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FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 25

[IB Docket No. 21-456; FCC 23-29; FR ID 147653]

Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: In this document, the Federal Communications Commission (Commission or we) revises its rules governing spectrum sharing among a new generation of broadband satellite constellations to promote market entry, regulatory certainty, and spectrum efficiency. The Commission adopts rules clarifying protection obligations between non-geostationary satellite orbit, fixed-satellite service (NGSO FSS) systems authorized through different processing rounds, subjects those protections to a sunset period, and requires all NGSO FSS operators licensed or granted market access in the United States to coordinate with each other in good faith.

DATES: Effective **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, except for the amendment to § 25.261 in amendatory instruction 4, which is delayed indefinitely. The Commission will publish a document in the *Federal Register* announcing the effective date of § 25.261 in instruction 4.

FOR FURTHER INFORMATION CONTACT: Clay DeCell, 202-418-0803.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Report and Order, FCC 23-29, adopted April 20, 2023, and released April 21, 2023. The full text is available online at https://docs.fcc.gov/public/attachments/FCC-23-29A1.pdf. The document is also available for inspection and copying during business hours in the FCC Reference Center, 45 L Street NE, Washington, DC 20554. To request materials in

accessible formats for people with disabilities, send an email to FCC504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

Procedural Matters

Regulatory Flexibility Analysis

The Regulatory Flexibility Act of 1980, as amended (RFA), 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." Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of the rule changes contained in this document on small entities. The FRFA is set forth in Section IV below.

Paperwork Reduction Act

This document contains new or 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 will be invited to comment on the modified information collection requirements contained in this document.

In this document, we have assessed the effects of requiring later-round NGSO FSS grantees to submit compatibility showings with respect to earlier-round grantees with whom coordination has not yet been reached. We find that doing so will serve the public interest and is unlikely to directly affect businesses with fewer than 25 employees.

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 the Report and Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. 801(a)(1)(A).

Synopsis

I. Introduction

1. In this document, we revise Commission rules governing spectrum sharing among a new generation of broadband satellite constellations to promote market entry, regulatory certainty, and spectrum efficiency through good-faith coordination. Specifically, we adopt rules clarifying protection obligations between non-geostationary satellite orbit, fixed-satellite service (NGSO FSS) systems authorized through different processing rounds by using a degraded throughput methodology, and subject those protections to a sunset period. After the sunset period, new entrants authorized in later processing rounds will share spectrum on an equal basis with earlier-round incumbents. We also clarify that all NGSO FSS operators licensed or granted market access in the United States must coordinate with each other in good faith, regardless of their processing round status, and we explain our expectations for information sharing during this good-faith coordination. This document will continue the Commission’s efforts to promote development and competition in broadband NGSO satellite services made possible by the new space age.

II. Background

2. This proceeding continues the Commission’s recent efforts to update and refine its rules governing NGSO FSS systems. Constellations of NGSO FSS satellites traveling in low- and medium-Earth orbit may provide broadband services to industry, enterprise, and residential customers with lower latency and wider coverage than has previously been available via satellite. The number of applications filed in recent years for NGSO FSS system authorizations, and the number of satellites launched, are unprecedented.

3. *Processing Round Procedure Overview.* Applications for NGSO FSS system licenses and petitions for declaratory ruling seeking U.S. market access for non-U.S.-licensed NGSO FSS systems are considered in groups based on filing date, under a processing round procedure. Pursuant to the Commission's rules, a license application for "NGSO-like" satellite operation, including operation of an NGSO FSS system, that satisfies the acceptability for filing requirements is reviewed to determine whether it is a "competing application" or a "lead application." A competing application is one filed in response to a public notice initiating a processing round. Any other application is a lead application. Competing applications are placed on public notice to provide interested parties an opportunity to file pleadings in response to the application. Lead applications are also placed on public notice. The public notice for a lead application initiates a processing round, establishes a cut-off date for competing NGSO-like satellite system applications, and provides interested parties an opportunity to file pleadings in response to the application.

