



PUBLIC NOTICE

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SPACE BUREAU UPDATES INITIAL SET OF GSO REFERENCE LINKS

SB Docket No. 25-157

By the Acting Chief, Space Bureau:

By this Public Notice, the Space Bureau (Bureau) updates the initial set of geostationary (GSO) satellite network reference links adopted in the Modernizing Spectrum Sharing for Satellite Broadband Report and Order (*Order*).¹ The updated dataset will promote more efficient spectrum sharing among today's broadband satellite systems by appropriately reflecting typical and widespread GSO satellite operations in the United States in compatibility analyses with non-geostationary (NGSO) constellations.

Background. On April 30, 2026, the Commission adopted the *Order* to update its spectrum-sharing rules for GSO and NGSO satellite systems operating in the 10.7-12.7 GHz, 17.3-18.6 GHz, and 19.7-20.2 GHz (space-to-Earth) bands.² The Commission concluded that the prior NGSO-GSO sharing regime—based upon NGSO systems complying with equivalent power-flux density (EPFD) limits developed in the 1990s—was spectrally inefficient and overprotective of modern GSO networks.³ To better support efficient spectrum use and the competitive satellite market, the Commission adopted an alternative sharing framework, incorporating good-faith coordination and performance-based GSO protection criteria as a backstop when coordination between GSO and NGSO operators is not reached.⁴

Specifically, as an alternative to compliance with EPFD limits in the United States, the Commission adopted a procedure whereby an NGSO applicant may either certify that it has completed a coordination agreement with any operational co-frequency GSO satellite network or submit a compatibility showing which demonstrates that it will not cause unacceptable interference to any such system with which coordination has not been completed.⁵ To perform these compatibility showings, NGSO operators will rely on a set of GSO reference links, which reflect typical GSO operations in the U.S. and the resultant impacts on GSO systems from enhanced NGSO operations.⁶ Reference links are

¹ *Modernizing Spectrum Sharing for Satellite Broadband*, Report and Order, SB Docket No. 25-157, FCC 26-26 (2026). On May 13, 2026, the *Order* was published in the Federal Register,¹ announcing a July 13, 2026 effective date for certain adopted rules. 91 FR 26928. However, the compatibility-showing requirement in section 25.146(a)(3) requires approval under the Paperwork Reduction Act, and its effective date is delayed indefinitely pending that approval. Accordingly, the Bureau has not yet begun reviewing or approving compatibility showings under the new rules.

² *Id.*

³ *Id.* at para. 33.

⁴ *Id.* at para. 3.

⁵ *Id.* at Appx. A. Compatibility showings must demonstrate that the NGSO system will: 1) cause no more than 3% time-weighted average degraded throughput of any GSO reference link that uses adaptive coding and modulation (ACM); 2) cause no more than 0.1% absolute change in link availability to any GSO reference link; and 3) cause no more than -10.5 dB I/N for 80% of time for any GSO reference link that does not use ACM. *Id.*

⁶ *Id.* at n.77.

used by NGSO operators to demonstrate compliance with the long-term and short-term interference metrics,⁷ and the operational parameters of an NGSO system must ensure that the GSO protection criteria are satisfied at every reference link.⁸ In practice, as noted in the *Order*,⁹ there may be one protection criterion for one reference link that is the constraining factor on the operational parameters of a given NGSO system (referred to as the “most sensitive link”).¹⁰ The operational parameters required to protect this most sensitive link as the worst-case protection scenario will be the operational parameters that the NGSO system may employ when providing service anywhere in the United States.¹¹ Consequently, all GSO links—regardless of whether they are included in the reference link dataset—will be protected by the operational constraints placed on NGSO systems to protect the most sensitive reference link. Indeed, the actual protection of GSO operations will often be greater than the protection levels adopted by the Commission.¹²

The *Order* adopted an initial set of 328 GSO reference links that were drawn from both International Telecommunication Union data and the Commission’s licensing databases and were filtered for conformance with a set of selection criteria.¹³ The Commission concluded that reasonable selection parameters for the reference links were necessary for efficient spectrum sharing.¹⁴ In adopting this initial set of reference links, the Commission also noted the potential for its further refinement,¹⁵ and delegated authority to the Bureau to initiate a proceeding by Public Notice to remove, revise, or add appropriate GSO links.¹⁶

On May 12, 2026, the Bureau sought comment on the initial set of GSO reference links, potential revisions to the dataset, and the accompanying selection criteria.¹⁷ The Public Notice asked for input and analysis on the dataset, including as to whether certain links or information should be added or removed

⁷ *Id.* at para. 66.

