential revision of the Ka-band EPFD limits, under which GSO networks also currently operate. *See* SES Comments at 13, 16-20. In any event, we consider and adopt reasonable, performance-based protection criteria for GSO networks that will continue to support competitive GSO services.

[156] *See* DIRECTV Reply, Attach. 1; DIRECTV Dec. 8, 2025 *ex parte*, Attach. B; DIRECTV Jan. 16, 2026 *ex parte*, Attach. A; EchoStar Reply, Exh. 1; Eutelsat Jan. 26, 2026 SB *ex parte*, Attach.; *see also generally* Viasat Comments at 8-9.

[157] *See* DIRECTV Reply, Attach. 1 at 29-46; EchoStar Reply, Exh. 1.

[158] DIRECTV Dec. 8, 2025 *ex parte*, Attach. B at 10; DIRECTV Jan. 16, 2026 *ex parte*, Attach. A at 10.

[159] *See* Eutelsat Jan. 26, 2026 SB *ex parte*, Attach. at 6; Eutelsat et al. Reply, Appx. Eutelsat also includes a static analysis which indicates that a GSO network would not be able to deploy 60 cm antennas if the Starlink system were configured with an Nco of 8 and a GSO-arc avoidance angle of 4 degrees. Eutelsat Jan. 26, 2026 SB *ex parte*, Attach. at 14. This result is inconsistent with the real-world test results summarized in section III.A.1.a. above, which included GSO earth station antennas of as small as 35 cm. *See also* SpaceX Jan. 29, 2026 *ex parte* at 3.

47. Commenters also present simulations showing exceedances of proposed protection criteria that demonstrate the interplay between short-term and long-term interference protections. For example, studies of the Starlink system in Ka-band assuming an Nco of 40 and a GSO-arc avoidance angle of either 18 degrees or 4 degrees found less than a 0.1% absolute increase in unavailability at non-ACM GSO network user terminal locations in Oregon (0.016% and 0.03%, respectively), Utah (0.041% and 0.056%, respectively), Oklahoma (0.071% and 0.098%, respectively), Alabama (0.030% and 0.032%, respectively), and New Mexico (0.046% and 0.095%, respectively); and exceedances of the 0.1% limit in New York (0.104% and 0.171%, respectively).[160] For the Amazon system, studies assuming an Nco of 16 and a GSO-arc avoidance angle of either 6 degrees or 2 degrees in Ka-band showed compliance with a 0.1% absolute increase in unavailability limit for user terminals in Oregon (0.025% and 0.038%, respectively) and Alabama (0.01% and 0.035%, respectively); mixed results—compliance with an avoidance angle of 6 degrees and exceedances at 2 degrees—for earth stations in Oklahoma (0.024% and 0.566%, respectively), New York (0.03% and 0.39%, respectively), and New Mexico (0.01% and 1.37%, respectively); and exceedances for an earth station in Utah (0.14% and 1.47 %, respectively).[161] However, in all these cases for both the Starlink and Amazon systems, the separate long-term limit proposed for non-ACM GSO links such as these, −10.5 dB I/N for 80% of the time, was exceeded.[162] Because both long-term and short-term limits would need to be met at all locations, the effect of the −10.5 dB I/N long-term limit would further reduce the expected short-term absolute increases in unavailability in all cases, even where a 0.1% short-term limit was met with a wide margin. With ACM networks, analyses for the Amazon Ka-band system, for example, similarly indicate that the proposed long-term protection criteria of 3% throughput degradation is the limiting factor even when a short-term 0.1% absolute increase in unavailability limit is met.[163]

48. Having concluded that existing EPFD limits are needlessly prescriptive, outdated, and overprotective of GSO operations, and that they unreasonably constrain services by innovative new NGSO systems, we turn to their replacement.[164] For FSS systems using ACM, we conclude—again—that the performance-based metrics of throughput degradation and increase in absolute unavailability represent efficient and appropriate protection criteria. Indeed, when recently establishing protection criteria for NGSO-NGSO sharing in bands including the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands, the Commission likewise set long-term and short-term protection thresholds using these metrics.[165] The Commission did so because, for ACM satellite systems, the degraded throughput methodology reflects modern technology, results in efficient spectrum sharing, and is readily administrable.[166] The same

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[160] DIRECTV Reply, Attach. 1 at 14-25; *see also* DIRECTV Comments, Attach. 1 at 10-11.

[161] DIRECTV Reply, Attach. 1 at 33-44.

[162] *Id.*, Attach. 1 at 27, 46.

[163] *See* EchoStar Reply, Exh. 1 at 7 (modeling the Amazon system with an Nco of 16 and a GSO-arc avoidance angle of 2 degrees and finding impacts at a Ka-band user terminal in Washington of 0.03% absolute increase in unavailability and 4.2% degradation in throughput).

[164] Our revised rules will reflect the new NGSO-GSO sharing framework as an alternative to compliance with EPFD limits in the United States. Even under current rules, although NGSO operators must certify they will comply with any applicable EPFD levels in Article 22 and Resolution 76 of the ITU Radio Regulations, including for international operations, the EPFD levels may be exceeded when permitted by the ITU Radio Regulations, for example on the territory of any country whose administration has agreed to the exceedance. *See* 47 CFR § 25.146(a)(2); ITU Radio Regulations, Art. 22, 22.5CA.

[165] *NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 3702, para. 9; *NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12660-61, para. 9; *see also* 47 CFR 25.261(d).

[165] *NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 3702, para. 9; *NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12660-61, para. 9; *see also* 47 CFR 25.261(d).

[166] *NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 3706-08, paras. 17-19.

reasoning now applies to the NGSO-GSO sharing context. Even the ITU, when more recently establishing protections for GSO networks from NGSO systems in bands between 37.5 GHz and 51.4 GHz, chose a degraded throughput methodology, not EPFD limits.[167] In contrast, pursuing merely different EPFD limits would sacrifice the benefits of performance-based metrics and needlessly delay reform, as parties proposing the development of new EPFD limits do not themselves propose definitive limits for adoption.[168]

49. A degraded throughput methodology does not make enforceability more difficult than the current EPFD regime.[169] As noted below, under our modernized framework, NGSO applicants will be required to submit transparent technical analyses of how they would meet the GSO protection criteria, which will be subject to public and Commission review. In contrast, the current ITU compliance assessments have been noted as "opaque" and encouraging "gamesmanship."[170] Nor is the degraded throughput analysis unduly complex given its benefits,[171] as it is already used by satellite operators to assess NGSO-GSO interference.[172] Nor would GSO operators lose the ability to control their service quality. As we discussed in response to similar concerns in the NGSO-NGSO sharing context,[173] the interference criteria must be met at all analyzed locations. Since the worst-case locations will drive NGSO operators' determinations of appropriate system parameters and any mitigation measures, the actual degradations in throughput, absolute increases in unavailability, and I/N levels will be less than the protection criteria in many circumstances. And studies on the record confirm these differing impacts.[174] Thus, earth station equipment that is used for high-availability applications, and that is less sensitive to sidelobe interference than the most sensitive user terminals to be protected, will experience real-world effects significantly below the protection criteria. In a similar vein, Eutelsat raises concerns that the degraded throughput methodology inappropriately allows a gateway link to be degraded as much as a user

[167] *See* ITU Radio Regulations Art. 22, No. 22.5L; ITU Resolution 770 (Rev. WRC-23).

[168] *See* Telesat Comments at 6-7; Telesat Reply at 5-6; SES Comments at 19-20. This same reasoning applies to the proposal from SES to recalculate EPFD limits in both the Ku-band and Ka-band based on a long-term aggregate I/N protection criterion of −10.5 dB for 90% of the time, which was first proposed over six months after the close of the comment period. *See* SES Mar. 3, 2026 *ex parte* at 8.

[169] Eutelsat, SES, and Viasat raise such concerns. Eutelsat et al. Comments at 14; SES Comments at 9; SES Apr. 3, 2026 *ex parte* at 5; Viasat Comments at 8. While SES argues it would be impossible in practice to "determine whether a given NGSO constellation is exceeding permitted throughput or availability degradation levels," SES Comments at 9, this objection would apply equally to the EPFD limits. *See* SES Jan. 8, 2026 *ex parte* at 2-3 (relaying an unintended but prolonged interference problem experienced under current EPFD rules); *see also* Viasat Mar. 9, 2026 *ex parte* at 6. Viasat also indicates that the EPFD limits have significant enforcement challenges themselves. *See* Viasat Comments at 25-29, Exh. H.

[170] *See* ICLE Comments at 9; Viasat Comments at 25.

[171] *See NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 13172-73, para. 17 (explaining that a degraded throughput approach is "the most technically promising option as it would account for realities of modern NGSO systems and be based on a key design consideration for such systems"). *But see* SES Comments at 8-10; DIRECTV Comments at 7-9; Eutelsat et al. Comments at 13-14.

[172] *See, e.g.*, Telesat Reply at 5 (noting the degraded throughput methodology is "useful for case-by-case analyses such as NGSO-GSO bilateral coordination").

[173] *See NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12670-71, para. 29; *see also, e.g.*, Letter from Adel Al-Saleh, CEO, SES, to Jessica Rosenworcel, Chairwoman, FCC, IB Docket No. 21-456, at 2 (filed Oct. 21, 2024) (arguing that a 0.4% absolute increase in unavailability limit would mean "NGSO operators would be unable to meet the needs of customers that require high, guaranteed availability levels").

[174] *See, e.g.*, SpaceX Dec. 16, 2025 *ex parte* at 4 (noting that the impact of the largest Ku-band NGSO system on availability for 98% of mass-market GSO user terminal links analyzed "would be at least an order of magnitude below the [0.1%] short-term criterion threshold"); Amazon Comments at 11, Appendix at A-15, Table 14, A-16, Table 15.

link, although impacts to gateway links can impact service to numerous customers at once.[175] Again, this is a theoretical concern that is unlikely, if ever, to occur in reality, because the NGSO system must be configured to cause no more interference than the most protective criteria for a GSO link, and because larger, gateway earth station antennas are inherently less susceptible to sidelobe interference than smaller user terminals and therefore will receive less, often substantially less, interference than the thresholds.[176]

2. Long-Term Interference Backstop

50. We adopt a 3% time-weighted average degraded throughput threshold as the long-term interference metric that NGSO systems must comply with for the protection of GSO networks using ACM in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands.

51. Consistent with the Commission's decision making in the NGSO-NGSO sharing context for modern satellite systems using ACM, we conclude that adopting this value best furthers our goals of allowing for competitive new and improved services by NGSO operators while providing adequate protection of GSO networks. First, this value has been thoroughly developed, debated, and adopted for the protection of GSO networks using ACM in the Q- and V-bands internationally, as well as for the protection of NGSO systems using ACM in bands including the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands.[177] Second, the 3% value is the only degraded throughput value proposed, analyzed, and supported on the record.[178] Third, the 3% throughput-degradation threshold limits the interference allowed at any analyzed GSO network earth station location, not the expected average of interference across all locations. Since the worst-case scenarios will drive the overall NGSO system parameters necessary to guarantee protection of the most sensitive link, actual interference will be less than 3% in many circumstances. Importantly, GSO satellite operators will be able to further reduce this level of throughput degradation for given customers by the use, or continued use, of appropriate earth station equipment that

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[175] *See* Eutelsat Jan. 26, 2026 SB *ex parte*, Attach. at 3.

[176] Other criticisms of the degraded throughput methodology are similarly unconvincing. Viasat, for example, states that the ITU's Q- and V-band degraded throughput framework is not yet ready for implementation. Viasat Comments at 12, Exh. C. However, the Commission's degraded throughput framework in the NGSO-NGSO context has already answered the questions Viasat raises. *Compare, e.g.*, *id.* at 12 (stating that the ITU framework considers "only a single geographic location"), with *NGSO FSS Inter-Round Sharing Second Order*, 39 FCC Rcd at 12687, paras. 77-78 (generally requiring at least three geographically diverse locations for analysis). *See also* Eutelsat et al. Reply at 12. SES argues that "disputes have emerged" in using the degraded throughput methodology. SES Comments at 8 n.20. However, implementation of the EPFD limits has been disputed for years, yet the Commission established its EPFD framework over 20 years ago. Eutelsat argues that the degraded throughput framework developed for the "greenfield" Q- and V-bands is not appropriate for the Ku- or Ka-bands, where GSO network infrastructure has been operating for decades and is being used to provide a wide range of services. Eutelsat et al. Reply at 12; *see also* Viasat Comments at 11. This concern, however, can be addressed within the degraded throughput methodology by selection of an appropriate set of GSO reference links. Eutelsat also states that degraded throughput analyses "requir[e] detailed traffic modeling." Eutelsat et al. Comments at 14. However, operators already perform degraded throughput modeling when designing and coordinating their systems. Viasat states that degraded throughput models "evaluate existing GSO networks and technologies." Viasat Comments at 8. But the ITU EPFD limits' requirement to evaluate hypothetical networks does not result in efficient spectrum sharing, and we retain the ability to update specific GSO reference links in the future to keep pace with evolving GSO network designs. SES argues that the degraded throughput methodology is unsuitable for GSO protection, in comparison to NGSO protection from other NGSO systems, because GSO satellites provide fixed, continuous coverage from a stationary orbital arc, while NGSO systems can coordinate with each other dynamically. *See* SES Jan. 8, 2026 *ex parte* at 2; *see also* Eutelsat et al. Comments at 13-14. This ignores the fact that the degraded throughput methodology was adopted first for the protection of GSO ACM networks by NGSO systems internationally and only later adopted in the NGSO-NGSO sharing context domestically. *See* ITU Radio Regulations, Art. 22, No. 22.5L; 47 CFR § 25.261(d).

[177] *See* ITU Radio Regulations, Art. 22, No. 22.5L; ITU-R Resolution 770 (Rev. WRC-23); 47 CFR § 25.261(d).

[178] *See* Amazon Comments at 14; SpaceX Comments at 7; Astranis Reply at 8; PK and OTI Comments at 8-9.

is less sensitive than the most sensitive links to be protected, considering geographic and other factors.[179] And, GSO operators may coordinate directly with NGSO operators regarding accommodation of particular use cases, and we will require good-faith coordination efforts by both GSO and NGSO operators in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. Finally, analysis on the record indicates that a 3% degraded throughput threshold is achievable by current and planned NGSO systems,[180] and could enable significantly greater spectrum use and cost savings by NGSO systems in comparison to the current EPFD limits.[181]

52. We find that objections expressed in the record with respect to the well-established 3% degraded throughput limit for ACM systems are technically unpersuasive. Despite its past support for a 3% threshold for ACM systems in the NGSO-NGSO context,[182] Viasat argues that such a threshold would "leave GSO networks and their end users exposed to significant interference risks."[183] Viasat's supporting study, however, focuses on the interplay between a roughly 3% degradation in throughput and the impact on non-performance-affecting static "reserve capacity"[184]—a hypothetical concept contemplated in the 1990s that is ill-defined and does not reflect how actual ACM systems operate.[185] The study indicates that ACM systems, which are specifically designed to better handle intermittent interference, will experience substantially more interference and worse performance than non-ACM systems.[186] We believe that months of real-world testing are a better indicator of actual interference impacts than studies relying on the "reserve capacity" concept.

53. Eutelsat expresses concern that, even with a 3% time-weighted average throughput degradation threshold, throughput losses will exceed 3% at times.[187] Eutelsat argues that if "a customer experiences a 13.62% degradation for 1% of a 24-hour period, that means they experience about 15 minutes a day of massively degraded service," which is "especially problematic for enterprise level or business-to-business customer links."[188] This worst-case analysis, however, which could not be replicated by one other commenter,[189] assumes that both the GSO and the NGSO customer would need the full capacity of all the spectrum at issue on all available satellites for that full 15 minutes at the same times,[190] and that Eutelsat chooses an earth station antenna that is particularly susceptible to interference for its enterprise customer.[191] As noted above, GSO operators can reliably reduce their expected interference

[179] *See* section III.A.1. *supra*.

[180] *See, e.g.*, *id.*

[181] *See* sections III.A.3. and A.4. *supra* and section III.D. *infra*.

[182] Viasat Comments, IB Docket No. 21-456, at 3 (filed Aug. 7, 2023).

[183] Viasat Comments at 8, Exh. B.

[184] *Id.*, Exh. B at 7-16, 24-25; *see also id.*, Exh. F.

[185] *See* SES Comments at 18-19 ("Additionally, different methodologies, including ill-defined 'reserve capacity' concepts, were used and are inconsistent with today's Ka-band GSOs.").

[186] Viasat Comments, Exh. B at 15-16, Tables 10 & 11.

[187] Eutelsat et al. Comments, Annex 1 at 3; *see also* Eutelsat Jan. 26, 2026 SB *ex parte*, Attach. at 2-3; Viasat Comments, Exh. B at 20; Viasat Reply at 13-14; SES Reply at 16, Appx. D.

[188] Eutelsat et al. Comments, Annex 1 at 3.

[189] Amazon Reply at 32 n.172.

[190] Eutelsat et al. Comments, Annex I at 1 (assuming an Nco of 2).

[191] Eutelsat studied a 45 cm diameter antenna (small for the Ka-band) and antenna pattern AP8 (a pattern relatively susceptible to interference).

through appropriate earth station antenna choice and network design.[192] We need not devise general interference limits based on a combination of unlikely events and worst-case scenarios.[193] Further, as a long-term protection criterion, the change in time-weighted average throughput has already been adopted internationally for the protection of GSO networks using ACM from NGSO systems in the Q- and V-bands.[194] To the extent that an NGSO system complying with the long-term and short-term protection criteria still presents a realistic risk of such interference spikes to a GSO network, that possibility can be discussed during good-faith coordination between the operators.