4. The Commission reviews each application in the processing round and all the pleadings filed in response to each application. Based upon this review and consideration of such other matters as it may officially notice, the Commission will grant all the applications for which the Commission finds that the applicant is legally, technically, and otherwise qualified, that the proposed facilities and operations comply with all applicable rules, regulations, and policies, and that grant of the application will serve the public interest, convenience and necessity. The Commission will deny the other applications.

5. *NGSO FSS System Spectrum Sharing Overview.* The Commission has adopted rules for spectrum sharing among NGSO FSS systems. NGSO FSS space station applications granted with a condition to abide by these sharing rules are exempt from frequency band segmentation procedures that otherwise apply to applications for NGSO-like satellite operation. Instead, NGSO FSS operators must coordinate with one another

in good faith the use of commonly authorized frequencies. If two or more NGSO FSS satellite systems fail to complete coordination, a default spectrum-splitting procedure applies.

6. Under the default spectrum-splitting procedure, whenever the percentage increase in system noise temperature of an earth station receiver, or a space station receiver for a satellite with on-board processing, of either system, $\Delta T/T$, exceeds 6% due to interference from emissions originating in the other system in a commonly authorized frequency band, such frequency band will be divided among the affected satellite networks (i.e., individual links) in accordance with the following: (1) Each of n (number of) satellite networks involved must select 1/n of the assigned spectrum available in each of these frequency bands; (2) the affected station(s) of the respective satellite systems may operate in only the selected (1/n) spectrum associated with its satellite system while the $\Delta T/T$ of 6% threshold is exceeded; and (3) all affected station(s) may resume operations throughout the assigned frequency bands once the $\Delta T/T$ of 6% threshold is no longer exceeded. The spectrum selection order for each satellite network is determined by the date that the first space station in each satellite system is launched and capable of operating in the frequency band under consideration.

7. In the NGSO FSS Report and Order, the Commission stated that it will "initially limit" sharing under the $\Delta T/T$ of 6% threshold to qualified applicants in a processing round. The Commission explained that treatment of later applicants would be case-by-case based on the situation at the time and considering both the need to protect existing expectations and investments and provide for additional entry, as well as any comments filed by incumbent operators and reasoning presented by the new applicant.

8. *NPRM.* The NPRM sought comment on rule changes that would clarify the relative obligations between NGSO FSS systems approved in different processing rounds. Specifically, the Commission proposed to limit the existing NGSO FSS

spectrum-splitting procedure in section 25.261 to those systems approved in the same processing round, and to require systems approved in a later processing round to coordinate with, or demonstrate they will protect, earlier-round systems. The Commission invited comment on how to quantify inter-round protection and whether it should sunset after a period of time. The Commission also proposed to require all NGSO FSS grantees, regardless of their processing round status, to coordinate with each other in good faith and sought comment on specific information sharing obligations that could facilitate operator-to-operator coordination. In response to the NPRM, seventeen comments, fifteen reply comments, and numerous *ex partes* were filed.

III. Discussion

9. After review of the record, we adopt rule changes that will promote market entry, regulatory certainty, and spectrum efficiency among a new generation of broadband NGSO satellite constellations. Specifically, we adopt three proposals in the NPRM that received broad support: 1) limiting the default spectrum-splitting procedure in section 25.261 to NGSO FSS systems approved in the same processing round, before sunsetting; 2) requiring NGSO FSS systems approved in a later processing round to coordinate with, or demonstrate they will protect, earlier-round systems; and 3) requiring all NGSO FSS grantees to coordinate with each other in good faith. We also address three issues that produced a diverse record. After reviewing the proposed options for inter-round protection, we conclude that an interference analysis based on a degraded throughput methodology offers the most technically promising path for NGSO FSS inter-round sharing and require later-round systems to use such a methodology when demonstrating that they will protect earlier-round systems. On information sharing requirements, we clarify our expectations as to the necessary exchanges of information that will take place as part of the universal NGSO FSS good-faith coordination requirement we are adopting in this Order. We also conclude that protection of earlier-round NGSO FSS systems must

ensure a stable environment for continued service and investment but should not hinder later-round systems indefinitely. Accordingly, we adopt a sunsetting provision. NGSO FSS systems will be entitled to protection from systems approved in a subsequent processing round until ten years after the first authorization or market access grant in that subsequent processing round. After that date, all systems in both processing rounds will be treated on an equal basis with respect to spectrum sharing in the absence of a coordination agreement, and the default spectrum-splitting procedure in section 25.261 will also apply between systems in the two rounds. Finally, we apply the rule changes adopted in this final rule to all current NGSO FSS licensees and market access grantees as well as pending and future applicants and petitioners.