⁸ The three NGSO operational parameters typically leveraged to protect the most sensitive links are: 1) reducing the number of satellite beams that can serve any given location simultaneously using the same frequencies (i.e., the number of co-frequency beams or Nco); 2) increasing the “avoidance angle” of the GSO arc beyond a required 3-degree baseline; and 3) reducing radiated power levels. *See id.* at para. 18.

⁹ *See id.* at para. 47.

¹⁰ The most sensitive link may be different for different NGSO systems depending on specific orbital characteristics and other system parameters.

¹¹ This is because the location of all GSO network earth stations, especially blanket-licensed earth stations, is not generally known to the NGSO operator. More tailored protections could be agreed during coordination between NGSO and GSO satellite operators, however.

¹² *See, e.g.,* *Order* at para. 49 (“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.”).

¹³ *Id.* at para. 67.

¹⁴ *Id.* at para. 69, n.237.

¹⁵ *Id.* at para. 51, n.176 (“[W]e retain the ability to update specific GSO reference links in the future to keep pace with evolving GSO network designs.”).

¹⁶ *Id.* at para. 69.

¹⁷ *Space Bureau Seeks Comment on GSO Reference Links*, SB Docket No. 25-157, Public Notice, DA 26-467 (SB rel. May 12, 2026), erratum, DOC-421870 (rel. May 20, 2026) (*GSO Reference Links Notice*). The Notice was published in the Federal Register. 91 FR 31697 (May 28, 2026).

from the database and on whether the selection criteria should be modified at this time.¹⁸ Nine comments, seven reply comments, and several *ex partes* were filed in response.¹⁹

Discussion. Based on the record, we update the initial set of adopted GSO reference links. We also add new links proposed by GSO satellite operators, correct parameters of links already included in the dataset, and remove outdated links and links operated outside of the United States, consistent with the selection criteria used for the initial set of reference links.²⁰ The updated set of GSO reference links is included in the Attachment to this Public Notice. We conclude it is premature to make broader changes to the dataset or underlying selection criteria at this time and adopt the updated dataset using the selection criteria used for the initial set of links.²¹

First, GSO operators submitted a number of up-to-date reference links to reflect current operations that are consistent with the selection criteria used to create the initial dataset.²² In addition, one NGSO operator provided a set of proposed replacement reference links that it identified and selected using the Commission's licensing database for every authorized GSO operator in the 17.3-18.6 GHz and 19.7-20.2 GHz bands (Ka-band).²³ We have reviewed these proposed links and agree that they are reasonably representative of a variety of widespread GSO operations in the United States and appropriate for inclusion in the dataset.²⁴

Second, further review of the initial set of reference links shows that certain links either reflect operations outside the United States, are unassociated with any current operator or operations serving the United States or were submitted for GSO networks that never began operations or ceased operations over a decade ago.²⁵ We remove these legacy reference links considering the updated links from GSO

¹⁸ *Id.*

¹⁹ All citations to comments, reply comments, and *ex partes* are to filings made in response to the *GSO Reference Links Notice*.

²⁰ Order at para. 67; *GSO Reference Links Notice* at 2.

²¹ *GSO Reference Links Notice* at 2.

²² These links were submitted by DIRECTV, SES, Eutelsat, Hispasat, Astranis, and Viasat. The incorporated links encompass varying link characteristics and are traceable to the operator through the Commission's satellite licensing database (International Communications Filing System or ICFS). See Amazon Reply at 4. In addition, Astranis submitted reference links related to its proposed operations at the 121° W.L. orbital location. We do not include links for prospective operations in the database. See, e.g., Order, FCC 26-26, para. 69, n.237.

²³ Amazon Comments at 5, Appendix.

²⁴ See Order, FCC 26-26, para. 67. While some commenters argue that operational parameters filed in ICFS may not be representative of typical operating parameters, we note that the inclusion of additional reference links will not disadvantage GSO operators. See, e.g., DIRECTV Reply at 4. But see Hispasat Reply at 11-12; SES Reply at 15-16.