3. Short-Term Interference Backstop

54. We adopt a 0.1% absolute increase in link unavailability as the short-term GSO interference metric. For the reasons discussed below, we conclude that this 0.1% value, which is more protective than the alternative 0.4% value proposed on the record and adopted in the NGSO-NGSO sharing context, will provide adequate protection of GSO networks while offering substantially improved opportunities for efficient spectrum sharing with NGSO systems.[195] Indeed, we expect the real-world short-term impact to be less than this 0.1% value in many instances given not only varying GSO network antenna performance but also technical studies indicating that it is the long-term protection criteria we are adopting that are the limiting factor, since it is the most restrictive protection criterion that will govern NGSO operational characteristics.[196]

55. As an initial matter, as in the NGSO-NGSO sharing context,[197] we considered both a *relative* measure of increase in link unavailability and an *absolute* measure of increase in unavailability. We again conclude that the use of an absolute increase in link unavailability as the short-term interference metric provides a more reliable measure of short-term interference that is not as susceptible to significant fluctuations as a relative increase metric would be. This is because, for satellite links with a high baseline availability, the relative measure of increase can prove incredibly sensitive. For example, if a GSO link with a baseline availability of 99.99% were reduced to 99.98%, this would represent an absolute change of only 0.01% but a relative change of 100%; while the same, relative 100% increase in unavailability for a GSO link with a baseline availability of 99.5% would represent a 50-times larger or 0.5% absolute change. Especially given the lower value of 0.1% increase that we are adopting in the NGSO-GSO sharing context in comparison with the 0.4% increase permitted in the NGSO-NGSO sharing context,[198] we conclude that the absolute measure of unavailability will provide sufficient protection without the volatility and potential for extremely limiting protection requirements under a relative increase in unavailability metric.[199]

56. We also find that the 0.1% unavailability increase criterion will adequately protect GSO networks. Indeed, it may approximate the maximum short-term interference a GSO satellite operator in Ku-band would expect from another GSO satellite operating 6.5 degrees away on the GSO arc, a distance

[192] *See, e.g.*, Amazon Comments, Appendix at A-16, Table 15.

[193] Further, while Viasat argues that a 3% time-weighted average throughput degradation limit "would place GSO services at a significant competitive disadvantage relative to NGSO services," Viasat Reply at 14, NGSO systems are protected by the same criterion under the Commission's rules. 47 CFR § 25.261(d).

[194] *See* ITU Radio Regulations, Art. 22, No. 22.5L.

[195] *See* SpaceX Comments at 7 (supporting 0.1% absolute threshold); Astranis Reply at 8 (same); Amazon Comments at 14-15 (supporting 0.4% threshold).

[196] *See* section III.B.1. *supra*.

[197] *See NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12667, para. 21.

[198] *See* 47 CFR § 25.261(d)(1)(ii).

[199] We note also that no value for a potential *relative* increase in unavailability threshold has been proposed on the record.

at which no coordination between the GSO operators would be required under the ITU Radio Regulations because the interference is expected to be negligible.[200] Moreover, like the long-term interference metric adopted above, this short-term interference metric will limit the increase in link unavailability at any analyzed location. Since the worst-case locations will drive NGSO operators' determinations of appropriate system parameters and any mitigation measures, the actual increase in unavailability will be less than 0.1% in many circumstances. And importantly, GSO operators can realistically increase the availability of their links by choosing earth station equipment that is less sensitive to interference than the most sensitive GSO links being protected. In addition, GSO operators may coordinate directly with NGSO operators regarding any particular use cases. We also conclude that adopting a 0.1% absolute increase in unavailability metric will simultaneously support competitive new and expanded NGSO services because analyses on the record indicate it can accommodate current and planned NGSO systems.[201]

57. Further, we note that, while the Commission does not guarantee privately negotiated service levels of GSO operators,[202] we believe that concerns on the record about maintaining high availability GSO links are overstated.[203] First, the 0.1% limit is inherently protective. Even the most sensitive GSO reference link, which typically represents a small, mass-market user terminal rather than an enterprise-level customer demanding high availability,[204] could maintain a link availability near 99.9% in the presence of an operational NGSO system. Second, actual enterprise-level customers or others negotiating for high availability services will experience significantly less—perhaps exponentially less—reduction in unavailability than 0.1%. This is because the operating parameters of the NGSO system will be driven by the need to protect the most vulnerable GSO link, and because the inherent design of GSO links predicated on maintaining high availability renders them less susceptible to interference from NGSO systems, for example by use of earth station antennas with higher main-beam gain and lower sidelobes.[205] Third, as we explained in the NGSO-NGSO context, we expect that any cumulative, real-world effects of two or more NGSO systems will likely be less than a simple multiplication of the 0.1% limit by the number of NGSO interferers—even for the most sensitive GSO link—because doing so fails to account for mitigation techniques or other spectrum-sharing measures that may be applied by the NGSO systems

[200] *See* SpaceX Comments at 7. SES estimates that a more realistic interference expectation from GSO satellites located 6.5 degrees away is significantly lower. *See* SES Reply at 10-11, Appx. A. In any event, we note that the 0.1% limit is four times more protective than the 0.4% threshold adopted for NGSO systems using ACM in the same frequency bands.

[201] *See* section III.A.1. *supra*.

[202] *See generally NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12674, para. 36.

[203] *See* SES Reply at 13, Appx. C, D; *see also* Viasat Comments at 14-15; EchoStar Reply at 5-6; Avanti Reply at 3-4; *see also generally* NAB Reply at 6. We note that no commenter citing concerns about service-level agreements has submitted any such agreements on the record or sought a protective order to do so.

[204] *See, e.g.*, SES Reply, Appx. C at C-1 (stating that, today, a Ku-band GSO operator could deliver services with 99.7% availability to a 60-centimeter earth station antenna and could achieve 99.98% availability using a 1.2-meter antenna).

[205] *See* SpaceX Comments at 7; *see also* SpaceX Dec. 16, 2025 *ex parte* at 4 ("The impact of the largest NGSO system on availability for 98% of mass market GSO user terminal links would be at least an order of magnitude below the short-term criterion threshold and for 90% of user terminal links the impact would, at most, be nearly two orders of magnitude below the 0.1% threshold. For the larger, higher gain antennas used for gateways and high-availability customer links, the impact to 90% of reference links will be, at worst, roughly 4 orders of magnitude (10,000x) below the protection criterion threshold. In other words, the proposed protection criteria pose no plausible risk to a high-availability service where a GSO has committed to a 99.7% availability target[.]"). Thus, using an absolute increase in unavailability threshold does not "place[] the Commission rather than the markets in the role of deciding what quality of service consumers want," EchoStar Comments at 7, because real-world performance will depend significantly upon business decisions made by the GSO operator.

to reduce interference to each other, and accordingly reduce their overall aggregate impact to GSO networks.[206] Accordingly, our adoption of a 0.1% limit on absolute increase in unavailability considers the real-world implications of the limit in order to achieve an efficient and reasonable balance between expanded NGSO services and continued, competitive GSO services, rather than imposing arbitrary constraints on NGSO systems to guarantee a theoretical level of GSO service premised on simple, worst-case interference assumptions. We also consider the interplay of the 0.1% limit with our long-term protection criteria. As indicated in simulations,[207] even NGSO system configurations that result in a 0.01% short-term impact to non-ACM GSO links, or a 0.03% impact to ACM GSO links, could exceed the applicable long-term limits of −10.5 dB for 80% of the time or 3% time-weighted average degraded throughput, and therefore the short-term impact would be reduced even further to comply with the long-term criteria. In this way, our choice of long-term GSO protection criteria, especially a limit of −10.5 dB for 80% of the time for GSO networks not using ACM, further addresses concerns raised about short-term impacts to GSO networks, and in particular to non-ACM networks.[208]

4. Interference Backstop for GSOs Without ACM

58. As we move towards performance-based protection metrics for NGSO-GSO spectrum sharing in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands, we recognize that there are continuing GSO satellite operations that do not employ ACM because of the nature of the service they are providing—for example, video transmissions to geographically diverse areas of the country that cannot adapt to changing interference environments in particular areas—and for which a degraded throughput limit would be inappropriate.[209] These GSO satellite services are more prominent in Ku-band, especially BSS, but also exist in Ka-band as well.[210] For the protection of non-ACM GSO satellite links we adopt a protection threshold of −10.5 dB I/N for 80% of the time.

59. With an I/N threshold of −10.5 dB, the level of interference that a Ku-band GSO satellite would experience from an NGSO system is approximately equivalent to that of two GSO Ku-band satellites that are separated by approximately 6.5 degrees.[211] As noted above, under the ITU coordination procedures, Ku-band GSO satellite networks that are separated by more than 6 degrees are not required to coordinate with each other because of the presumed negligible interference effects. In addition, a −10.5 dB I/N limit for 80% of the time was assumed to be protective of FSS and BSS networks in the portions of the Ka-band (24.65-25.25 GHz and 27-27.5 GHz) during international studies with International Mobile Telecommunications (IMT) systems prior to WRC-19.[212] And, the −10.5 dB I/N limit has been validated through real-world testing.[213]

60. The long-term limit of −10.5 dB I/N for 80% of time will work in tandem with the 0.1% absolute increase in unavailability short-term limit to protect non-ACM GSO operations.[214] While some

[206] *See NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12673, para. 34.

[207] *See* section III.B.1. *supra*.

[208] *See* DIRECTV Comments at 7-9; EchoStar Reply at 6-8; SES Dec. 24, 2025 *ex parte* at 2. To the extent that a GSO operator employs the most sensitive user terminals for customers requiring high availability, such use cases may be discussed during good-faith coordination with NGSO operators.

[209] *See, e.g.*, DIRECTV Comments at 7-8; Telesat Comments at 4.

[210] *See* DIRECTV Comments at 1 n.2.

[211] *See* SpaceX Comments at 7.

[212] *See* TG 5/1 Liaison.

[213] *See* section III.A.1.a. *supra*; SpaceX Reply at 7.

[214] Thus, contrary to DIRECTV's concerns, the −10.5 dB I/N limit is not a "substitute" for the short-term criterion of absolute increase in unavailability, *see* DIRECTV Reply at 8, but a supplement to it that will provide additional

(continued….)

commenters argue that a short-term metric alone is the most relevant for assessing interference to non-ACM links,[215] we believe that including an additional, long-term interference metric will provide additional protection to GSO video distribution links without being overly constraining on NGSO operators,[216] as it is supported by the largest NGSO operator in Ku-band,[217] where non-ACM links are more prevalent.

61. We will require the −10.5 dB I/N for 80% of time limit to be met for non-ACM links in both Ku-band and Ka-band. While the record indicates the remaining non-ACM GSO networks are generally concentrated in Ku-band,[218] non-ACM GSO networks are also deployed and providing video service to customers using Ka-band and at least for these networks, the choice of not using ACM is a result of the video distribution type of service being provided, not due to the use of older or less advanced earth station equipment alone.[219] Noting that the only specific proposal on the record for the long-term protection of non-ACM GSO links is the −10.5 dB I/N limit, we will, as with our short-term limit and long-term ACM limit described above, apply this equally to GSO operations in the Ku-band and Ka-band.[220]

5. GSO-Arc Avoidance Angle

62. Above, based on an exceptional technical record,[221] we adopted protection criteria for modern GSO networks that will enable substantial improvements in spectrum use by NGSO systems, resulting in higher capacity and lower costs, using performance-based metrics that accommodate the gold standard of efficient satellite spectrum management—coordination.[222] Nonetheless, we recognize that moving towards a modernized, degraded-throughput based spectrum sharing framework is a significant shift from the EPFD protections that GSO operators had been accustomed to receiving in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands in the United States.

63. Therefore, in addition to the specific protection criteria described above, we will require NGSO systems in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands to observe a 3-degree GSO-arc

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protection to non-ACM networks. Using an interference threshold for 80% of the time is a standard approach for long-term protection criteria for FSS. *See* SpaceX Jan. 30, 2026 *ex parte* at 2 n.9.

[215] *See* DIRECTV Comments at 8; EchoStar Comments at 7.

[216] Although we believe this is a reasonable additional protection requirement for non-ACM GSO operations, we are also mindful of the trending growth of NGSO services and decline in traditional GSO video services. *See, e.g.*, para. 5, *supra*; *2024 Marketplace Report*, FCC 24-136, para. 204 and Fig. II.E.1 (noting that traditional Multichannel Video Programming Distributor (MVPD) subscribership has been declining since 2012, and that DBS subscribers in Ku-band fell by 3 million from 2022 to 2023, or an 18% decline); *Applications of SES S.A. and Intelsat S.A. For Consent to Transfer Control of Licenses and Authorizations*, Memorandum Opinion and Order, DA 25-614, para. 32 (SB/WTB/OET rel. July 11, 2025) (noting declining satellite revenues from media services).

[217] *See* SpaceX Comments at 7; SpaceX Jan 30, 2026 *ex parte* at 2.

[218] *See, e.g.*, Telesat Comments at 5.

[219] *See* DIRECTV Reply at 4-5, 7-8. Thus, protecting non-ACM links in Ka-band will not necessarily incentivize use of "legacy technology," contrary to Amazon's assertion that any non-ACM networks in the Ka-band are simply "a choice of the GSO operator to use outmoded equipment." Amazon Comments at 16.

[220] *But see* Amazon Reply at 37.

[221] *See* section III.A.1. *supra*.

[222] *See* section III.A.5. *supra*; *see also, e.g., NGSO FSS Inter-Round Sharing First Report and Order*, 38 FCC Rcd at 13173, para. 20 (noting the Commission "has consistently affirmed that coordination among NGSO FSS operators in the first instance offers the best opportunity for efficient spectrum sharing"); *Part 25 Second Report and Order*, 30 FCC Rcd at 14752-53, paras. 108-110 (offering continued protection of coordinated GSO operations even when they did not comply with default, two-degree spacing rules).

avoidance angle with respect to any operational co-frequency GSO satellite serving the United States.[223] This angle, which was one of the angles used during the SpaceX real-world testing campaign,[224] approximately reflects the widest main-beam width of GSO satellite earth station antennas currently listed and protected under ITU EPFD limits.[225] Since NGSO operations near the GSO arc typically represent the greatest interfering scenario for a GSO network earth station, observing this 3-degree GSO-arc avoidance angle will provide an additional layer of assurance that NGSO satellite transmissions will not fall within the main beam of the receiving victim earth station and therefore the resulting increase in interference will be minimal.[226] At the same time, it will facilitate NGSO deployment.

64. In the NGSO-NGSO sharing context, the Commission adopted protection criteria for NGSO systems authorized through an earlier processing round and required later-round applicants to demonstrate compliance with those limits if coordination agreements with the earlier-round operators had not yet been reached.[227] While those technical demonstrations were pending before the Commission, however, NGSO operators are permitted to begin operating on a non-interference basis.[228] In this instance, a minimum GSO-arc avoidance angle will achieve a similar balance of encouraging immediate services to the public and providing protection of other operators. Thus, we will allow NGSO satellite applicants to submit technical demonstrations of compliance with the GSO protection criteria, and begin operating on an unprotected, non-interference basis even if those technical demonstrations remain pending and not yet acted on by the Commission,[229] provided they operate consistent both with the operational parameters reflected in the technical demonstrations and the 3-degree GSO-arc avoidance angle.

65. We note that the minimum 3-degree GSO-arc avoidance angle represents an additional layer of protection for GSO networks that may restrict NGSO systems more than is strictly necessary. Although an avoidance angle may not sufficiently protect GSO networks on its own, because it does not account for other key variables such as transmit power and the number of co-frequency satellites transmitting to the same location at the same time, it should provide an added level of assurance to GSO network operators should NGSO systems need to begin operating while their technical demonstrations of compliance with the protection criteria remain pending.[230] With greater experience implementing the new NGSO-GSO sharing framework, we may re-visit this requirement.

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[223] *See, e.g.,* Telesat Apr. 23, 2026 *ex parte* at 1; CSF Apr. 22, 2026 *ex parte* at 4.

[224] *See* SpaceX Jordan Test at 14-15.

[225] *See* ITU Radio Regulations, Art. 22, Table 22-1D (listing a 30 cm BSS earth station antenna). This 3-degree GSO-arc avoidance *angle*, as measured on either side of the GSO satellite, is equivalent to a total 6-degree GSO-arc avoidance *zone*, which is greater than the approximately 5.8-degree full beamwidth of the main lobe of a 30 cm BSS earth station antenna. *See also* DIRECTV Apr. 23, 2026 *ex parte* at 1-3 (noting that a Ku-band DBS 45 cm antenna has a half-power beamwidth of approximately 3.7 degrees and requesting a GSO-arc avoidance (*zone*) angle of 4.5 degrees, which is less than the equivalent 6-degree zone we are adopting).

[226] While Telesat opposes establishing a pre-determined minimum GSO-arc avoidance angle and argues that "[i]t is entirely possible for an NGSO system to meet limits to protect GSO networks without invoking GSO arc avoidance," Telesat Comments at 8, no technical analysis on the record assumes a GSO-arc avoidance angle of 0, and a 3-degree angle is near the low end assumed in studies. *See* sections III.A.1. and III.B.1. *supra*. To ensure that NGSO emissions avoid the main beam of even the smallest GSO earth station antenna currently protected under EPFD limits, we conclude that a simple, 3-degree GSO-arc avoidance angle requirement is a reasonable added protection for GSO operations.

[227] 47 CFR § 25.261(d).

[228] 47 CFR § 25.261(d)(3).

[229] *See id.*

[230] We can assess any concerns of compliance with the minimum GSO-arc avoidance angle during individual consideration of certifications and compatibility showings. *See generally, e.g.*, DIRECTV Feb. 9, 2026 *ex parte* at 3

(continued….)

6. GSO Reference Links

66. To accompany the protection criteria above, we adopt a set of GSO reference links reflecting typical and widespread GSO operations in the United States. Reference links are used by an NGSO operator to demonstrate that it will comply with the long-term and short-term interference metrics. Reference links provide transparency and regulatory certainty for both GSO and NGSO operators as to the types of operations that will be protected to the threshold levels.

67. As an initial matter, the GSO reference links we adopt include 328 links provided in the record and drawn from both ITU data and the Commission's licensing databases and filtered according to a filtering methodology.[231] After review, we find these links are reasonably representative of a variety of widespread GSO operations and appropriate as an initial set of links to be tested against. While some commenters urge the Commission to seek further comment on development of GSO reference links,[232] the Commission specifically did so in the *Notice*,[233] and those parties criticizing the GSO reference links provided on the record, without offering a set of links of their own, do not provide an alternative for consideration at this time.[234]

68. In addition to the 328 links, Amazon performed an analysis of 3,944 Ka-band GSO links taken from the Commission's licensing database and selected four of the most sensitive links among these, which Amazon states are protectively representative of 97.6% of the links studied.[235] Using a smaller set of the most sensitive links—which drive the interference analysis in any event—could well be a simpler and more efficient means of demonstrating compliance with the protection criteria. However, for our initial set of GSO reference links, we include a broader collection of links that may provide GSO operators greater confidence in the results of the compatibility demonstrations.