A. Limiting the Default Spectrum-Splitting Procedure to Systems Approved Through the Same Processing Round, before Sunsetting

10. In the NPRM, the Commission noted that, while it stated in the 2017 NGSO FSS Report and Order that it would "initially limit" the default spectrum-splitting procedure in section 25.261 to qualified NGSO FSS applicants in the same processing round, there is no such limitation in the current rule text. Nonetheless, recent NGSO FSS system licenses and grants of market access have included a requirement to apply the spectrum-splitting procedure only among NGSO FSS systems approved within the same processing round. To provide greater regulatory certainty, the Commission proposed to codify this limitation. Doing so would eliminate general "case-by-case" consideration of how to treat later NGSO FSS applicants relative to approved systems, except when considering waiver requests.

11. Commenters broadly welcome the Commission's proposal, which we adopt to provide greater regulatory stability and predictability to NGSO FSS operators as they deploy their initial constellations, subject to the sunsetting provision described below. The purpose of the Commission's recent NGSO FSS processing rounds has been to

establish a sharing environment among authorized systems to provide a measure of certainty in lieu of adopting an open-ended requirement to accommodate all future applicants. NGSO FSS operators have planned, invested, and begun deploying thousands of satellites in their initial constellations based in part on their assessment of the specific characteristics of other participants in their processing round, which allows them to estimate the amount of spectrum likely to be available during a situation governed by the spectrum-splitting procedure. Limiting the spectrum-splitting procedure to systems approved within the same processing round is therefore an important element of regulatory stability for NGSO FSS grantees as they deploy their initial constellations, reflected in the licensing decisions taken under the current, case-by-case approach. Over time, this anticipated NGSO FSS sharing environment will change as system authorizations granted in the same processing round are surrendered or not ultimately built out, new entrants are approved in later processing rounds and coordinate with existing systems, and operators' own system designs are updated for later-generation constellations. Therefore, while we do expect that the need for the stability and predictability offered by limiting the default spectrum-splitting procedure to systems approved through the same processing round will diminish over time and should be counterbalanced with the benefits of promoting new entry, as addressed through the sunsetting provision discussed below, we conclude that the establishment of an initial sharing environment will promote the development of NGSO FSS systems.

12. While no commenter suggests the Commission grant every new NGSO FSS application filed after a processing round cut-off date on an equal basis with applications filed within the processing round, some parties nonetheless encourage the Commission to retain discretion when considering later-filed NGSO FSS applications. We always retain such discretion in the context of a rule waiver upon a finding of good cause, although we expect such circumstances to be rare. We believe the waiver standard is the appropriate

threshold for considering whether an NGSO FSS application submitted after a relevant processing round cut-off date should be treated as if it had been filed within the processing round window and therefore given equal access to spectrum, through the default spectrum-splitting procedure, with timely filed applications.

B. Protection of Earlier-Round Systems from Later-Round Systems

13. Another important element of regulatory stability for NGSO FSS grantees is the knowledge that they will be protected from harmful interference that might be caused by later-authorized systems. In the NPRM, the Commission proposed to codify an inter-round protection requirement consistent with licensing decisions. The rule would require that, 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 demonstrate that it will not cause harmful interference to any such system with which coordination has not been completed.