²⁵ See Amazon Comments at 3-4; SpaceX Comments at 3. Many of these links were drawn from ITU Circular Letter CR/116, which circulated prior to the deployment of any commercial Ka-band satellites. See Amazon Comments at 3-4. We note also that, without an existing GSO operator affiliated with reference links, an NGSO operator would have no operator with which to coordinate, making private agreements regarding spectrum sharing infeasible. Given the opportunity to revisit the reference link dataset, and the up-to-date links submitted by GSO operators for their operations in this proceeding, we see no need to maintain outdated or non-U.S. links in the dataset. We therefore disagree with arguments that legacy GSO links included in the initial dataset should be entitled to deference, see SES Reply at 3, 14-15, because none were submitted by contemporary GSO operators in this proceeding and, notably in Ka-band, such links were submitted to the ITU based on planned, not operational, networks. We note further that GSO operators participating in this proceeding have provided new reference links for their operations and none have claimed that these legacy links reflect their current operations. See SES Reply at 15. However, while we perform this clean-up of the initial set of GSO reference links, and in particular links based on the 1999 ITU Circular Letter, we do not establish at this time a mechanism for future removals, which could generate additional concerns. See, e.g., Hispasat Reply at 14-16; SES Reply at 6-7.

operators that we add to the dataset. We also remove links for GSO operators that are either redundant or superseded by up-to-date links provided by those operators in the record.²⁶

Third, we modify certain link parameters in the initial dataset that now appear to be either non-representative of typical operations or otherwise inaccurate. Specifically, commenters in response to the Public Notice point out several non-ACM links in the initial dataset with unusually high carrier-to-noise (C/N) levels of up to 18 dB.²⁷ DIRECTV, one of the most widespread users of non-ACM links, states that such high C/N thresholds “are not reflective of non-ACM operations.”²⁸ SpaceX proposes to apply a maximum unavailability C/N for non-ACM links of 9.5 dB, which DIRECTV supports for broadcasting-satellite service user links as consistent with its existing operations and network design.²⁹ SpaceX further notes that of the 40 new non-ACM user terminal links submitted by GSO operators in response to the Public Notice, only three have unavailability C/N thresholds exceeding 9.5 dB, each of which appears to originate from a satellite that has surpassed its design lifespan.³⁰ SES, which submitted the new high C/N links, argues that some of its GSO media distribution services rely on non-ACM links designed to achieve high availability levels and use an unavailability C/N threshold of 12.6 dB to maximize link capacity.³¹ We determine that higher C/N values appear to be relative outliers on older networks, and agree with DIRECTV and SpaceX that a 9.5 dB C/N threshold is a reasonable upper bound for modern, widespread and typical non-ACM user terminal links to facilitate spectrum sharing. Accordingly we incorporate the 9.5 dB C/N threshold into the revised dataset.³² Separately, we also modify certain parameters of Hispasat links to reflect corrections noted on the record.³³

Fourth, we streamline the columns of the reference link dataset to clarify the necessary information, support coordination, and remove extraneous information not needed as input to the compatibility demonstrations.³⁴

Finally, we decline to make broader changes to the dataset or selection criteria at this time.³⁵ The Commission’s *Order* ended over two decades of overprotective and spectrally inefficient restrictions on NGSO systems for the benefit of GSO networks. The new sharing framework has yet to be implemented, but the services available to consumers across the United States from fast-growing NGSO systems will be limited by the NGSO operational parameters necessary to protect the most sensitive link in the GSO reference link dataset.³⁶ Given that determining the most sensitive link depends on several factors, we are wary of modifying or reducing the selection criteria and potentially introducing edge-cases into the analysis. Further, we note specific rationales to maintain contested criteria,³⁷ and that to the extent that

²⁶ See Amazon Reply at 4-5.

²⁷ See SpaceX Comments at 4-6; DIRECTV Reply at 6-7.

²⁸ DIRECTV Reply at 6.

²⁹ DIRECTV Reply at 6-7; *see also* SpaceX Comments at 5-6.

³⁰ SpaceX Reply at 7.

³¹ See SES Reply at 12; *see also* Hispasat Comments at 9-10.

³² We note that the Commission assigned an unavailability C/N threshold of 0 dB to ACM links, consistent with the Commission’s NGSO-NGSO spectrum sharing framework. *See Order*, FCC 26-26, para. 78.

³³ See Hispasat Comments at 10; SpaceX Reply at 8.

³⁴ See Amazon Reply at 3-4; *see also* SES Comments at 3-5.

³⁵ See GSO Reference Links Notice at Appendix A.

³⁶ See, e.g., Letter from Emily Hsu, Corporate Counsel, Kuiper Systems LLC, to Marlene H. Dortch, Secretary, FCC, at 3 (filed Aug. 31, 2026) (*Amazon Ex Parte*).