69. In adopting these reference links, we recognize the diversity of operating parameters that may inform the protection of small earth station terminals, such as those used in Earth Stations in Motion (ESIMs).[236] And we recognize that GSO networks, and NGSO systems, will continue to evolve. Accordingly, we delegate authority to the Space Bureau to revisit the baseline set of links we identify today, and to remove, revise, or add appropriate GSO links in the future, after seeking comment. We direct the Bureau to initiate such a focused proceeding within 15 days after release of this Report and Order, and to adopt a decision within 60 days after close of that comment period. We note that operating

(Continued from previous page)
(stating that "even if [Starlink] operates with a target avoidance angle of 4 degrees it is not capable of maintaining that avoidance angle and has an effective arc avoidance angle that is actually closer to 3.5 degrees"). In addition, given the conservativism of this requirement, there is insufficient technical justification for the proposed adoption of PFD limits on emissions from the sidelobes of NGSO satellites within the GSO-arc avoidance angle that are transmitting away from the victim GSO network earth station. *But see* DIRECTV Apr. 23, 2026 *ex parte* at 3.

[231] *See* SpaceX Reply, Appx. 1, Technical Supplement; *see also* Telesat Comments at 6, Annex 2 and Amazon Comments at 17-18 (proposing comparable filtering methodologies).

[232] Eutelsat et al. Reply at 12-13.

[233] *See Notice*, 40 FCC Rcd at 3400, para. 24.

[234] *See* Eutelsat et al. Reply at 13, Annex 2; SES Reply at 8-10. We disagree with parties who suggest that NGSO systems serving the United States should be limited by sensitive antennas used exclusively by GSO receive earth stations outside the United States, as doing so would reduce service quality to American consumers. *See* Eutelsat et al. Reply at 13, Annex 2.

[235] *See* Amazon Jan. 29, 2026 *ex parte* at 4; *but see* SES Feb. 26, 2026 *ex parte*.

[236] *Compare, e.g.*, SpaceX Reply, Appx. 1 at A-1 (excluding links for specialty applications like ESIMs and antenna sizes smaller than 45 cm for both Ku- and Ka-band) *with* SES Reply at 8-9 (arguing ESIMs are a "common ubiquitous service on GSO satellites" and should be included among GSO reference links); *see also* EchoStar Reply at 10-11; Viasat Reply at 11; Astranis Reply at 6-8; Viasat Feb. 18, 2026 *ex parte* at 1-2.

NGSO systems may be required to adjust their operations to protect any new GSO reference links added in the future.[237]

7. Aggregate Interference Limits

70. As we look towards more efficient spectrum sharing between GSO and NGSO systems, we find no technical basis in the record—or compelling justification—to create and adopt aggregate limits on interference from NGSO systems into GSO networks. Indeed, as we noted when recently declining to create aggregate limits on NGSO interference into other NGSO systems,[238] a host of unresolved questions remain, including: as to the need for any aggregate limits given the ongoing and, at times, uncertain deployment of newly authorized NGSO constellations; the derivation of any proposed aggregate limits that avoids simplistic, worst-case assumptions and accounts for mitigation techniques or other spectrum-sharing measures that may be applied by the NGSO systems and reduce their overall aggregate impact; and the implementation of any aggregate limits among operational NGSO systems, an issue that remains unresolved internationally more than 25 years after aggregate EPFD limits were adopted.[239]

71. Limiting new entry while we wait and see which NGSO FSS systems will deploy, out of a fear of future aggregate interference that may never arise, would artificially and unreasonably inhibit competition contrary to the public interest. More fundamentally, as we move towards performance-based metrics based on real-world data and realistic interference concerns, any aggregate limits would run the stark risk of piling worst-case assumptions on top of one another to the detriment of efficiency and real-world costs. Parties advocating aggregate limits have not submitted aggregate interference studies or modeling or otherwise shown that any such limits—and none are proposed on the record—would be justified.[240] Nonetheless, should a demonstrated need arise in the future, we may revisit the question of

[237] Thus, while we consider the protection of existing GSO networks and technologies serving the United States, we have the ability to update the set of GSO reference links to reflect future GSO operations as well. Although Viasat advocates for imposing more stringent restrictions on NGSO systems for the protection of potential future GSO networks, Viasat Comments at 8, such restrictions would be inefficient. A dedicated, Bureau-led Public Notice proceeding also presents a more efficient forum to refine the set of GSO reference links without delaying the overall implementation of the degraded throughput methodology. This Bureau-led proceeding can consider additional reference links and related arguments raised in recent *ex parte* filings. *See, e.g.*, SES Apr. 21, 2026 SB *ex parte* at 3, Appx. C; Eutelsat Apr. 22, 2026 *ex parte*, Attach.; CSF Apr. 22, 2026 *ex parte* at 2-3; DIRECTV Apr. 23, 2026 *ex parte*, Attach. B; Astranis Apr. 24, 2026 *ex parte*, Attach. We note that some concerns with the GSO reference links were submitted six months after the close of the comment period, with no accompanying reference links or validation criteria. *See* Viasat Feb. 26, 2026 *ex parte*; Viasat Mar. 9, 2026 *ex parte*. *But see* SpaceX Mar. 5, 2026 *ex parte*; SpaceX Mar. 21, 2026 *ex parte*. While Viasat argues that the set of GSO reference links proposed by SpaceX is overinclusive, underinclusive, and should incorporate additional elements, we agree with SpaceX that any overinclusion will not harm GSO operators, that reasonable selection parameters are necessary for efficient spectrum sharing, that exclusion of uplink interference for certain links was reasonable and may add an element of conservatism, that use of operator-defined multiple C/N objectives could lead to inefficient spectrum use, *see NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12679, para. 50, and further as stated above, we conclude that the set of GSO reference links is reasonably representative and appropriate as an initial set of links, pending any future refinements and given the continuing absence of comprehensive alternative proposals from GSO operators.

[238] *NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12682-83, para. 61.

[239] *See* Amazon Comments at 15; Amazon Reply at 35-36. Even commenters supporting aggregate interference limits on NGSO systems do not address the necessary issues involved. *See, e.g.*, DIRECTV Comments at 9; EchoStar Comments at 14-15; Eutelsat et al. Comments at 15. Viasat urges us to finally resolve the implementation of the ITU's aggregate EPFD limits. Viasat Comments at 28. As we are removing EPFD limits, including aggregate limits, within the United States, the appropriate venue for continued work on the consultation meeting process under ITU Resolution 76 is in international fora.

[240] *See, e.g.*, DIRECTV Comments at 9-10.

aggregate limits.[241] And, of course, operators are free to discuss and agree upon ways to account for any aggregate interference effects during their good-faith coordination discussions.

C. Other Technical and Procedural Considerations

1. Terrestrial Operations

72. Modernizing the NGSO-GSO spectrum sharing framework can be accomplished without affecting the required protection levels of terrestrial operations. Within the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands subject to EPFD limits, NGSO systems must also adhere to PFD limits in the 10.7-11.7 GHz, 12.2-12.7 GHz, and 17.7-18.3 GHz band segments developed for the protection of co-primary fixed services.[242] The EPFD limits and PFD limits address different geometries of the NGSO system's operation—the former addresses interference from NGSO operations near the GSO arc, whereas the latter addresses NGSO operations near the horizon. In addition, NGSO systems must meet PFD limits to protect terrestrial services in the 18.6-19.7 GHz portion of the Ka-band where EPFD limits do not apply.[243]

73. We recognize that several terrestrial commenters propose a comprehensive re-evaluation of the protection afforded by current PFD limits[244]—critiquing the assumptions about both fixed-service (FS) and FSS deployments underlying current limits, including FS deployments considered and the scale of NGSO satellite deployments;[245] noting that, unlike Ka-band PFD limits, Ku-band PFD limits do not scale based on constellation size;[246] seeking new demonstrations that NGSO systems complying with PFD limits will continue to protect terrestrial services from the risk of aggregate interference;[247] and otherwise suggesting that the PFD limits adopted at WRC-2000 are outdated.[248] Such comprehensive studies re-evaluating the Ku-band and Ka-band PFD limits may be warranted.[249] However, the parties calling for such studies have neither begun them, provided necessary characteristics for them, or otherwise provided any technical basis for the conclusion that the current, required protection levels of terrestrial services are in fact inadequate, or that single-entry PFD limits should be newly evaluated based on potential aggregate interference.[250] Accordingly, there is insufficient support in the record to indefinitely delay updating the NGSO-GSO sharing framework in bands overlapping terrestrial allocations and in which PFD limits will

[241] We decline to initiate, at this time, a Further Notice of Proposed Rulemaking on aggregate limits because the present record does not indicate that our concerns regarding such limits would be resolved by commenters in the short term. *See* CSF Apr. 22, 2026 *ex parte* at 5. *But see, e.g.*, SES Apr. 23, 2026 *ex parte* at 3-4; Eutelsat Apr. 22, 2026 *ex parte* at 1-2.

[242] 47 CFR §§ 2.106, 25.146(a)(1).

[243] *See* 47 CFR § 25.146(a)(1); ITU Radio Regulations, Art. 21, Table 21-4.

[244] *See* AT&T Comments at 3-6; CTIA Reply at 3; FWCC Reply at 5-7; Nokia Reply at 2-3; UTC Reply at 2-4; *see also* Comsearch Comments at 2.

[245] *See, e.g.*, AT&T Comments at 4; Nokia Reply at 1; *see also* UTC Reply at 2 (arguing that existing PFD limits "were predicated upon unrealistic models").

[246] *See, e.g.*, AT&T Comments at 3-4; UTC Reply at 3-4.

[247] *See, e.g.*, AT&T Comments at 6; CTIA Reply at 3.

[248] *See, e.g.*, AT&T Comments at 4; UTC Reply at 2.

[249] *See, e.g.*, Amazon Reply at 39. We do note that no terrestrial commenter has raised concern with the PFD limits in the 18.6-19.7 GHz band in which EPFD limits do not apply today.

[250] While AT&T argues that, as a terrestrial operator, it is not in a position to conduct studies of NGSO interference, neither has it contributed characteristics or any technical data towards such potential studies. *See* AT&T Comments at 6.

continue to apply,[251] especially where the substantial technical record indicates that eliminating the EPFD limits will not result in unacceptable interference to GSO networks as described above.

74. We also note that expanding more efficient and intensive spectrum use in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands is consistent with other Commission priorities, including in the Upper C-band, where the Commission has sought comment on repurposing at least 100 megahertz in the 3.98-4.2 GHz band from FSS use to next-generation wireless services and relocating some GSO FSS operations to other available FSS spectrum.[252] Regarding the potential relocation of some high-availability services from C-band to Ku-band, in which rain fade plays a larger role in link design, we note that the combination of adaptive power control, appropriate earth station selection and link design, and our modest 0.1% absolute increase in unavailability metric will mean GSO satellite operators will face significantly lower than even a 0.1% change in unavailability at earth stations designed to support high availability links. For the protection of video distribution links specifically, we have adopted a limit of −10.5 dB I/N not to be exceeded 80% of the time, which will provide an extra layer of protection for these links in addition to the short-term absolute change in unavailability criterion.[253] Further, at least 20 megahertz of C-band spectrum are proposed to remain for satellite services requiring C-band transmission characteristics under even the broadest repurposing of the band for which comment was sought in the Notice of Proposed Rulemaking.[254] Accordingly, we reject arguments that revising the NGSO-GSO sharing framework will jeopardize any portion of an Upper C-band transition.[255]

2. Radio Astronomy

75. Modernizing the NGSO-GSO sharing framework will also not affect ongoing obligations of NGSO licensees to successfully coordinate with radio astronomy service (RAS) sites. Indeed, the record details the close coordination and data sharing between RAS and NGSO satellite systems pursuant to Footnote US131 of the Table of Frequency Allocations.[256] Given this successful record of coordination to date, we continue to expect that the obligation on NGSO licensees operating in the 10.7-11.7 GHz band to complete coordination with RAS prior to commencing operation will ensure the continued protection of RAS sites. Furthermore, requirement of coordination for any related fixed infrastructure (e.g., gateways) within the National Radio Quiet Zone (NRQZ) pursuant to 47 CFR Section 1.924 accommodates coordination requirements for the federal facilities within the NRQZ. As NGSO licensees have different operating parameters, the general coordination requirement provides flexibility to adapt to specific scenarios. Accordingly, there is no basis in the record to adopt additional, specific technical requirements regarding the operational means NGSO systems may employ to protect RAS sites as agreed

[251] Similarly, while some commenters argue that we should defer action in frequency bands with terrestrial allocations to separate, band-by-band rulemaking proceedings, *see, e.g.*, CTIA Comments at 10 and UTC Reply at 3-4, the Commission already considered and rejected this argument in the *Notice* and invited parties to develop the issues related to the protection of terrestrial services in this rulemaking. *Notice*, 40 FCC Rcd at 3397, 3402, paras. 17, 31.

[252] *See Upper C-band (3.98–4.2 GHz)*, Notice of Proposed Rulemaking, GN Docket No. 25-59, FCC 25-78 (2025) (*Upper C-band Notice*).

[253] *See* NAB Dec. 31, 2025 *ex parte* at 1-3 (expressing concern over reliability of content contribution and distribution from broadcasters migrated from C-band to Ku-band); NAB Reply at 3-4 (explaining that ACM is not used in most GSO video distribution applications).

[254] *See Upper C-band Notice*, FCC 25-78, paras. 1-2.

[255] *See, e.g.*, CTIA Comments at 6-7; SES Comments at 15-16; NAB Dec. 31, 2025 *ex parte*. In addition, prior application filing freezes in frequency bands subject to pending rulemaking proceedings provide no basis for a rulemaking "freeze" in the Ku-band pending resolution of the Upper C-band proceeding. *But see id.* at 3.

[256] *See* CORF Comments at 8-11.

in coordination,[257] or to require new studies or aggregate interference analyses at this time,[258] or to simply convert existing single-entry PFD limits to aggregate limits,[259] as some RAS commenters have suggested. It should be noted that for the specific case of NGSO's providing Supplemental Coverage from Space, the FCC Report and Order[260] did note that SCS licenses would be considered on a case-by-case basis and encouraged applicants to conduct outreach and work with appropriate federal agency contacts (NSF for radio astronomy) in advance of submission of license applications to the Commission, including conducting Monte Carlo analyses of potential impacts to radio astronomy systems using their specific configurations, as appropriate. Should any difficulties arise in the future during coordination discussions among NGSO operators and RAS site operators the Commission may assist in finding a solution agreeable to all parties involved.

3. Cross-Border Considerations

76. The ITU Radio Regulations provide that EPFD limits may be exceeded on the territory of any country whose administration has authorized such operation, and doing so in the United States, to the benefit of American consumers, is fully consistent with our international and cross-border obligations.[261] From a practical standpoint, modern NGSO systems are capable of keeping the energy from their downlink beams from spilling over into the territory of adjacent countries by using narrow beams with sharp roll-off while continuously monitoring and controlling the amount of power and location of the beams on the ground.[262] The customer terminals associated with these systems also employ narrow beams with suppressed sidelobes that continuously track NGSO satellites at specific elevations, resulting in minimal exposure outside the main beam of the antenna.[263] Thus, modern NGSO satellite systems have the technical capability to exceed the EPFD limits within the territory of the United States while respecting the EPFD limits on the territory of adjacent countries that have not authorized exceedances of the limits. We will continue to require such international compliance from NGSO satellite systems notified by the United States, without requiring any additional measures or specific cross-border agreements to implement the updated NGSO-GSO sharing framework in the United States.[264]

4. Implementation and Technical Demonstrations of Compatibility

77. In implementing the modernized NGSO-GSO sharing framework, the Commission's recently adopted degraded throughput framework in the NGSO-NGSO sharing context provides a ready example that we may draw from. Specifically, in 2024, the Commission adopted spectrum sharing requirements for NGSO FSS systems authorized in a later processing round to protect NGSO FSS systems authorized in an earlier processing round.[265] As we are adopting here, the Commission adopted a long-term protection criteria of 3% time-weighted average throughput degradation and short-term

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[257] *See id.* at 11.

[258] *See* NRAO Reply at 1-2; AAS Reply at 2.

[259] *See* CORF Comments at 11-12.

[260] *See* FCC 24-28.

[261] ITU Radio Regulations, Art. 22, No. 22.5CA (noting EPFD limits "may be exceeded on the territory of any country whose administration has so agreed").

[262] Amazon Comments at 16.

[263] *Id.*

[264] *See, e.g.*, CSF Comments at 6 (inquiring "whether localized coordination mechanisms, such as specific safeguards near national borders, would be required to prevent interference"). Thus, despite some concerns, we conclude there is no need to "invent[] a new coordination regime along vast borders of the United States." Avanti Reply at 5-6.

[265] *See NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12657, para. 1.

protection criterion based on the absolute increase in link unavailability.[266] In the NGSO-NGSO sharing context, prior to commencing operations, an NGSO FSS licensee or market access recipient must either certify that it has completed a coordination agreement with any operational NGSO FSS system licensed or granted U.S. market access in an earlier processing round, or submit for Commission approval a compatibility showing which demonstrates by use of a degraded throughput methodology that it will not cause harmful interference to any such system with which coordination has not been completed.[267] Such compatibility showings must contain a demonstration that the later-round system will cause no more than 3% time-weighted average degraded throughput of the link to the earlier-round system, for links with a baseline link availability of 99.0% or higher at a C/N threshold of 0 dB; and a demonstration that the later-round system will cause no more than 0.4% absolute change in link availability to the earlier-round system using a C/N threshold value of 0 dB, for links with a baseline link availability of 99.0% link availability or higher.[268] While a compatibility showing remains pending before the Commission, the submitting NGSO FSS licensee or market access recipient may commence operations on an unprotected, non-interference basis with respect to the operations of the system that is the subject of the showing.[269]

78. We believe that carrying over this implementation framework from the NGSO-NGSO context, where it was rigorously debated, will facilitate technical showings in the NGSO-GSO sharing context as well because NGSO operators will be familiar with its application.[270] This implementation framework also includes adopting the same C/N threshold for ACM links and the specific C/(N+I) threshold from the GSO reference link database for non-ACM links,[271] assumptions about additional sources of interference,[272] rain-fade model flexibility using the rainfall rates from the GSO reference link database,[273] ability to use information received through any coordination discussions,[274] a set of parameters and assumptions to facilitate the compatibility analysis,[275] and flexibility for NGSO operators in adopting mitigation techniques to ensure compliance with the protection thresholds.[276] As part of this framework, NGSO applicants and operators would be required to submit a compatibility demonstration which shows that their results and proposed operational configuration (including key parameters such as

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[266] *See* 47 § CFR 25.261(d).

[267] *Id.*

[268] 47 CFR § 25.261(d)(1).

[269] 47 CFR § 25.261(d)(3).

[270] *See* Amazon Comments at 13-14. We note that implementing the degraded throughput methodology in this case, as in the NGSO-NGSO sharing case under section 25.261(d), will not require development of extensive new evaluation and enforcement procedures and methodologies, software tools, or staffing resources, despite concerns from some commenters. *See* DIRECTV Comments at 11-12; Eutelsat et al. Comments at 14-16; EchoStar Reply at 12-15; *see also* Viasat Comments at 22. In addition, as this framework will allow NGSO licensees to begin operating consistent with their compatibility showings immediately on a non-interference basis, we do not see a benefit in adopting the proposed rule that a compatibility showing is deemed conditionally approved after a 30-day review period, subject to the final outcome of the Space Bureau review. *See* CSF Apr. 22, 2026 *ex parte* at 4-5.

[271] *NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12679, para. 50; *see also, e.g.*, SES Apr. 21, 2026 SB *ex parte* at 2; DIRECTV Apr. 23, 2026 *ex parte* at 4.

[272] *NGSO FSS Inter-Round Sharing Second Report and Order*, 39 FCC Rcd at 12684, 12685, 12686, paras. 65, 68, 70.

[273] *Id.* at 12687, paras. 77-79.

[274] *Id.* at 12692, para. 94.

[275] *Id.* at 12690, para. 89.

[276] *Id.* at 12694, para. 100.

Nco, GSO-arc avoidance angle, and power levels)[277] will meet the protection criteria for all of the approved GSO reference links. Further, NGSO operators will be required to share relevant technical information, including the compatibility demonstration, as needed by the GSO operators in assessing interference or for performing their own technical analysis that can aid in the coordination. Thus, through coordination, GSO operators would be able to receive the most up-to-date and technically precise details of NGSO system operations for use in their own assessments, without involving Commission resources or incentives towards protracted disputes.[278] The Commission, however, would be available if assistance is needed in coordination or to resolve real-world interference concerns.

79. We note that the latest developments in modeling NGSO and GSO systems may be used in the compatibility analyses.[279] We also note that we will also consider arguments by NGSO satellite applicants and operators that, because of successful coordination with one or more GSO network operators, certain of the GSO reference links included in the set of standard reference links may no longer need to be demonstrated as protected because equivalent links are not used by any remaining GSO operators serving the United States with whom coordination has not yet been reached.

5. Transition to New Rules

80. An immediate transition to the modernized NGSO-GSO sharing framework will offer immediate benefits without jeopardizing legacy services. Today, as discussed above, NGSO services are unreasonably constrained by EPFD limits based on decades-old proposed systems, assumptions, and methodologies, which results in protection levels for GSO networks significantly higher than the protection they expect from other co-primary GSO networks. Updating this framework to a set of protection criteria based on degraded throughput for ACM networks, absolute increase in unavailability, and an I/N limit for non-ACM networks, will adequately protect ongoing GSO operations while uncapping significant new NGSO capacity. Further delaying the transition to a modernized sharing framework, including for up to 18 years or through grandfathering provisions,[280] would sacrifice the immediate economic and other benefits of the new framework.[281] As supported by real-world testing, the new rules can be implemented without introducing unacceptable interference to GSO networks. Retaining the existing EPFD limits, even temporarily, would have a concrete and substantial impact on NGSO deployment and the ability of NGSO operators to deliver innovative new services to customers

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[277] *See, e.g.*, SES Apr. 21, 2026 SB *ex parte* at 2.

[278] Compatibility showings will be available to the Commission in the event of any interference concerns, and need not be placed on public notice for this benefit. *But see id.*

[279] *See* SpaceX Comments at 8; *see, e.g.*, ITU-R WP 4A Docs. 4A/224, 4A/515, 4A/519, 4A/522, and 4A/523; *see also* Amazon Jan. 29, 2026 *ex parte* at 6-9.

[280] *See* Eutelsat et al. Reply at 15; *see also* EchoStar Comments at 15-16; DIRECTV Comments at 12-13; DIRECTV Reply at 13-14. To the extent that some GSO service agreements will be updated following the adoption of new NGSO-GSO sharing rules, *see* Eutelsat et al. Reply at 14, we note that such agreements are often already conditioned upon regulatory requirements, and the need to update these private agreements does not justify delaying the substantial benefits of enhanced, growing NGSO services to the American public. Further, we have considered and adopted GSO protection criteria based on the operations of current GSO networks, and therefore we conclude that existing GSO networks will continue to be able to provide competitive services without the need of grandfathering. *But see* EchoStar Comments at 16. And, concerns that an immediate adoption of revised sharing rules would result in "nearly immediate harmful impact on GSO operators," *see* DIRECTV Comments at 12, are belied by the repeated real-world testing in which EPFD limits were exceeded with minimal impact on GSO network earth stations. *See* section III.A.1.a. *supra*. Immediate implementation of the revised NGSO-GSO sharing rules is also distinguishable from the sunset period adopted in the NGSO-NGSO sharing context, which sunset a new protection requirement at the same time it was adopted. *But see* DIRECTV Comments at 12 n.25 (citing *NGSO FSS Inter-Round Sharing Second Report and Order*, 38 FCC Rcd at 3712-14, paras. 29-31).

[281] SpaceX Comments at 6 (arguing "the case for rapidly retiring the current EPFD rules is clear and urgent").

within the United States.[282]

81. We will apply all rule changes adopted in this Report and Order to current NGSO licensees and market access grantees, pending applicants and petitioners, as well as future applicants and petitioners.[283] With respect to pending applications, applicants do not gain any vested right merely by filing an application, and the simple act of filing an application is not considered a "transaction already completed" for purposes of this analysis.[284] Applying our new rules and procedures to pending space station applications will not impair the rights any applicant had at the time it filed its application. Nor will doing so increase an applicant's liability for past conduct. Similarly, with respect to current licensees and market access grantees, none of the actions we take here increase liability for past conduct, impair rights a party possessed when he acted, or impose new duties with respect to transactions already completed. Rather, all of these actions take effect in the future, after the rules become effective. Accordingly, applying these rule changes to existing licenses and grants of market access will not upset any grantee's reasonable expectations.[285]

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[282] We note that SpaceX has already been granted a waiver to begin operating in exceedance of the EPFD limits in the United States. SpaceX EPFD Waiver, DA 26-36, para. 17.

[283] An agency order is impermissible as "primarily retroactive" if it "'alters the *past* legal consequences of past actions.'" *Mobile Relay Assocs. v. FCC,* 457 F.3d 1, 11 (D.C. Cir. 2006) (quoting *Bowen v. Georgetown Univ. Hosp.,* 488 U.S. 204, 219 (1988) (Scalia, J., concurring) (emphasis in original)). An order can be primarily retroactive if it (1) "increase[s] a party's liability for past conduct"; (2) "impair[s] rights a party possessed when he acted"; or (3) "impose[s] new duties with respect to transactions already completed." *Landgraf v. USI Film Prods.,* 511 U.S. 244, 280 (1994). An agency order that "alters the future effect, not the past legal consequences" of an action or that ''upsets expectations based on prior law'' is not primarily retroactive. *Mobile Relay Assocs.,* 457 F.3d at 11 (citations and quotations omitted). Rather, such an order is considered secondarily retroactive and will be upheld if "reasonable, *i.e*., if it is not arbitrary or capricious," both "in substance and in being made retroactive." *Id.*; *U.S. Airwaves, Inc. v. FCC,* 232 F.3d 227, 233 (D.C. Cir. 2000).

[284] *Chadmoore Communications, Inc. v. FCC*, 113 F.3d 235, 240-41 (D.C. Cir. 1997) ("In this case the Commission's action did not increase [the applicant's] liability for past conduct or impose new duties with respect to completed transactions. Nor could it have impaired a right possessed by [the applicant] because none vested on the filing of its application."); *Hispanic Info. & Telecomms. Network v. FCC*, 865 F.2d 1289, 1294-95 (D.C.Cir.1989) ("The filing of an application creates no vested right to a hearing; if the substantive standards change so that the applicant is no longer qualified, the application may be dismissed."); *Schraier v. Hickel*, 419 F.2d 663, 667 (D.C.Cir.1969) (filing of application that has not been accepted does not create a legal interest that restricts discretion vested in agency); *see also United States v. Storer Broadcasting Co.*, 351 U.S. 192 (1952) (pending application for new station dismissed due to rule change limiting the number of licenses that could be held by one owner); *Bachow Communications, Inc. v. FCC*, 237 F.3d 683, 686-88 (D.C. Cir. 2001) (upholding freeze on new applications and dismissal of pending applications in light of adoption of new licensing scheme); *PLMRS Narrowband Corp. v. FCC*, 182 F. 3d 995, 1000-01 (D.C. Cir. 1999) (applicant did not, by virtue of filing application, obtain the right to have it considered under the rules then applicable).

[285] In addition, we will allow current licensees and market access recipients to submit a letter request to modify particular conditions in their grants consistent with the rule changes adopted in this Order, accompanied by any showings of compliance with the new NGSO-GSO sharing rules, including compatibility showings. *See, e.g.*, *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809, 7833, para. 71, n.162 (2017). We decline to adopt a blanket waiver of such existing license conditions, however, because: (1) of the availability of this simple means to request update of the conditions; (2) operation under the GSO protection criteria we adopt in this rulemaking will first require submission of a technical demonstration of compatibility or certifications of coordination with GSO operators; and (3) some NGSO operators could prefer to operate under their existing EPFD conditions, which remains an alternative. *But see* Amazon Comments at 22.

6. Additional Frequency Bands and Other Issues

82. While the record provides ample basis to revise the NGSO-GSO sharing framework in the 10.7-12.7 GHz, 17.3-18.6 GHz, and 19.7-20.2 GHz bands of focus in this rulemaking, it does not provide a basis for action in other bands.[286] Indeed, no NGSO system proponent advocates changes in additional frequency bands at this time,[287] and commenters addressing other bands either request that we explicitly decline any changes in C-band,[288] or raise issues in other bands that are beyond the scope of this rulemaking.[289] Accordingly, we limit our actions to those areas of demonstrated need regarding NGSO operations in the 10.7-12.7 GHz, 17.3-18.6 GHz, and 19.7-20.2 GHz bands in the United States.[290]

7. Alternative Sharing Frameworks and Sunsetting

83. While we are modernizing the NGSO-GSO sharing framework based on the best available data today, we recognize that future revisions may be warranted to further refine this framework and maximize the benefits to American consumers.[291] While some commenters propose to sunset the GSO protection criteria requirements and move towards a framework of coordination only between GSO and NGSO systems,[292] or coordination with a "safe harbor" GSO-arc avoidance angle requirement, we believe that encouraging coordination under the new protection criteria that we are adopting will offer immediate benefits and provide a new record of experience on which we could re-consider GSO-NGSO sharing in the future.[293] Accordingly, we decline to adopt any alternative NGSO-GSO sharing frameworks at this time.

D. Costs and Benefits

84. We have carefully reviewed the record in this proceeding, including all studies submitted therein. We conclude that the benefits of the changes we adopt today exceed the costs. Our evaluation of

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[286] *See Notice*, 40 FCC Rcd at 3403, para. 36 (seeking comment on whether the Commission should explore updates to the NGSO-GSO sharing regime in other frequency bands subject to ITU EPFD limits or in V-band frequencies).

[287] *See* Amazon Comments at 20 (arguing the Commission should "focus its efforts narrowly on the Ku-band and Ka-band, in recognition that those constraints (especially in the Ka-band) are particularly onerous" and that "[a]ddressing additional bands at present is more likely to delay needed action than remedy the concrete problem").

[288] *See* CTIA Comments at 3-6; AT&T Comments at 7-8; Nokia Reply at 3.

[289] Some commenters urge changes in portions of the Ka-band in which EPFD limits do not apply, which are outside the scope of this rulemaking. *See* Astranis Comments at 7-8; Viasat Comments at 29-30; EchoStar Comments at 11-12. Viasat's request that we modify two-degree spacing rules to facilitate deployment of smaller GSO network earth station terminals is also outside the scope of this proceeding. Viasat Comments at 30. In addition, given our focus on shifting away from EPFD limits in this rulemaking, we decline proposals to make changes to the current implementation of EPFD limits. *See* Viasat Comments at 25-29.

[290] We also note that any changes to terrestrial power limits in the 12.2-12.7 GHz band are beyond the scope of this rulemaking. *See* DIRECTV Reply at 14-15. *But see* EchoStar Comments at 12-14. And we note that we do not create any regulatory burdens on non-operator earth station licensees. *See* Gogo Reply at 2-4.

[291] *See, e.g.*, NAB Reply at 5-6 (arguing any new sharing rules should be "reversible" in the event "some factor in the engineering interference studies [in this proceeding] turns out to be incorrect or missed entirely").

[292] *See* SpaceX Comments at 5-6, 8-9; CSF Comments at 6; CSF Apr. 22, 2026 *ex parte* at 2; ITIF Apr. 16, 2026 *ex parte* at 1.

[293] *See* Amazon Comments at 18-20 (proposing a 10-year sunset of GSO protection limits and thereafter coordination or a "safe harbor" of 2-4 degree GSO-arc avoidance). We note there is no technical record at this time to quantify that NGSO systems complying with a 2 degree or 4 degree GSO-arc avoidance angle only—irrespective of their downlink power, number of co-frequency beams, or other operational parameters—would provide a certain level of protection to GSO networks. In the GSO-GSO context, for example, the Commission's two-degree orbital spacing policy has been accompanied by power limits suitable for two-degree-spaced satellites. *See, e.g.*, 47 CFR § 25.140.

costs and benefits are contained in Appendix D.

IV. PROCEDURAL MATTERS

85. *Regulatory Flexibility Act.* The Regulatory Flexibility Act of 1980, as amended (RFA),[294] requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[295] Accordingly, the Commission has prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of the rule and policy changes contained in this Order on small entities. The FRFA is set forth in Appendix C.

86. *Paperwork Reduction Act*. This Order contains modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, other Federal agencies, and the general public are invited to comment on the modified information collection requirements contained in this document.

87. In this Order, we have assessed the effects of providing NGSO satellite system applicants an alternative to certifying compliance with EPFD limits in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands for operations in the United States, by instead demonstrating that they will comply with certain GSO satellite network protection criteria. We find that doing so will serve the public interest and is unlikely to directly affect businesses with fewer than 25 employees.

88. *Congressional Review Act.* The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs that this rule is major under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. § 801(a)(1)(A).

V. ORDERING CLAUSES

89. IT IS ORDERED, pursuant to Sections 4(i), 7(a), 303, 308(b), and 316 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 303, 308(b), 316, that this Report and Order IS ADOPTED, the policies, rules, and requirements discussed herein ARE ADOPTED, and Part 25 of the Commission's rules IS AMENDED as set forth in Appendix A.[296]

90. IT IS FURTHER ORDERED that this Report and Order SHALL BE effective 60 days after publication in the Federal Register, except that sections 25.146(a)(3) and 25.289(a)(2), which may contain new or modified information collection requirements, will not become effective until the Office of Management and Budget completes review of any information collection requirements that the Space Bureau determines is required under the Paperwork Reduction Act. The Commission directs the Space Bureau to announce the effective date for sections 25.146(a)(3) and 25.289(a)(2) by publication of a document in the Federal Register.

91. IT IS FURTHER ORDERED that the Commission's Office of Secretary SHALL SEND a copy of this Report and Order, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for the Small Business Administration (SBA) Office of Advocacy.

[294] 5 U.S.C. §§ 601–612. The RFA has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[295] 5 U.S.C. § 605(b).

[296] Pursuant to Executive Order 14215, 90 Fed. Reg. 10447 (Feb. 20, 2025), this regulatory action has been determined to be significant under Executive Order 12866, 58 Fed. Reg. 68708 (Dec. 28, 1993).

92. IT IS FURTHER ORDERED that the Commission's Office of the Managing Director, Performance Program Management, SHALL SEND a copy of this Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

For the reasons discussed above, the Federal Communications Commission amends 47 CFR part 25 as follows:

PART 25 – SATELLITE COMMUNICATIONS

1. The authority citation for part 25 continues to read as follows:

Authority: 47 U.S.C. 154, 301, 302, 303, 307, 309, 310, 319, 332, 605, and 721, unless otherwise noted.

2. Delayed indefinitely, amend § 25.146 by adding paragraph (a)(3) to read as follows:

§ 25.146 Licensing and operating provisions for NGSO FSS space stations.

(a) * * *

(3) For operation in the United States in the 10.7-12.7, 17.3-18.6, or 19.7-20.2 GHz bands, an NGSO FSS applicant may, as an alternative to certifying that it will comply with equivalent power-flux density limits in these bands, apply the following procedure: Prior to commencing operations, an NGSO FSS applicant must either certify that it has completed a coordination agreement with any operational co-frequency GSO satellite network, or submit for Commission approval a compatibility showing which demonstrates by use of a degraded throughput methodology that it will not cause unacceptable interference to any such system with which coordination has not been completed.

(i) Compatibility showings must contain the following elements:

(A) A demonstration that the NGSO system will cause no more than 3% time-weighted average degraded throughput of any GSO reference link that uses adaptive coding and modulation;

(B) A demonstration that the NGSO system will cause no more than 0.1% absolute change in link availability to any GSO reference link;

(C) A demonstration that the NGSO system will cause no more than −10.5 dB I/N for 80% of time for any GSO reference link that does not use adaptive coding and modulation; and

(D) A certification that the NGSO system will use a minimum GSO-arc avoidance angle of 3 degrees with respect to any operational co-frequency GSO space station serving the United States.

(ii) While a compatibility showing remains pending before the Commission, the submitting NGSO licensee or market access recipient may commence operations on an unprotected, non-interference basis with respect to the operations of any co-frequency GSO network with which coordination has not been completed.

* * * * *

3. Revise § 25.289 to read as follows:

§ 25.289 Protection of GSO networks by NGSO systems.

(a) *Unacceptable interference*. Unless otherwise provided in this chapter, an NGSO system licensee must not cause unacceptable interference to, or claim protection from, a GSO FSS or GSO BSS network.

(1) An NGSO FSS licensee operating in compliance with the applicable equivalent power flux-density limits in Article 22, Section II of the ITU Radio Regulations (incorporated by reference, § 25.108) will be considered as having fulfilled this obligation with respect to any GSO network.

(2) [Reserved]

(b) *Coordination*. GSO and NGSO satellite operators must coordinate in good faith the use of commonly authorized frequencies in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands in the United States.