³⁷ For example, while some commenters oppose the 25-degree earth station minimum elevation angle criterion, *see, e.g.,* SES Comments at 9-10, Hispasat Comments at 5-9, SpaceX notes that links submitted with elevation angles below 25 degrees may not accurately account for ground noise and increased sky brightness temperatures resulting

links which are not included in the dataset are no less sensitive or constraining for a particular NGSO system,³⁸ they will receive protection levels equal to or greater than the GSO protection criteria adopted by the Commission. Further, the Commission has never concluded that even a GSO link that receives less protection than the levels set in the *Order* would be nonviable in specific use cases. Rather, we will address future updates to the dataset and be in a better position to reassess the protection criteria after we gain experience with its implementation.³⁹ We will consider in particular any real-world operational information once the new rules are effective.⁴⁰ We reiterate that operating NGSO systems may be required to adjust their operations to protect any new GSO reference links added in the future.⁴¹

This Public Notice shall be effective 30 days after publication in the Federal Register.

Paperwork Reduction Act Analysis. As stated in the GSO Reference Links Public Notice, the action contained herein does not change, or propose to change, the information collection requirements subject to the Paperwork Reduction Act of 1995 (“PRA”), Public Law 104-13, contained in the *Order*.⁴² As a result, no new submission to the Office of Management and Budget is necessary to comply with the PRA requirements.

Regulatory Flexibility Act. As stated in the GSO Reference Links Public Notice, the actions in this Public Notice have not changed our Final Regulatory Flexibility Analysis (FRFA), which was set forth in the *Order*.⁴³ Thus, no supplemental FRFA is necessary.

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 non-major under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this Public Notice to Congress and the Government Accountability Office pursuant to 5 U.S.C. § 801(a)(1)(A). The Office of the Managing Director, Performance Program Management, will also send a copy of this Public Notice in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A).

OPEN Government Data Act. The OPEN Government Data Act⁴⁴ requires agencies to make “public data assets” available under an open license and as “open Government data assets,” i.e., in machine readable, open format, unencumbered by use restrictions other than intellectual property rights,

in higher system noise temperatures, making the links appear more robust than they actually are. SpaceX Reply at 5-6. DIRECTV accepts this critique. Letter from Brenna Sparks, Associate Vice President, External Affairs, DIRECTV, LLC, to Marlene H. Dortch, Secretary, FCC at 2 (filed Aug. 14, 2026). In addition, while several commenters object to referring to earth stations in motion (ESIMs) as a “niche” application and support their inclusion in the dataset, Amazon notes that the introduction of ESIMs has been premised upon on their not causing more interference than, and not requiring greater interference protection than, comparable fixed user terminals, which are included in the dataset. See Amazon *Ex Parte* at 4-5.

³⁸ See DIRECTV Comments at 4-5, Attach. B; Viasat Comments at 14.

³⁹ The Commission has already allowed NGSO operators to use the latest developments in modeling NGSO and GSO systems in the compatibility analyses, which includes with regard to receive earth station antenna patterns, and we do not revisit that decision here. See *Order*, FCC 26-26, para. 79, n.279. But see, e.g., SES Comments at 2-3; Viasat Comments at 23-28.

⁴⁰ But see SES Reply at 16-18.

⁴¹ *Order*, FCC 26-26, para. 69.

⁴² GSO Reference Links Public Notice, n.7

⁴³ GSO Reference Links Public Notice, n.7 (citing *Order*, Appx. C.).

⁴⁴ Congress enacted the OPEN Government Data Act as Title II of the Foundations for Evidence-Based Policymaking Act of 2018, Pub. L. No. 115-435 (2019), §§ 201-202.

and based on an open standard that is maintained by a standards organization.⁴⁵ This requirement is to be implemented “in accordance with guidance by the Director” of the OMB.⁴⁶ The term “public data asset” means “a data asset, or part thereof, maintained by the federal government that has been, or may be, released to the public, including any data asset, or part thereof, subject to disclosure under the Freedom of Information Act (FOIA).”⁴⁷ A “data asset” is “a collection of data elements or data sets that may be grouped together,”⁴⁸ and “data” is “recorded information, regardless of form or the media on which the data is recorded.”⁴⁹

People with Disabilities. To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at (202) 418-0530 (voice).

Additional Information. For further information regarding this proceeding, please contact Clay DeCell, Satellite Programs and Policy Division, Space Bureau at ClayDeCell@fcc.gov.

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⁴⁵ 44 U.S.C. §§ 3502(20), (22) (definitions of “open Government data asset” and “public data asset”), 3506(b)(6)(B) (public availability).

⁴⁶ OMB has not yet issued final guidance.

⁴⁷ 44 U.S.C. § 3502(22).

⁴⁸ 44 U.S.C. § 3502(17).

⁴⁹ 44 U.S.C. § 3502(16).

ATTACHMENT