4. Delayed indefinitely, add paragraph (a)(2) to § 25.289 to read as follows:

§ 25.289 Protection of GSO networks by NGSO systems.

(a) * * *

(2) An NGSO FSS licensee authorized pursuant to § 25.146(a)(3) will be considered as having fulfilled this obligation with respect to any GSO network.

* * * * *

APPENDIX B

GSO Reference Links

carrier_nu	dmin_cou	network	source	gso_lon_d	ellite_eirp	freq_GH	ibw_kH	s_rx_gain	rx_diame	es_Tsys	es_lat_d	es_lon_d	rr_mmh	gso_elevat	cni_thresh	bj_avail_p	seline_un	cn_clear	i_internal	cni_clear	clearsky	ass_rain	ACM (Yes/	UT or GV	rain_mar	ni_rain_m
6	United State	IDR-1	CR/116 (Ku)	-103	9.7	11.2	51.2	60.2264806	10.82	208.862831	30	-103	35.168	55.0257019	9	99.96	0.00094626	23.4982273	19.5860731	18.1054731	9.10547313	TRUE	No	GW	1.57196593	7.5335072
7	United State	IDR-2	CR/116 (Ku)	-103	11.2	11.2	51.2	56.6280562	7.15	181.98	30	-103	35.168	55.0257019	9	99.96	0.00185362	21.9981779	17.7342762	16.3523982	7.35239818	TRUE	No	GW	1.57196593	5.78043226
8	United State	IDR-3	CR/116 (Ku)	-103	12.2	11.2	51.2	53.5386899	5.01	281.98	30	-103	35.168	55.0257019	9	99.96	0.00392362	18.0068651	20.4850305	16.0612342	7.06123422	TRUE	No	GW	1.57196593	5.48926829
9	United State	IDR-4	CR/116 (Ku)	-103	14.2	11.2	51.2	49.9384952	3.31	308.85	30	-103	35.168	55.0257019	9	99.96	0.00687174	16.0113775	24.5445951	15.4416529	6.44165292	TRUE	No	UT	0.32663504	6.11501788
17	United State	SatMex 5	CR/116 (Ku)	-105	21.9	11.95	185	41.2885579	1.2	141.8	31.7	-105	23	53.0873931	7.6	99.94	0.05125415	12.2739452	22.7675058	11.9026402	4.30264024	TRUE	No	UT	0.26963431	4.03300593
19	United State	Telstar 4	CR/116 (Ku)	-119	48.4	11.95	22500	38.1667328	0.8	131.7	42	-119	7.6	41.4941814	8.3	99.7	0	14.9419366	40	14.9284065	6.62840654	TRUE	No	UT	0.03443848	6.59396805
20	United State	SatMex 5	CR/116 (Ku)	-100	23.5	11.95	185	60.404933	10	141.8	29	-100	23	56.1689073	9.4	99.99	0	33.03138	26.8066891	25.8776471	16.4776471	TRUE	No	GW	1.48877414	14.988873
21	United State	SatMex 5	CR/116 (Ku)	-105	50	11.95	34000	60.404933	10	141.8	31.7	-105	23	53.0873931	16.9	99.99	0	36.8472484	40	35.1333024	18.2333024	TRUE	No	GW	1.2991262	16.9341762
22	France	Telecom 2, V	CR/116 (Ku)	-1	53	12.75	36000	35.8308036	0.6	175	44	-1	60	39.2752612	8	99.6	0.13007974	13.3284227	22.613379	12.8444031	4.84440311	TRUE	No	UT	0.72775401	4.1166491
34	France	DTH DVB	CR/116 (Ku)	2.2137	50	11.7	32987.4	35.4843171	0.6	153	40.4	2.2137	27.2915416	43.2771327	4.6	99.7	0.00756583	11.7608386	23.6289274	11.487173	6.88717297	TRUE	No	UT	0.28079887	6.6063741
40	Spain		CR/116 (Ku)	-8	21.01	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99	0.05339861	10.7205754	18.5730936	10.0611804	4.76118038	TRUE	No	UT	0.3625428	4.39863758
41	Spain		CR/116 (Ku)	-8	45.52	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.7	0	35.2305754	18.5730936	18.4803274	13.1803274	TRUE	No	UT	0.3625428	12.8177846
42	Spain		CR/116 (Ku)	-8	47.73	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.9	0	37.4405754	18.5730936	18.5170878	13.2170878	TRUE	No	UT	0.3625428	12.854545
43	Spain		CR/116 (Ku)	-8	51.08	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.97	0	40.7905754	18.5730936	18.5471078	13.2471078	TRUE	No	UT	0.3625428	12.884565
72	Spain		CR/116 (Ku)	-8	21.38	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99	0.03673974	11.0905754	18.5730936	10.377113	5.07711297	TRUE	No	UT	0.3625428	4.71457017
73	Spain		CR/116 (Ku)	-8	39.63	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.7	0	29.3405754	18.5730936	18.2235961	12.9235961	TRUE	No	UT	0.3625428	12.5610533
74	Spain		CR/116 (Ku)	-8	41.58	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.9	0	31.2905754	18.5730936	18.3468	13.0468	TRUE	No	UT	0.3625428	12.6842571
75	Spain		CR/116 (Ku)	-8	45	12.5	64	36.0588002	0.6	125	43	-8	38	40.3833524	5.3	99.97	0	34.7105754	18.5730936	18.4686686	13.1686686	TRUE	No	UT	0.3625428	12.8061258
91	Spain		CR/116 (Ku)	-8	47.64	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99	0.06994217	11.0190482	24.1009182	10.8105367	4.71053671	TRUE	No	UT	0.3625428	4.34799391
92	Spain		CR/116 (Ku)	-8	49.28	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.7	0.02291544	12.6590482	24.1009182	12.3581193	6.25811926	TRUE	No	UT	0.3625428	5.89557645
93	Spain		CR/116 (Ku)	-8	50.36	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.9	0.01389116	13.7390482	24.1009182	13.3568006	7.25680062	TRUE	No	UT	0.3625428	6.89425782
94	Spain		CR/116 (Ku)	-8	54.46	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.97	0.00370433	17.8390482	24.1009182	16.9171417	10.8171417	TRUE	No	UT	0.3625428	10.4545989
110	Spain		CR/116 (Ku)	-8	47.75	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99	0.06200611	11.1290482	24.1009182	10.9153175	4.8153175	TRUE	No	UT	0.3625428	4.45277469
111	Spain		CR/116 (Ku)	-8	49.39	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.7	0.02180372	12.7690482	24.1009182	12.4606676	6.36066762	TRUE	No	UT	0.3625428	5.99812481
112	Spain		CR/116 (Ku)	-8	51.47	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.9	0.00788357	14.8490482	24.1009182	14.3615273	8.26152729	TRUE	No	UT	0.3625428	7.89898449
113	Spain		CR/116 (Ku)	-8	54.62	12.5	27500	36.0588002	0.6	125	43	-8	38	40.3833524	6.1	99.97	0.00363834	17.9990482	24.1009182	17.0460809	10.9460809	TRUE	No	UT	0.3625428	10.5835381
202	United State	A5b	CR/116 (Ku)	-120	21.6	11.2	82	40.7255603	1.2	134.83	45.6	-120	15.792	37.5080733	5.8	99.96	0.00111699	15.4744369	19.8850152	14.1320448	8.33204483	TRUE	No	UT	0.13797258	8.19407224
203	United State	A5c	CR/116 (Ku)	-81	22.9	11.2	82	40.7255603	1.2	134.83	25.46	-81	77.09396	60.2329547	5.8	99.96	0.01819611	17.1167369	21.378338	15.7342317	9.93423175	TRUE	No	UT	0.71467932	9.21955243
204	United State	B14a	CR/116 (Ku)	-103	20	11.2	82	40.7255603	1.2	134.83	30.03	-103	35.31992	54.9914399	5.8	99.6	0.0085661	14.1521621	17.5930357	12.5300844	6.73008437	TRUE	No	UT	0.32658584	6.40349853
205	United State	B14b	CR/116 (Ku)	-120	20	11.2	82	40.7255603	1.2	134.83	45.6	-120	15.792	37.5080733	5.8	99.6	0.00228843	13.8744369	17.5930357	12.3370302	6.53703017	TRUE	No	UT	0.13797258	6.39905759
206	United State	B14c	CR/116 (Ku)	-81	21	11.2	82	40.7255603	1.2	134.83	25.46	-81	77.09396	60.2329547	5.8	99.6	0.03625995	15.2167369	19.0373195	13.7094844	7.9094844	TRUE	No	UT	0.71467932	7.19480508
207	United State	A8a	CR/116 (Ku)	-103	21.6	11.2	82	40.7255603	1.2	134.83	30.03	-103	35.31992	54.9914399	5.8	99.96	0.00479212	15.7521621	19.8850152	14.334175	8.53417497	TRUE	No	UT	0.32658584	8.20758913
208	United State	A8b	CR/116 (Ku)	-120	23	11.2	82	40.7255603	1.2	134.83	45.6	-120	15.792	37.5080733	5.8	99.96	0.00031254	16.8744369	21.5503159	15.6010192	9.80101924	TRUE	No	UT	0.13797258	9.66304666

APPENDIX C

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Modernizing Spectrum Sharing for Satellite Broadband*, *Notice of Proposed Rulemaking* (*Notice*).[2] The Federal Communications Commission (Commission) sought written public comment on the proposals in the *Further Notice*, including comment on the IRFA. No comments were filed addressing the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for, and Objectives of, the Order

2. The *Notice* in this proceeding launched a much needed review of the long-standing spectrum sharing regime between geostationary (GSO) and non-geostationary (NGSO) satellite systems operating in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. The decades-old spectrum sharing regime constitutes the primary restrictive regulatory requirement on NGSO satellite systems currently deploying at breakneck speed. Innovation in the satellite industry has witnessed new NGSO satellite operators launching thousands of satellites in the short span of a few years, and these operators are beginning to offer high-speed, low-latency broadband services. The *Notice* sought to develop a substantial technical record concerning modern and efficient spectrum sharing among NGSO FSS (Fixed Satellite Service) systems, GSO FSS, and BSS (Broadcast Satellite Service) networks in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands, while ensuring that any rule changes continue to safeguard and maintain the protection of co-frequency terrestrial services.

3. In response to the record developed from the *Notice*, the *Order* replaces the outdated framework of equivalent power-flux density (EPFD) limits on NGSO systems with modern protection criteria that take account of the improved spectrum sharing possibilities that modern satellite technology has brought, including through use of adaptive coding and modulation. Specifically, the *Order* requires NGSO satellites transmitting in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands to protect co-frequency GSO networks using a long-term protection criteria of 3% time-weighted average throughput degradation as a long-term interference protection criterion. The *Order* adopts a short-term GSO protection criterion of 0.1% absolute increase in link unavailability. For GSO satellite links that do not use ACM, such as point-to-multipoint video transmissions, we adopt a protection criterion of −10.5 dB interference-to-noise (I/N) for 80% of the time. As an additional measure of protection for GSO networks, we require NGSO systems to observe a minimum 3-degree avoidance angle of the GSO arc. We decline to establish aggregate limits or other limits on NGSO systems at this time. Having taken a fresh look at today's satellite technology and operations, these new spectrum sharing rules will promote more efficient and effective use of the shared spectrum, and support a more competitive market for satellite broadband and other in-demand services while uncapping the potential of satellite constellations that were unthinkable when the current regime was developed, to the ultimate benefit of American consumers.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

4. No comments were filed addressing the impact of the proposed rules on small entities.

[1] 5 U.S.C. § 603. The RFA, 5 U.S.C. §§ 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA) Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *Modernizing Spectrum Sharing for Satellite Broadband, Revision of the Commission's Rules to Establish More Efficient Spectrum Sharing between NGSO and GSO Satellite Systems*, SB Docket No. 25-157, RM-11990, Notice of Proposed Rulemaking, FCC 25-23, Appx. B (Apr. 29, 2025).

[3] 5 U.S.C. § 604.

C. Response to Comments by the Chief Counsel for the Small Business Administration Office of Advocacy

5. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA,[4] the Commission is required to respond to any comments filed by the Chief Counsel for the Small Business Administration (SBA) Office of Advocacy, and to provide a detailed statement of any change made to the proposed rules as a result of those comments.[5] The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

6. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the adopted rules.[6] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[7] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[8] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[9] The SBA establishes small business size standards that agencies are required to use when promulgating regulations relating to small businesses; agencies may establish alternative size standards for use in such programs, but must consult and obtain approval from SBA before doing so.[10]

7. Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe three broad groups of small entities that could be directly affected by our actions.[11] In general, a small business is an independent business having fewer than 500 employees.[12] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 34.75 million businesses.[13] Next, "small organizations" are not-for-profit enterprises that are independently owned and operated and are not dominant in their field.[14] While we do not have data regarding the number of non-profits that meet that criteria, over 99 percent of nonprofits have fewer than 500

[4] Small Business Jobs Act of 2010, Pub. L. No. 111-240, 124 Stat. 2504 (2010).

[5] 5 U.S.C. § 604(a)(3).

[6] *Id*. § 604.

[7] *Id*. § 601(6).

[8] *Id*. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[9] 15 U.S.C. § 632.

[10] 13 CFR § 121.903.

[11] 5 U.S.C. § 601(3)-(6).

[12] *See* SBA, Office of Advocacy, *Frequently Asked Questions About Small Business* (July 23, 2024), https://advocacy.sba.gov/wp-content/uploads/2024/12/Frequently-Asked-Questions-About-Small-Business_2024-508.pdf.

[13] *Id*.

[14] 5 U.S.C. § 601(4).

employees.[15] Finally, "small governmental jurisdictions" are defined as cities, counties, towns, townships, villages, school districts, or special districts with populations of less than fifty thousand.[16] Based on the 2022 U.S. Census of Governments data, we estimate that at least 48,724 out of 90,835 local government jurisdictions have a population of less than 50,000.[17]

8. The rules adopted in the *Order* will apply to small entities in the industries identified in the chart below by their six-digit North American Industry Classification System (NAICS)[18] codes and corresponding SBA size standard.[19] Based on currently available U.S. Census data regarding the estimated number of small firms in each identified industry, we conclude that the adopted rules may impact a substantial number of small entities. Where available, we also provide additional information regarding the number of potentially affected entities in the identified industries below.

Regulated Industry (Footnotes specify potentially affected entities within a regulated industry where applicable)	NAICS Code	SBA Size Standard	Total Firms[20]	Total Small Firms[21]	% Small Firms
Satellite Telecommunications	517410	$44 million	332	195	58.73%
All Other Telecommunications	517810	$40 million	1,673	1,007	60.19%

E. Description of Economic Impact and Projected Reporting, Recordkeeping and Other Compliance Requirements for Small Entities

9. The RFA directs agencies to describe the economic impact of adopted rules on small entities, as well as projected reporting, recordkeeping and other compliance requirements, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.[22]

10. The *Order* defines specific metrics for long-term interference and short-term interference that must be used in compatibility analyses demonstrating that a NGSO FSS system operating in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands in the United States will adequately protect co-frequency GSO networks. The *Order* adopts a long-term interference metric for GSO networks using ACM of 3%

[15] *See* SBA, Office of Advocacy, *Small Business Facts, Spotlight on Nonprofits* (July 2019), https://advocacy.sba.gov/2019/07/25/small-business-facts-spotlight-on-nonprofits/.

[16] 5 U.S.C. § 601(5).

[17] *See* U.S. Census Bureau, 2022 Census of Governments – Organization, https://www.census.gov/data/tables/2022/econ/gus/2022-governments.html, tables 1-11.

[18] The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. *See* www.census.gov/NAICS for further details regarding the NAICS codes identified in this chart.

[19] The size standards in this chart are set forth in 13 CFR § 121.201, by six digit NAICS code.

[20] *U.S. Census Bureau*, "*Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2022*." Economic Census, ECN Core Statistics Economic Census: Establishment and Firm Size Statistics for the U.S., Table EC2200SIZEREVFIRM, 2025.

[21] *Id.*

[22] 5 U.S.C. § 604(a)(5).

degraded throughput threshold and a 0.1% absolute increase in link unavailability as the short-term interference metric, along with a protection criterion for GSO networks not using ACM of −10.5 dB interference-to-noise (I/N) for 80% of the time and a 3-degree minimum GSO-arc avoidance angle, based on the technical record developed in this proceeding. The Commission concludes that establishing a protection metrics consistent with the technical evidence in the record provides the benefit of a clear standard for new NGSO operators, and a benchmark that parties can use to negotiate any alternative protections mutually agreed to in coordination.

11. The adopted protection criteria will impact information NGSO system applicants are required to report to the Commission, and small NGSO system applicants may incur compliance costs as a result of the Order. Specifically, NGSO system applicants may need to hire professionals or expend staff time on familiarization and implementation of the rules adopted in the Order. However, because of the costs involved in developing and deploying an NGSO satellite constellation in these bands, the Commission anticipates that few, if any, NGSO operators affected by this rulemaking would qualify under the SBA definition of "small entity," and therefore small entities are not likely to have to hire professionals, or incur any compliance costs as a result of the *Order*.

F. Discussion of Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

12. The RFA requires an agency to provide, "a description of the steps the agency has taken to minimize the significant economic impact on small entities…including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected."[23]

13. The *Order* amends rules that are applicable to space station operators requesting a license or grant of U.S. market access from the Commission. Specifically, the *Order* adopts changes to the spectrum sharing requirements among GSO and NGSO satellite systems operating in the United States in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands, and specifies details of the technical demonstration that NGSO space station applicants in these bands must submit to show that they will not cause harmful interference to co-frequency GSO space station licensees and market access grantees. The technical demonstration of compatibility is based on a degraded throughput methodology, assessing absolute increase in link unavailability, and an I/N limit.

14. The Commission specifically considered, and declined, to adopt: a short-term interference criterion of 0.4% absolute increase in unavailability, an alternative of coordination or compliance with a GSO-arc avoidance angle only, or a sunset provision, because such proposals would provide less protection to GSO networks while not being shown to be technically necessary for the expansion of NGSO systems. The Commission also considered, but declined, to create new aggregate interference limits as none were proposed on the record.

G. Report to Congress

15. The Commission will send a copy of the *Order*, including this Final Regulatory Flexibility Analysis, in a report to Congress pursuant to the Congressional Review Act.[24] In addition, the Commission will send a copy of the *Order*, including this Final Regulatory Flexibility Analysis, to the Chief Counsel for the SBA Office of Advocacy and will publish a copy of the *Order*, and this Final Regulatory Flexibility Analysis (or summaries thereof) in the Federal Register.[25]

[23] 5 U.S.C. § 604(a)(6).

[24] *Id*. § 801(a)(1)(A).

[25] *Id.* § 604(b).

APPENDIX D

Regulatory Impact Analysis

Modernizing Spectrum Sharing for Satellite Broadband Report and Order

I. EXECUTIVE SUMMARY

A. Summary

1. In the *Modernizing Spectrum Sharing for Satellite Broadband Report and Order (NGSO-GSO Sharing Report and Order* or *Order)*, the Federal Communications Commission (FCC) modernizes the spectrum sharing regime between geostationary (GSO) and non-geostationary (NGSO) satellite systems operating in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. The *Order* replaces equivalent power-flux density (EPFD) limits on NGSO systems[1] with performance-based GSO protection criteria. It also requires good-faith coordination efforts by both GSO and NGSO operators in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. We adopt the following technical backstops to protect GSO systems when coordination has not been reached:

- A long-term protection criterion of 3% time-weighted average throughput degradation for GSO satellite links using adaptive coding and modulation (ACM);[2]
- A short-term protection criterion of 0.1% absolute increase in link unavailability;
- A supplemental protection criterion of −10.5 dB interference-to-noise (I/N) for 80% of the time for GSO satellite links that do not use ACM, such as point-to-multipoint video transmissions; and
- A supplemental protection requirement for NGSO systems to observe a minimum 3-degree avoidance angle of the GSO arc.

2. This economically significant regulatory action is submitted to the Office of Information and Regulatory Affairs (OIRA) for interagency review. This regulatory impact analysis (RIA) presents an assessment of the regulatory compliance costs and benefits associated with this action and is consistent with Executive Order 12866. Comparing the performance-based GSO protection criteria with other alternative policy options, Commission Staff concludes that the adoption of these proposed rules will result in significant benefits that outweigh the associated costs. This rule is considered a deregulatory action under Executive Order 14192.

B. Table of Benefits and Costs

3. *Summary of Benefits and Costs*. Based on Staff analysis, the net present value of benefits —after netting out costs of doing business and compliance—over five years would be $1.6 billion to $19.9 billion using a 3% annual discount rate or $1.4 billion to $17.1 billion using a 7% annual discount rate. Given these net benefit estimates, Staff finds that the overall benefits of the regulatory action outweigh the total costs.

[1] *See* 47 CFR § 25.146(a)(2). In addition, NGSO FSS licensees authorized to operate in the 10.7-11.7 GHz band must, prior to commencing operations, successfully coordinate with radio astronomy observatories that use the adjacent 10.6-10.7 GHz band. 47 CFR § 2.106(a), (c)(131). The bands between 17.7 GHz and 20.2 GHz are also subject to coordination with Federal Government users. 47 CFR § 2.106(a), (c)(334).

[2] ACM or link adaptation is a term used in wireless communications to denote the match of the modulation, coding, and other signal and protocol parameters to the conditions on the radio link (e.g., the path loss, interference due to signals coming from other transmitters, the sensitivity of the receiver, the available transmitter power margin). *See* Shami, Abdallah; Maier, Martin; Assi, Chadi (2010-01-23), Broadband Access Networks: Technologies and Deployments, Springer Science & Business Media, at 100.

		Method 1				*Method 2*			
		Present Value (3% discount)		**Present Value (7% discount)**		**Present Value (3% discount)**		**Present Value (7% discount)**	
	Year	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**
Benefits	2026	$0.5	$0.6	$0.5	$0.6	$0.2	$0.3	$0.2	$0.3
($ Billions)	2027	$1.3	$1.6	$1.2	$1.5	$0.3	$0.4	$0.2	$0.3
	2028	$2.6	$3.2	$2.3	$2.8	$0.3	$0.4	$0.3	$0.4
	2029	$4.3	$5.5	$3.7	$4.7	$0.4	$0.5	$0.3	$0.4
	2030	$7.0	$9.0	$5.7	$7.4	$0.4	$0.6	$0.3	$0.4
	Total	$15.7	$19.9	$13.5	$17.1	$1.6	$2.2	$1.4	$1.8
Quantifiable	2026	$112	$112	$107	$107	$112	$112	$107	$107
Costs	2027	$13	$13	$12	$12	$13	$13	$12	$12
($ Thousands)	2028	$13	$13	$11	$11	$13	$13	$11	$11
	2029	$12	$12	$11	$11	$12	$12	$11	$11
	2030	$12	$12	$10	$10	$12	$12	$10	$10
	Total	$162	$162	$152	$152	$162	$162	$152	$152
Qualitative Costs		*Costs from negotiating agreements induced by new spectrum sharing framework.*							
Net Gain ($ Billions)	**Total**	$15.7	$19.9	$13.5	$17.1	$1.6	$2.2	$1.4	$1.8

II. NEED FOR REGULATORY ACTION

4. Wireless telecommunications devices function by transmitting signals over the electromagnetic spectrum, a finite public resource managed by the FCC. To promote efficient use of the spectrum and to minimize harmful interference, the FCC allocates spectrum into various bands. It designates some bands for exclusive, licensed use, while requiring shared use of other bands based on technical and other rules to mitigate harmful interference. In the most commonly used frequency bands used by satellite operators, between 10.7 GHz and 30 GHz, NGSO systems share primary fixed-satellite service (FSS) allocations with GSO networks, and they must also operate compatibly or coordinate with other federal and non-federal users of these bands.

5. NGSO FSS systems must comply with, among other rules, power limits expressed in EPFD to demonstrate that they do not cause unacceptable interference to GSO FSS and Broadcasting Satellite Service (BSS) networks. As NGSO operators supply data to a growing number of users, however, the record has shown that EPFD restrictions present a significant and growing regulatory constraint on NGSO systems seeking to meet consumer capacity needs, particularly during periods of peak congestion. Technological advances in the past three decades and the inherent issues in the EPFD limits warrant the establishment of a new, performance-based spectrum sharing framework between GSO and NGSO systems in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. By adopting the rules in the *Order*, the Commission would enable the U.S. space industry to make better use of spectrum resources. Specifically, the rules would enable NGSO systems to use more satellites to serve the same area, at potentially higher power, and over a wider portion of the visible sky while continuing to protect GSO networks as supported by real-world testing. This would immediately boost capacity, translating to faster broadband speeds for American consumers.

III. BACKGROUND ON NGSO-GSO SHARING

6. Broadband satellite services rely on shared spectrum. In the most commonly used frequency bands, between 10.7 GHz and 30 GHz, NGSO systems share primary fixed-satellite service (FSS) allocations with GSO networks and must also operate compatibly with BSS networks and stations

in other services, including terrestrial services.[3] NGSO FSS systems must comply with power limits expressed in EPFD to demonstrate that they meet their broader obligation not to cause unacceptable interference to GSO FSS and BSS networks.[4] NGSO FSS systems must also meet separate power limits expressed in power-flux density (PFD) to protect terrestrial services.[5] Applicants for NGSO FSS space station licenses, and non-U.S.-licensed satellite operators seeking access to the U.S. market, must certify that they will comply with the specified EPFD limits.[6]

7. The current EPFD limits for the protection of GSO networks were developed in the late 1990s, adopted internationally in 2000, and subsequently incorporated into the Commission's rules in 2000 and 2017.[7] In 2019, the international community required NGSO FSS systems operating in the higher Q- and V-bands between 37.5 GHz and 51.4 GHz to meet certain long-term[8] and short-term[9] GSO protection criteria that incorporate a degraded throughput methodology.[10] The World Radiocommunication Conference (WRC) 2019 (WRC-19) did not adopt EPFD limits in these bands. WRC-23 considered, but ultimately did not adopt, a proposal to review the EPFD limits under a future agenda item for WRC-27.[11] Instead, ITU-R Working Party 4A is studying EPFD limits and will report findings at WRC-27.

8. On April 28, 2025, the Commission, in response to a petition for rulemaking by SpaceX, released an NPRM that proposed to revise the spectrum sharing regime between GSO and NGSO systems in downlink frequency bands between 10.7 GHz and 30 GHz that are subject to EPFD limits, and to amend sections 25.146 and 25.289 of the Commission's rules.[12] The *NPRM* sought to develop a substantial technical record concerning modern and efficient spectrum sharing among NGSO FSS systems and GSO FSS and BSS networks in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands that could increase efficient use of the spectrum while protecting other services.[13]

[3] *See* 47 CFR § 2.106(a).

[4] 47 CFR § 25.146(a)(2), (c); 47 CFR § 25.289; ITU Radio Regulations, Art. 22, Nos. 22.2, 22.5I.

[5] 47 CFR § 25.146(a)(1).

[6] 47 CFR §§ 25.114(d)(12), 25.137(b), 25.146(a)(2). Prior to initiating service, NGSO FSS operators' EPFD showings submitted to the International Telecommunication Union (ITU) must receive a "favorable" or "qualified favorable" finding by the ITU Radiocommunication Bureau (BR). 47 CFR § 25.146(c).

[7] *Modernizing Spectrum Sharing for Satellite Broadband, Revision of the Commission's Rules to Establish More Efficient Spectrum Sharing between NGSO and GSO Satellite Systems*, Notice of Proposed Rulemaking, SB Docket No. 25-157, RM-11990, FCC 25-23, para. 5. (rel. Apr. 29, 2025) (*NGSO-GSO Spectrum Sharing NPRM*); 47 CFR §§ 25.146(a)(2), (c), 25.289.

[8] The long-term protection criteria is based on the percentage reduction in time-weighted average spectral efficiency calculated on an annual basis for generic GSO reference links using adaptive coding and modulation. ITU Radio Regulations, Art. 22, Nos. 22.5L, 22.5M.

[9] The short-term protection criteria is based on the percentage increase of the time allowance for the carrier-to-noise (C/N) value associated with the shortest percentage of time specified in the short-term performance objective of generic GSO reference links. ITU Radio Regulations, Art. 22, Nos. 22.5L, 22.5M.

[10] ITU Radio Regulations, Art. 22, Nos. 22.5L, 22.5M; ITU-R Resolution 769 (WRC-19); ITU-R Resolution 770 (Rev. WRC-23).

[11] Inter-American Telecommunication Commission (CITEL), Proposals for the Work of the Conference, Document WRC23/44/A27/A4 (June 26, 2023).

[12] *See NGSO-GSO Spectrum Sharing NPRM*, FCC 25-23, para. 2 & n.1.

[13] *Id.*, paras. 19-37.

IV. REGULATORY ACTION

9. The *Order* establishes a new, performance-based spectrum sharing framework between GSO and NGSO systems in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands. The new GSO protection framework would require good-faith coordination between GSO and NGSO operators. Where good-faith coordination fails, the rule would require NGSO satellites transmitting in the 10.7-12.7, 17.3-18.6, and 19.7-20.2 GHz bands to protect co-frequency GSO networks using a long-term protection criteria of 3% time-weighted average throughput degradation. The *Order* adopts a short-term GSO protection criterion of 0.1% absolute increase in link unavailability. For GSO satellite links that do not use ACM, the *Order* would adopt a protection criterion of −10.5 dB interference-to-noise (I/N) for 80% of the time. As an additional measure of protection for GSO networks, the *Order* would require NGSO systems to observe a minimum 3-degree avoidance angle of the GSO arc. To accompany these protection criteria, the *Order* adopts a realistic set of GSO reference links reflecting typical and widespread GSO operations in the United States. These GSO reference links are based on the set of 328 links provided in the record and drawn from both ITU data and the Commission's licensing databases.[14]

V. BENEFITS

10. By modernizing the spectrum sharing framework between GSO and NGSO satellite systems, the rules adopted in the *Order* should deliver substantial economic benefits to American households, satellite competitors, and other stakeholders. As discussed in detail in the *Order*, these rules should increase capacity and broadband speeds, foster new competitive entry, and promote U.S. leadership globally. They should also strengthen the ability of NGSOs to serve as a lifeline to Americans in rural and remote areas. The record of this proceeding reflects broad support for modernizing satellite spectrum sharing. Commenters point out that, with greater operational flexibility under revised sharing rules, new NGSO systems would need smaller constellations and still have greater capacity to reach more customers, which would reflect a substantial reduction in launch costs, satellite costs, and costs of a new low-Earth orbit (LEO) constellation.[15] Those lower costs should encourage new entry as well as lower prices for customers.[16] The revised rules are also anticipated to support innovation through the availability of higher-throughput, lower-latency connectivity in rural and underserved areas.[17] Accordingly, Staff is unpersuaded by arguments that the benefits of revising the EFPD limits are uncertain, speculative and overstated.[18]

11. Certain commenters submitted studies concerning the benefits, with one providing quantitative estimates. An analysis by Harold Furchtgott-Roth suggests that the effects of moving away

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[14] SpaceX Reply, Technical Supplement. Thus, while we consider the protection of existing GSO networks and technologies serving the United States, we have the ability to update the set of GSO reference links to reflect future GSO operations as well.

[15] *See, e.g.*, Furchgott-Roth Econ. Study I at 8 (a "constellation that would require 462 LEO satellites under existing [EPFD] rules to have a certain coverage could obtain the same coverage with updated rules with only 360 satellites"); ICLE Comments at 6-7 (arguing the EPFD limits impose "significant market distortions" that "translate directly into higher costs per unit of capacity delivered to consumers, as operators must deploy more satellites and infrastructure to achieve the same service levels").

[16] Furchgott-Roth Econ. Study I at 8; *see also* ICLE Comments at 10 (arguing the "conclusion that a degraded throughput methodology is more appropriate for GSO operations that use ACM is economically sound").

[17] *See* SOAR Comments at 2; Appalachian Broadband Innovators Comments at 3.

[18] *See* Viasat Comments, Exh. A at 19-21 (arguing that NGSO service has been successful in the EFPD framework, that NGSO ability to serve underserved populations is overstated, and that future GSO capabilities will be able to provide many NGSO benefits). Staff finds: (1) that the success of the existing framework is not a convincing reason to impede more efficient uses of spectrum; (2) that despite some limitations, NGSO service may be the best and sometimes only option for service to a substantial portion of the U.S. population; and (3) that potential long-term innovation in GSO capabilities should not prevent immediate and future benefit from improved NGSO service.

from the outdated EPFD rules would increase NGSO system capacity by 74% to 180%, which could reduce average costs per unit of capacity by 43% to 64%.[19] The study further estimated that this would increase annual global consumer welfare by $1.62 billion to $16.2 billion, translating to a net present value increase in global welfare ranging from $10 billion to $100 billion.[20] A second study submitted by the Phoenix Center posited that a rising relative willingness to pay for NGSO broadband—even without growth in the overall satellite market—implies that today's spectrum sharing- rules are too restrictive and should shift toward greater accommodation of NGSO systems.[21] The intuition of the model presented in the study is that, as NGSO demand has grown far faster than demand for GSO services, an efficient regime must evolve to reflect this higher marginal valuation of NGSO connectivity.[22] While the study did not provide quantitative estimates of benefits, Staff believes that the results of this study align with the steps we are taking today.

12. While Staff generally agrees with the conclusion of the Harold Furchtgott-Roth study, we find that the report does not adequately justify the assumptions underlying the consumer surplus calculations. For example, the report assumes price reductions ranging from 10% to 50% without providing a supporting rationale and provides no estimate of price elasticity of demand or passthrough rate, despite these assumptions being crucial in calculating consumer surplus. Furthermore, even setting aside methodological concerns with the consumer surplus calculations, it would still be necessary to appropriately scale any global consumer surplus estimates to derive a corresponding estimate of the change in domestic consumer surplus.[23] If we assumed that U.S. consumers account for only one-quarter of the global benefits, the estimated annual benefits are reduced to approximately $405 million to $4.05 billion. If we conservatively take the lower bound estimate of $405 million, the corresponding net present value of benefits accruing over the next five years is $1.9 billion when using a discount rate of 3% and $1.7 billion when using a discount rate of 7%.[24] Under these revised assumptions, the overall increase in benefits to U.S. consumers nevertheless remains substantial.

13. Commission Staff conducted a separate internal assessment of benefits. Staff based its analysis on the potential relationship between the increase in supply of satellite capacity discussed in the *Order* and the projected overall growth in the size of satellite data services market. Based on support in the record, Staff assumed an increase in capacity in the foreseeable future of between 500% and 700%.[25] Staff related these assumed increases in capacity to industry analyst projections of the market value of U.S. satellite data services as well as the supply of satellite capacity using two alternative methodologies.

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[19] Furchtgott-Roth Econ. Study I, Appx. B at B-1. The study also noted that a modernized NGSO-GSO sharing framework could ultimately benefit consumers by increasing capacity of NGSO FSS systems of a given size; reducing the number of satellites necessary for an NGSO FSS system to provide a certain capacity of service to a certain geography or population; facilitating entry and enhancing competition for services from LEO-satellite systems; reducing prices for services from LEO-satellite systems; and increasing elasticity of demand. *Id.*, Appx. B at B-1 to B-2.

[20] These estimates assume a 10% reduction in price and a 25% increase in capacity for the lower estimate, and a 50% reduction in price and a 250% increase in capacity for the higher estimate. *Id.*, Appx B. at B-2.

[21] Phoenix Center Reply at 3.

[22] *Id.* at 6.

[23] Furchtgott-Roth notes that "[u]pdating 25-year-old epfd rules would provide tens of billions of dollars of benefits to customers around the world, particularly to the 2 billion people not yet connected to the Internet." Furchgott-Roth Econ. Study I at 2.

[24] Using a 3% discount rate, the present value is calculated as follows: $\$405\ million \times \sum_{i=1}^{5} 1/(1+3\%)^i = \$1{,}854{,}781{,}411$, which we round to $1.9 billion. Similarly, using the 7% discount rate, the present value is $\$405\ million \times \sum_{i=1}^{5} 1/(1+7\%)^i = \$1{,}660{,}579{,}962$, which we round to $1.7 billion.

[25] SpaceX Comments at 3; Amazon Comments at 12, Appx.

First, we assume that the supply of NGSO high throughput satellite (HTS) capacity is 500-700% greater than it would be in 2030 absent the rule changes and infer that market value will expand proportionally based on the preexisting relationship between satellite market value and capacity. Second, we assume that the industry analyst's projected growth of HTS satellite capacity from 2025 to 2030 is correct, but that some fraction of that capacity growth is due to the 500% to 700% increase in HTS NGSO capacity due to the *Order* and that the fraction of market value growth due to the *Order* is also the same.[26] For both methods, Staff then assumes that NGSO operators will earn 58% in profits on the gain in market value, and we use this as our estimate of gains in producer surplus.[27] Staff did not attempt to estimate consumer surplus so that our estimate of benefits, which consists of gains in producer surplus, is conservative.[28] We describe the two methods in detail below.

14. According to January 2025 analyst estimates for the years 2024-2034, the value of U.S. satellite data services will grow from $3.40 billion to $19.53 billion at a CAGR of 19.1%.[29] Based on a separate April 2024 report estimating NGSO and GSO HTS capacity in 2023 and 2028, NGSO and GSO capacity will grow between 2023 and 2028 at a compound annual growth rate (CAGR) of 59.1% and 22.2%, respectively, leading to a total HTS CAGR of 56.1%.[30]

15. *Method 1*: First, Staff assumes that analyst projections do not anticipate the capacity increase that Staff attributes to the revised spectrum sharing rules, such that 2030 capacity would be 500-700% more than the initial projections.[31] Staff then calculates the new CAGR of capacity implied by the

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[26] Staff acknowledges that the relationship between reported projections of satellite market value and projections of satellite capacity is a correlation and assume that this correlation holds when capacity changes.

[27] Robert Cyran, *SpaceX Will be a Better $1 Trln Bet Than Tesla* (Dec. 26, 2024), https://www.reuters.com/breakingviews/spacex-will-be-better-1-trln-bet-than-tesla-2024-12-26/ (noting that analysts estimate that Starlink's 2024 earnings before interest, taxes, depreciation, and amortization (EBITDA) margin is 58%). We note that, as discussed above, NGSO operators may be able to achieve capacity gains with smaller constellations under the new rules. Because we assume that capacity improvements will not require expanding constellation size, we do not attribute any increase in capital expenditures to our rules. Staff nevertheless multiplied market value gains by an estimate of profit margins for a major NGSO operator to account for potential increases in operating expenditures (i.e., customer and technical support and other staff necessary to serve a larger pool of customers).

[28] Additionally, we note that, to the extent that increasing competition erodes profit margins in the future, total benefits would increase, as profit losses would transfer to consumer surplus, and additional benefits would arise from elimination of deadweight loss.

[29] Market.US, *Global Satellite Data Service Market Size, Share Analysis Report By Service Type (Image Data, Data Analytics), By End User (Defense and Security, Agriculture, Maritime, Environment, Energy and Power, Other End Users), Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends and Forecast 2025-2034* (Jan. 2025), https://market.us/report/satellite-data-service-market/.

[30] According to Novaspace, NGSO HTS capacity will grow from 23,701 to 241,764 Gbps and GSO HTS capacity will grow from 3,375 to 9,215 from 2023 to 2028. CAGRs here and elsewhere in this analysis are calculated as the constant rate required to achieve the 2028 value from the 2023 value, according to the formula:

$$CAGR = (Value_{EndingYear}/Value_{StartingYear})^{\frac{1}{EndingYear-Starting\,Year}} - 1.$$

All numbers resulting from the calculations are rounded when presented in the text, but calculations in the underlying analysis are conducted using machine precision. Thus any discrepancy in numbers is due to rounding in the text. Novaspace, *Non-geostationary orbit constellations redefining the High Throughput Satellites market landscape* (Apr. 25, 2024), https://nova.space/press-release/non-geostationary-orbit-constellations-redefining-the-high-throughput-satellites-market-landscape/. Total HTS throughput CAGR is calculated as the constant rate required to achieve the 2028 summed value of NGSO and GSO capacity from the 2023 summed value.

[31] In other words, Staff assumes that because of the *Order*, the projected HTS NGSO capacity of 612,127 Gbps in 2030 would expand by either 500% or 700%, yielding a range of 3.7 million to 4.8 million Gbps. The value of

(continued….)

new 2030 level of capacity and then use the new CAGR to estimate the increase in the value of U.S. data services for the years 2025-2030.[32] The markets value gains are then converted to gains in producer surplus by multiplying by the profit margin of 58%. Staff treats the net present value (NPV) increase in producer surplus as a public benefit. Total HTS throughput CAGR is 124.2% to 137.5%, which is significantly larger than the original CAGR of 56.1% for every year from 2026 to 2030, resulting in $15.7 to $19.9 billion in NPV at a 3% discount rate or $13.5 billion to $17.1 billion NPV at a 7% discount rate.[33]

16. *Method 2*: Second, Staff assumes that the industry analysts anticipate some sort of regulatory change to achieve the projected supply increase. In this scenario, Staff assumes that the *Order* is part of these anticipated regulatory changes, so that a fraction of the increase in capacity supply from 2025 to 2030 is attributable to the *Order*. Staff assumes that the *Order* will lead to an increase in NGSO HTS capacity of either 500% or 700% from 2025 to 2030. Based on the 2025 capacity of 60,009 Gbps, this is 300,045 Gbps or 420,063 Gbps, respectively. By comparison, a projection based on analyst reports indicates that total HTS capacity will increase by 560,846 Gbps from 2025 to 2030 (using a CAGR of 56.1%). This implies that either 300,045 Gbps / 560,846 Gbps = 53.5% or 420,063 / 560,846 Gbps = 74.9% of growth is due to the *Order*. Staff then assumes the *Order* is responsible for the same fraction (either 53.5% or 74.9%) of the increase in satellite markets value each year between 2025 and 2030 and calculate the PV gain associated with that fraction of the increase in market value. After multiplying by the profit margin of 58%, this leads to a producer surplus gain in present value that is attributed to the *Order* ranging from $1.6 billion to $2.2 billion in benefits using a 3% discount rate, or $1.4 to $1.8 billion using a 7% discount rate.

17. Combining the results of the two approaches, Staff finds benefits ranging from $1.6 billion to $19.9 billion using a 3% discount rate and ranging from $1.4 billion to $17.1 billion using a 7% discount rate.

VI. COSTS

18. Staff accepts the findings of the *Order* that the rules adopted therein, including the long-term and short-term criteria for GSO satellite links using ACM, protection criteria for those that do not use ACM, and the minimum avoidance angle of the GSO arc will continue to provide sufficient protection to GSO operations from substantial interference, and therefore Staff concludes that they will not result in harm or substantial costs to GSO providers. Staff is therefore unpersuaded by arguments raised in a Brattle Group report submitted by Viasat, alleging that abandoning the long-standing EPFD framework would impose unacceptable interference costs on GSO operators,[34] since, as the *Order* concludes, the performance-based GSO protection criteria that the *Order* adopts are sufficient to protect incumbent GSO operations and other incumbent users. Staff also is unpersuaded by Brattle's arguments that the new framework would undermine the property rights and market-driven approach of the EPFD

(Continued from previous page)
612,127 Gbps is estimated by extrapolating from the 2023 NGSO HTS capacity of 23,701 Gbps using the 59.1% CAGR rate. Total HTS 2030 capacity is calculated using extrapolations of the GSO HTS 2023 capacity based on the 22.2% CAGR.

[32] Assuming a baseline capacity before the new rules take effect in 2025 of 60,009 Gbps, the implied HTS NGSO CAGR range over 2025 to 2030 is 127.7% to 141.2%. Using this to estimate new NGSO supply from 2026-2029, implies a CAGR range of 124.2% to 137.5% for total HTS supply.

[33] Given a discount rate r and year value V_i, we calculate a producer surplus PV of five years as $\sum_{i=2026}^{2030} \frac{V_i}{(1+r)^{i-2025}}$.

[34] Viasat Comments, Exh. A at 11-13. *See also* Viasat Comments, Exh. A at 17-19 (arguing that without proper protections from EFPD limits GSOs will lose functionality and resiliency in space-based telecommunications would suffer generally). As we do not find any significant increase in interference under the new framework, GSO functionality and space resiliency should remain unharmed.

framework.[35] In contrast, the new framework would improve these aspects as it makes the use of coordination explicit and allows for mutually beneficial outcomes above and beyond those that would be required by our backstop performance criteria. Rather than reduce innovation and investment through greater regulatory uncertainty and interference risk, as Brattle claims,[36] the new rules will continue to protect existing spectrum users, while encouraging investment through more efficient spectrum use. Staff also finds Brattle concerns about international coordination[37] unfounded because it is legally feasible for an administration to exceed the ITU EFPD limits[38] and technologically feasible for service providers to operate both under and above those limits in adjacent countries.[39]

19. Staff identifies two categories of costs: (1) increases in expenditures needed to serve a larger pool of customers, and (2) costs of complying with the revised rules. The analysis in the benefits section accounts for the category 1 costs – i.e., the costs to serve additional customers by multiplying estimated market value gains by an estimated profit margin. This amounts to subtracting incremental costs of serving new customers from incremental revenue. With respect to category 2, we recognize three kinds of potential costs of complying with the revised rules: familiarization costs, certification costs, and negotiation costs. Familiarization costs result from work that regulatees wishing to take advantage of the revised rules need to perform to familiarize themselves with the rule revisions. Certification costs are the labor costs that any NGSO operator wishing to take advantage of the new rules must incur in order to certify that it is using a degraded throughput methodology to avoid unacceptable interference. In the alternative, NGSO operators wishing to take advantage of the new rules may certify that they have a coordination agreement with any operational co-frequency GSO satellite network. Negotiation costs are costs that NGSO and GSO operators would need to incur to reach a coordination agreement. As there is a lack of information to estimate how frequent or long such negotiations would be, Staff is unable to quantity the costs of such negotiations. However, Staff concludes due to the relatively low number of negotiating partners in the industry coupled with the backstop option of a compatibility showing that associated costs would be relatively small compared to the volume of proposed benefits.

20. Staff estimates familiarization and certification costs by using needed labor hours worked by engineers and attorneys to make sure that NGSO operators understand and comply with the new rules. Staff estimates that telecommunications aerospace engineers are compensated at a rate of \$100.26/hour and telecommunications attorneys are compensated at \$140.73/hour.[40] Staff estimates that 26 NGSO constellations may be impacted by our rules, and conservatively assume that 26 NGSO regulatees will require familiarization and certification work.[41] For familiarization, Staff assumes reading and

[35] *Id.* at 6-8.

[36] *Id.* at 9-11 and 14-15.

[37] *Id.* at 16-17.

[38] ITU Radio Regulations, Art. 22, No. 22.5CA.

[39] *See* Amazon Comments at 16-17.

[40] The Bureau of Labor Statistics reports May 2024 hourly mean wages for aerospace engineers and lawyers in the telecommunications industry as \$68.76/hour and \$95.39/hour, respectively. Bureau of Labor Statistics (BLS), *Occupational Employment and Wage Statistics Query System*, https://data.bls.gov/oes/#/industry/517000 (accessed March 24, 2026). According to the Bureau of Labor Statistics, as of December 2025, civilian wages and salaries averaged \$33.45/hour and benefits averaged \$15.33/hour. Using these figures, benefits constitute a markup of \$15.33/\$33.45 ~ 46%. Taking 46% for cost of benefits, we arrive at an hourly compensation of \$100.26/hour (\$68.67/hour × \$146%), and \$140.73/hour (\$96.39/hour × \$146%), for engineers and attorneys, respectively. *See* Press Release, Bureau of Labor Statistics, Employer Costs for Employee Compensation—December 2025 (March 20, 2025), https://www.bls.gov/news.release/pdf/ecec.pdf (*Benefit Markup*).

[41] *Review of the Commission's Assessment and Collection of Regulatory Fees for Fiscal Year 2025; Assessment and Collection of Space and Earth Station Regulatory Fees for Fiscal Year 2025*, MD Docket Nos. 25-190, 24-85, Report and Order, 40 FCC Rcd 7557, 7605-07, Appx. E (Tables enumerating NGSO Small Constellations and

(continued….)

understanding the order will take 6 engineer hours of work and 2 lawyer hours of work for each constellation, implying $23,000 of costs for NGSO operators.[42] Because these rules replace existing rules, future entrants into NGSO FSS operators would not be expected to incur additional familiarization costs because they would need to familiarize themselves with only one set of rules prior to entry. For certification, we conservatively assume that each of the 26 NGSO constellations would wish to submit a section 25.146 compatibility showing and therefore incur the certification cost. Additionally, because the section 25.146 compatibility showing is different from what new applicants would need to submit to the ITU to certify compliance with EPFD limits outside the United States, we assume that new applicants would likewise incur the certification cost. In these cases, Staff estimates that 26 operators incur a one-time certification cost and that in future years, 4 new operators would incur the certification cost.[43] For each operator, we assume that certification comprises of 24 hours of engineering work and 8 hours of legal work.[44] Therefore, Staff estimates then that the first year will result in $92,000 in certification costs, and then every subsequent year will result in $14,000 in certification costs.[45] Adding the one-time familiarization costs to the first year certification costs, we have $115,000 of costs in the first year of the new rules, followed by the $14,000 of annual certification costs. Staff then finds that total costs, including familiarization and certification, from 2026 to 2030, sum to $162,000 using a 3% discount rate, and $152,000 using a 7% discount rate, respectively.[46]

VII. ALTERNATE POLICIES

A. Alternative A – No Action

21. Under this alternative, the Commission would decline to revise the current sharing

(Continued from previous page)
NGSO Large Constellations). This estimate is conservative because not all operators will choose to revise their operations in compliance with the new rules and could continue to operate under the previously set EPFD limits. Staff does not include GSO operators and small satellite operators in the total as the former is not obligated to familiarize themselves with the new rules and the former generally do not rely on the spectrum subject to this proceeding to provide services. *See Id*. at FCC Rcd 7598-7605, Appx. E.

[42] (Six hours of engineering work × $100.26/hour + 2 hours of legal work × $140.73) × 26 constellations = $22,958.52) ~ $23,000.

[43] The Paperwork Reduction Act supporting statement for the NGSO-NGSO Sharing Report and Order estimates that NGSO FSS Compatibility Showings and Certifications take 32 hours of in-house work at a rate of 4 per year. Part 25 of the Federal Communications Commission's Rules Governing the Licensing of, and Spectrum Usage by, Commercial Earth Stations and Space Stations – 47 CFR Sections 47 CFR 25.263, 25.209.25.212, 25.129, 47 CFR 25.142, 25.143, 25.250, 25.279, 47 CFR 25.277, 25.129, 25.135, 47 CFR 25.133, 25.137, 25.218, 25.220, 47 CFR 25.149, 25.252, 25.253, 25.254, 47 CFR 25.258, 25.144, 25.263, 47 CFR 25.146, 25.138, 25.147, 47 CFR 25.111(d), 47 CFR 25.119, 25.120, 25.121, 47 CFR 25.110, 25.115, 25.228, 47 CFR 25.140, 2.106, 47 CFR 25.403, 25.404, 25.117, 25.116, 47 CFR 25.143, 25.149, 25.258, 25.173, 47 CFR 25.171, 25.172, 25.259, 25.260, 47 CFR 25.170, 25.113, 25.118, 47 CFR 25.203, 25.218, 47 CFR 25.125(b), 25.125(c), 47 CFR 25.164, 25.165, 25.284, 47 CFR 25.148, 25.264, 25.144, 47 CFR 25.111, 25.114, 25.108, OMB Control No. 3060-0678 Paperwork Reduction Act (PRA) Supporting Statement at 18 (May 28, 2025), https://www.reginfo.gov/public/do/PRAViewICR?ref_nbr=202505-3060-038 (Follow link "View Supporting Statement and Other Documents" to access document).

[44] *Id*.

[45] In the first year, there will be the 26 certifications by NGSO operators, resulting in costs of (24 hours of engineering work × $100.26/hour + 8 hours of legal work × $140.73) × 26 constellations = $91,824.08) ~ $92,000. In subsequent years, there will be four certifications, resulting in costs of (24 hours of engineering work × $100.26/hour + 8 hours of legal work × $140.73) × 4 constellations = $14,128.32) ~ $14,000.

[46] Total costs using a 3% discount rate comprise $23,000 familiarization cost + [$92,000 +$14,000 $\times \sum_{i=2027}^{2030} 1/(1+3\%)^{i-2026}$] certification cost = $162,000. Total costs using a 7% discount rate comprise $23,000 familiarization cost + [$92,000 +$14,000 $\times \sum_{i=2027}^{2030} 1/(1+7\%)^{i-2026}$] certification cost = $152,000.

framework based on EPFD and PFD limits. The differing treatment of Ka-band frequencies in the current rules – where the EPFD limit in the upper portion of the band is substantially more restrictive than the EPFD limit in the lower portion of the band – was widely criticized in the record as technically unjustified.[47] In addition, the overall methodology used to derive the current EPFD limits has been called into question, including the use of methodologies designed to address short-term interference to develop long-term EPFD limits, overly conservative modeling of rain attenuation, and the inclusion of a large number of unstable links with negative link margin values in the set of GSO reference links used to derive the EPFD limits.[48] For these reasons, as well as others identified in the record, Staff finds that the current limits were overly and unnecessarily restrictive.

22. Modern management practices allow more satellites to serve the same area, at potentially higher power, and over a wider portion of the visible sky. Failure to adopt newer standards would leave satellite spectrum underutilized relative to its potential economic and technological value. Without further action, the Commission would forgo an opportunity to promote more efficient use of spectrum, stimulate innovation, and bridge the digital divide.[49]

B. Alternative B – Adopt Modern Performance-Based GSO Protection Rules as Bright-line Rules to Replace Existing EPFD

23. Under this alternative, the Commission would replace the current sharing framework based on EPFD limits with performance-based GSO network protection requirements. These performance-based requirements would include: (1) a long-term protection criterion of 3% time-weighted average throughput degradation for GSO satellite links using ACM; (2) a short-term protection criterion of 0.1% absolute increase in link unavailability for GSO satellite links; (3) a protection criterion of –10.5 dB interference-to-noise (I/N) for 80% of the time for GSO satellite links that do not use ACM; and (4) an NGSO minimum 3-degree avoidance angle of the GSO arc. Given the overly conservative nature of the current sharing framework, these more modern and permissive requirements are an improvement over Alternative A, as they would result in an increase in satellite capacity, while protecting incumbent GSO providers. As discussed below, however, this alternative is inferior to the rules adopted, because it does not permit parties to negotiate a mutually beneficial coordination agreement that may be superior to what would exist from the mere application of the modern performance-based requirements described above.

C. Alternative C (Adopted Rules) – Introduce A Coordination-based Framework with a Backstop of Modern Performance-Based GSO Protection Rules As a Default Protection Regime Should the Parties Be Unable to Agree

24. The Commission has emphasized that private coordination among satellite operators, based on real-world operating parameters, offers the best opportunity for efficient spectrum sharing.[50] The current EPFD limits do not accommodate such coordination because they must be met regardless of any agreements between particular NGSO and GSO satellite operators. Commission precedent also

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[47] *See, e.g.*, Telesat Comments, Annex 1 ("There is no valid technical reason for the bands to have different limits."); SES Comments at 17-18; Amazon Comments at 6; CSF Comments at 4; NetChoice Comments at 3. In addition, Amazon notes that "no real-world NGSO constellation can precisely map onto the ITU EPFD limits" and that "an NGSO operator must limit its design and operations 100% of the time to meet the limits for only one point for one of the sets of EPFD limits for any given band—and operate with EPFD levels below those limits in all other cases." Amazon Comments at 6-7.

[48] *See* SpaceX Oct. 29, 2025 *ex parte* at 2; *see also* SES Comments at 18-19 ("When developing the Ka-band EPFD limits, the Ka-band GSO parameters were not well known. Additionally, different methodologies, including ill defined 'reserved capacity' concepts, were used and are inconsistent with today's Ka-band GSOs.").

[49] *Communications Marketplace Report*, GN Docket No. 24-119, FCC 24-136, paras. 3, 185 (rel. Dec. 31, 2024).

[50] *See, e.g.*, *Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, Report and Order and Further Notice of Proposed Rulemaking, 38 FCC Rcd 3699, 3706, para. 20 (2023).

supports a requirement of good-faith coordination backstopped by performance-based interference metrics.

25. If the parties cannot agree on a coordination plan, then the performance-based GSO network protection requirements set forth in Alternative B would apply as a default protection requirement. Alternative C is superior to Alternative B, because it enables parties to negotiate a mutually beneficial coordination agreement if such an agreement is superior to what would result from the application of the performance-based GSO network protection requirements. Given this, the parties must be at least as well off under Alternative C compared to Alternative B.

VIII. JUSTIFICATION DETERMINATION

A. Benefits Exceed Costs

26. Staff finds that the changes adopted in the *Order* will generate large broad-based benefits to the public that exceed the relatively low compliance costs. Moving away from restrictive and outdated requirements will enable new uses and capabilities for NGSO satellites. Staff estimates large benefits in the form of increases in producer surplus from expanded economic activities in satellite telecommunications services. These activities will take the form of increased satellite deployment, expanded service and new innovations in technology that will spur economic activity and help close the digital divide. Staff estimates net benefits—after netting out compliance costs—ranging from $1.6 billion to $19.9 billion using a 3% discount rate and $1.4 billion to $17.1 billion using a 7% discount rate.

B. Highest Net-Benefit Alternative

27. Based on the record and economic analysis, Staff finds that Alternative C—the coordination framework with default performance-based, bright-line rules offers the greatest net benefit among the three alternatives considered. This combination of encouraging coordination among parties buttressed by backstop protection requirements should the parties be unable to agree, generates the most protection of GSO satellite operations without hindering mutually beneficial coordination between GSO and NGSO satellite operators.

C. Small Entity Impacts

28. The rules adopted by the Commission in the Report and Order will benefit many small entities by giving them greater access to satellite-based communication services, while imposing few direct compliance costs on small entities. The Regulatory Flexibility Act of 1980, as amended (RFA),[51] generally defines the term "small entity" as having the same meaning as under the Small Business Act.[52] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act."[53] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[54] We divide small entities into two industries—identified in the chart below—that could be directly affected by our actions, satellite telecommunications and other telecommunications.

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[51] 5 U.S.C. §§ 601 *et seq*., as amended by the Small Business Regulatory Enforcement and Fairness Act (SBREFA), Pub. L. No. 104-121, 110 Stat. 847 (1996).

[52] *Id.* § 601(6).

[53] *Id*. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[54] 15 U.S.C. § 632.

Regulated Industry (Footnotes specify potentially affected entities within a regulated industry where applicable)	NAICS Code	SBA Size Standard	Total Firms[55]	Total Small Firms[56]	% Small Firms
Satellite Telecommunications	517410	$44 million	332	195	58.73%
All Other Telecommunications	517810	$40 million	1,673	1,007	60.19%

29. The adopted modern sharing rules replace an outdated, spectrally inefficient sharing framework, and will promote more efficient use of spectrum, stimulate innovation, and bridge the digital divide. Small entities that use or provide input for these services will benefit. Out of the existing small satellite telecommunications providers, few if any are satellite operators, given the high fixed costs of deploying and operating satellites, and thus subject to the rules. We conclude that little to no compliance costs will be imposed on small entities. Additionally, the Commission considered alternative proposals and weighed their benefits against their potential costs to small businesses and other entities. On balance, the adopted rules will result in significant economic benefits for small entities.

D. Impacts on disadvantaged populations

30. The new adopted sharing framework should help disadvantaged populations, such as the extremely rural, who lack current access to telecommunications services. More utilization of spectrum stimulated by the new rules is likely to result in expanded coverage by satellites telecommunications services. Coverage might then extend to areas that were economically unprofitable, such as areas with very low population densities. Other disadvantaged groups are likely to face the same benefits as the general population as the benefits are likely broad-based. As for costs, we expect them to entirely take the form compliance costs for satellite service providers and not the general public. As a result, disadvantaged populations are unlikely to incur disproportionate costs.

[55] *U.S. Census Bureau*, "*Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2022*." Economic Census, ECN Core Statistics Economic Census: Establishment and Firm Size Statistics for the U.S., Table EC2200SIZEREVFIRM, 2025.

[56] *Id.*

APPENDIX E

List of Commenters

Comments

Letter from Colby Hall, Executive Director, Shaping Our Appalachian Region, to Marlene H. Dortch, Secretary, FCC (filed May 28, 2025) (SOAR Comments)

Letter from J. Jack Kennedy, Jr. to Marlene H. Dortch, Secretary, FCC (filed June 3, 2025) (Jack Kennedy Comments)

Letter from Don M. Green, CEO, Napoleon Hill Foundation, to FCC Commissioners (filed May 28, 2025) (Napoleon Hill Foundation Comments)

Letter from Donald K. Purdie, President and CEO, Appalachian Broadband Innovators, to Marlene H. Dortch, Secretary, FCC (filed June 6, 2025) (Appalachian Broadband Innovators Comments)

Letter from Dr. Teresa Tyson DNP, President and CEO, The Health Wagon, to Marlene H. Dortch, Secretary, FCC (filed June 10, 2025) (The Health Wagon Comments)

Letter from Richard Peterson, President, Central Council of the Tlingit and Haida Indian Tribes of Alaska, to FCC Commissioners (filed June 11, 2025) (Tlingit and Haida Indian Tribes Comments)

Letter from Sabrina Steward Mullins to Marlene H. Dortch, Secretary, FCC (filed June 13, 2025) (Sabrina Mullins Comments)

Letter from Dezarah Hall, Clerk of Court, Wise County, Virginia, to Marlene H. Dortch, Secretary, FCC (filed June 18, 2025) (Dezarah Hall Comments)

Letter from Billy Markham to Marlene H. Dortch, Secretary, FCC (filed June 26, 2025) (Billy Markham Comments)

Letter from Brandi Cole to Marlene H. Dortch, Secretary, FCC (filed June 26, 2025) (Brandi Cole Comments)

Letter from Ronald M. Norris to Marlene H. Dortch, Secretary, FCC (filed June 30, 2025) (Ronald Norris Comments)

Letter from Sonya Cox to Marlene H. Dortch, Secretary, FCC (filed June 30, 2025) (Sonya Cox Comments)

Letter from James R. Lawson to Marlene H. Dortch, Secretary, FCC (filed July 10, 2025) (James Lawson Comments)

Lexington Institute Comments

Progressive Policy Institute (PPI) Comments

Commercial Space Federation (CSF) Comments

The Software & Information Industry Association (SIIA) Comments

TechNet Comments

Kuiper Systems LLC (Amazon) Comments

Comsearch Comments

Hispasat, S.A., Eutelsat S.A., WorldVu Satellites Limited, Ovzon LLC (Eutelsat et al.) Comments

CTIA Comments

DIRECTV, LLC (DIRECTV) Comments

AT&T Services (AT&T) Comments

NetChoice Comments

Telesat Canada (Telesat) Comments

Computer & Communications Industry Association (CCIA) Comments

International Center for Law & Economics (ICLE) Comments

Chamber of Progress Comments

CORF - National Academy of Sciences Comments

National Radio Astronomy Observatory (NRAO) Comments

Information Technology and Innovation Foundation (ITIF) Comments

Space Exploration Holdings, LLC (SpaceX) Comments

SES S.A. and Affiliates (SES) Comments

Public Knowledge (PK) and Open Technology Institute at New America (OTI) Comments

Astranis Space Technologies Corp. (Astranis) Comments

Viasat, Inc. (Viasat) Comments

EchoStar Corporation (EchoStar) Comments

Reply Comments

Chamber of Progress Reply

NRAO Reply

Ovzon LLC (Ovzon) Reply

Astranis Reply

Eutelsat et al. Reply

CTIA Reply

SES Reply

Fixed Wireless Communications Coalition (FWCC) Reply

Telesat Reply

CCIA Reply

SpaceX Reply

Phoenix Center for Advanced Legal & Economic Public Policy Studies (Phoenix Center) Reply

DIRECTV Reply

Viasat Reply

Nokia Reply

American Astronomical Society Reply

Avanti Hylas 2 Limited (Avanti) Reply

National Association of Broadcasters (NAB) Reply

Gogo Business Aviation LLC (Gogo) Reply

Amazon Reply

EchoStar Reply

Utilities Technology Council (UTC) Reply

Software & Information Industry Association Reply

***Ex Parte* Filings**

CCIA July 16, 2025 *ex parte*

SpaceX Aug. 7, 2025 erratum

SpaceX Aug. 20, 2025 *ex parte*

Amazon Aug. 23, 2025 erratum

OTI Sept. 20, 2025 *ex parte*

Big Tent Supporters for Updating EPFD, Software & Information Industry Association, Open Technology Institute at New America, Public Knowledge, Lexington Institute, Chamber of Progress, Luke Hogg, Digital First Project, NetChoice, INCOMPAS, International Center for Law & Economics, Computer & Communications Industry Association Sept. 22, 2025 *ex parte*

UTC Sept. 25, 2025 *ex parte*

SpaceX Oct. 29, 2025 *ex parte*

SES Nov. 7, 2025 *ex parte*

SES Nov. 20, 2025 *ex parte*

CCIA Nov. 21, 2025 *ex parte*

SES Nov. 26, 2025 *ex parte*

DIRECTV Dec. 8, 2025 *ex parte*

SES Dec 10, 2025 *ex parte*

SpaceX Dec. 16, 2025 *ex parte*

CTIA Dec. 17, 2025 *ex parte*

SES Dec. 23, 2025 *ex parte*

SpaceX Dec. 22, 2025 *ex parte*

NAB Dec. 31, 2025 *ex parte*

SES Jan. 9, 2026 *ex parte*

DIRECTV Jan. 16, 2026 *ex parte*

Eutelsat Jan. 22, 2026 *ex parte*

Eutelsat Jan. 23, 2026 *ex parte*

Eutelsat Jan. 26, 2026 SB *ex parte*

Eutelsat Jan. 26, 2026 *ex parte*

Amazon Jan. 29, 2026 *ex parte*

SpaceX Jan. 29, 2026 *ex parte*

SpaceX Jan. 30, 2026 *ex parte*

SpaceX Feb. 6, 2026 *ex parte*

DIRECTV Feb. 9, 2026 *ex parte*

OTI and ICLE Feb. 14, 2026 *ex parte*

SpaceX Feb. 17, 2026 *ex parte*

DIRECTV Feb. 18, 2026 *ex parte*

Viasat Feb. 18, 2026 *ex parte*

OTI and ICLE Feb. 20, 2026 *ex parte*

DIRECTV Feb. 24, 2026 *ex parte*

Viasat Feb. 26, 2026 *ex parte*

SES Feb. 26, 2026 *ex parte*

SpaceX Feb. 26, 2026 *ex parte*

SES Mar. 3, 2026 *ex parte*

SpaceX Mar. 5, 2026 *ex parte*

SpaceX Mar. 6, 2026 *ex parte*

Viasat Mar. 9, 2026 *ex parte*

DIRECTV Mar. 13, 2026 *ex parte*

FWCC Mar. 30, 2026 Trusty Office *ex parte*

FWCC Mar. 30, 2026 Gomez Office *ex parte*

SES Apr. 3, 2026 *ex parte*

DIRECTV Apr. 7, 2026 *ex parte*

CCIA Apr. 14, 2026 *ex parte*

ITIF Apr. 16, 2026 *ex parte*

SES Apr. 16, 2026 *ex parte*

SES Apr. 21, 2026 *ex parte*

SES Apr. 21, 2026 SB *ex parte*

CSF Apr. 22, 2026 *ex parte*

Eutelsat Apr. 22, 2026 *ex parte*

Telesat Apr. 22, 2026 *ex parte*

Telesat Apr. 23, 2026 *ex parte*

DIRECTV Apr. 23, 2026 *ex parte*

SES Apr. 23, 2026 *ex parte*

Astranis Apr. 24, 2026 *ex parte*

OTI Apr. 24, 2026 *ex parte*

SpaceX Apr. 28, 2026 *ex parte*

Amazon Apr. 28, 2026 *ex parte*

STATEMENT OF
CHAIRMAN BRENDAN CARR

Re: *Modernizing Spectrum Sharing for Satellite Broadband*, Report and Order, SB Docket No. 25-157 (April 30, 2026).

Americans today benefit from increased competition for their broadband dollars. Wireless carriers are now competing for in-home subscribers. Cable companies are competing for wireless customers. And satellite is competing with both cable and wireless. Today's FCC decision will help supercharge that competition while expanding our country's technological leadership.

Even though high-speed, next-generation satellite services provide essential connectivity across the country already, Americans are now about to see another big upgrade. With today's decision, consumers could now see a seven-fold increase in capacity for these high-speed, satellite offerings.

You see, the Commission has had the same technical restrictions on LEO satellite power levels going all the way back to the 1990s. But those decades-old rules no longer reflect today's offerings. In fact, they are holding them back. Modern satellite designs make it far easier to share spectrum than what yesterday's regulations assume. We can do much better.

Today, low-Earth orbit satellite providers are scaling at a rapid pace. Starlink alone now serves millions of Americans and millions more around the world. Once dismissed as a niche offering, satellite broadband is a real—and growing—competitor in the connectivity marketplace.

That should inform how we approach power levels on satellite broadband. Are our rules keeping up with this new reality? Are they holding it back? For years, our framework has relied on legacy constructs like EPFD. Those rules were designed for a different generation of satellite systems, one defined by a small number of geostationary operators and primitive networks.

That is not the world we live in anymore. Today's systems move differently. They scale differently. They compete differently. So, our rules should too.

Updating our approach—moving beyond outdated EPFD limits and toward more modern interference protections—also promotes competition. It allows satellite providers to operate with greater parity alongside terrestrial broadband offerings.

And that competition matters. Because when you increase competition, you increase consumer choice. You drive investment. You push providers across technologies to do better.

The benefits will be felt most by the Americans who need them the most. Rural communities. Hard-to-reach areas. Places where the business case for traditional deployment remains challenging. For those Americans, high-speed satellite broadband is not theoretical. It is tangible. It is available now. And it is improving rapidly.

This is also about American leadership. U.S. companies are leading the world in next-generation satellite services. We should have a regulatory framework that matches that energy, not one that slows it down. And we are not going to leave Americans waiting on the wrong side of the digital divide while other countries debate whether they want the same types of next-gen systems operating in their parts of the world. We are going to act now in the interests of the American people.

For their excellent work on this item, I thank Clay DeCell, Jennifer Gilsenan, Stephanie Neville, Sankar Persaud, and Jay Schwarz at the Space Bureau, and Mohammad Ahmad, Patrick Sun, and Aleks Yankelevich from the Office of Economics and Analytics.

STATEMENT OF
COMMISSIONER OLIVIA TRUSTY

Re: *Modernizing Spectrum Sharing for Satellite Broadband*, Report and Order, SB Docket No. 25-157 (April 30, 2026).

Nearly thirty years ago, global satellite policymakers endorsed equivalent power-flux density, or (EPFD), limits in the Ku- and Ka- spectrum bands. These limits reflected a precautionary approach to protecting GSO satellites from harmful interference, while still enabling spectrum sharing between NGSO fixed satellite systems and incumbent GSO operators. Yet, notwithstanding the utility of the EPFD framework, few could have anticipated the scale and dynamism of the satellite ecosystem three decades following its adoption.

Today, GSO operators have deployed satellites with enhanced capabilities that support reliable internet connectivity, high-capacity video and audio distribution, and mission critical communications services for our military. Meanwhile, the NGSO sector has experienced explosive growth, with commercial providers launching constellations of hundreds to thousands of satellites in low Earth orbit. These systems deliver high-speed, low latency broadband, enable direct-to-device communications services, and more. Together, GSO and NGSO operators are expanding connectivity across the nation and making meaningful progress in our mission to close the digital divide.

Importantly, technological advances now allow NGSO systems to use shared spectrum far more efficiently and to mitigate interference in ways that were not possible when EPFD limits were first implemented. In light of these developments, it is clear that legacy rules, however well-intentioned, are a constraint to competition, innovation, and American leadership in the space economy. Today, we begin to correct course.

The President's 2025 Executive Order on Ensuring American Space Superiority underscores the importance of U.S. leadership in spectrum policy and calls on policymakers to enable commercial space growth through more efficient spectrum management.

This rulemaking advances that goal. It follows the general approach that the Commission has already taken for NGSO-NGSO sharing and the ITU has adopted in the Q- and V- bands for GSO-NGSO sharing. And it promotes more effective spectrum sharing by moving beyond rigid EPFD limits in the Ku- and Ka- downlink bands and toward a framework grounded in good-faith coordination, coupled with clear short- and long-term protection criteria. This approach better balances the need for NGSO systems to expand capacity with appropriate safeguards for ongoing GSO operations.

Just as important, today's decision positions the United States to lead globally in modernizing satellite spectrum policy. For years, the United States has recognized the need to revisit international EPFD rules that limit the ability of American companies to improve performance, reduce costs, and deliver better services worldwide. I appreciate the Chairman's collaboration in advancing language that positions the U.S. as a leader in future international discussions on EPFD limits. I am optimistic that today's action, and the real-world results it enables, will strengthen our hand in advancing global spectrum harmonization through the ITU process.

I thank the Space Bureau for their hard work on this item.