14. Commenters broadly support, and none oppose, a requirement for later-round NGSO FSS grantees to protect earlier-round grantees, which we adopt herein. As explained in the NPRM, the protection of an NGSO FSS system from systems approved through a subsequent processing round goes to the heart of the stability of interference environment the Commission intended to create through use of the processing round procedure. Accordingly, to clarify the obligations of later-round grantees and to provide greater regulatory certainty, we codify a requirement that, prior to commencing operations, an NGSO FSS licensee or market access recipient must either submit in the International Communications Filing System (ICFS) a certification 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 showing that it will not cause harmful interference to any such system with which

coordination has not been completed. If an earlier-round system becomes operational after a later-round system has commenced operations, the later-round licensee or market access recipient must submit a certification of coordination or a compatibility showing with respect to the earlier-round system no later than 60 days after the earlier-round system commences operations as notified under section 25.121(b) or otherwise. Notices of commencement of operations for NGSO FSS systems subject to section 25.261 will be placed on public notice as informative to facilitate the filing of these certifications and showings. Compatibility showings will be placed on public notice for comment by interested parties before action by the Commission. Further, to address the possibility that a later-round system may need to significantly limit its operations to protect a large, planned, earlier-round system of which only one or a few satellites have been launched and are operating, we will allow later-round systems to operate on an unprotected, non-interference basis with respect to an earlier-round system after they have submitted a required compatibility showing for the earlier-round system and while it remains pending with the Commission. By requiring this technical showing before operations on a non-interference basis may begin, we will allow the affected earlier-round operator, and any other interested parties, to provide the Commission with their views on the sufficiency of the showing. At the same time, we guard against an incentive for earlier-round grantees to use Commission processes to delay service by the later-round system by vigorously opposing all compatibility showings by grantees that have not yet completed coordination with them.

C. Level of Protection for Earlier-Round Systems

15. The NPRM identified three principal methods, suggested by satellite operators, by which the Commission could quantify a required level of protection for earlier-round NGSO FSS systems from later-round systems or otherwise ensure their compatible operations. First, the Commission could develop and adopt an interference-to-noise (I/N)

limit. The I/N limit could incorporate a standard reference antenna mask and standard noise temperature and specify a percentage of time during which the limit may be exceeded. Applicants in a later processing round could be required to demonstrate that their proposed systems would comply with the I/N limit based on a probabilistic analysis. Second, the Commission could adopt interference protection criteria based upon the percentage of degraded throughput experienced by the earlier-round NGSO FSS system. A degraded throughput method would recognize that most, if not all, modern NGSO systems will use adaptive coding and modulation (ACM) and may be designed to meet performance objectives stated as either the packet error ratio or the spectral efficiency (bit/s/Hz) as a function of carrier-to-noise ratio (C/N). Satellite systems using ACM can maintain a satellite connection despite signal degradation, but at lower throughput rates. Third, the Commission could adopt a modified spectrum-splitting procedure for inter-round sharing. Under this option, when a 6% $\Delta T/T$ threshold is passed, the earlier-round system would be entitled to use 75% of the commonly authorized spectrum and the later-round system 25% of the available spectrum, instead of the 50%/50% split applicable to NGSO FSS systems approved through the same processing round.

16. Commenters are divided on their preference for an I/N limit, a degraded throughput methodology, or a modified band-splitting option. Supporters of an I/N limit argue that it is easily administrable, familiar to operational NGSO systems engaged in coordination, and less susceptible to misapplication based on subjective carrier characteristics. Commenters that favor a degraded throughput methodology note that it takes into account the design and objectives of modern NGSO systems, including the use of ACM. Proponents of a modified band-splitting option argue that it would encourage both parties to coordinate because both would have to reduce their spectrum use when the interference trigger is reached. Several commenters request the Commission seek further comment on the development of an inter-round protection criteria before it is adopted,

and specifically argue that no reference values currently exist for quantifying proposed new criteria.

17. After review of the record in response to the NPRM, we believe that pursuing a degraded throughput approach to quantify the level of protection for earlier-round systems from later-round systems is the most technically promising option as it would account for the realities of modern NGSO systems and be based on a key design consideration for such systems. As they transit through the view of an earth station, NGSO satellites operate across a range of path distances, elevation angles, and antenna scan angles. Atmospheric conditions, such as rain attenuation, can also cause link degradations and outages, especially in higher frequency bands and modern NGSO systems use ACM, uplink and downlink power control, and network protocols to provide continuous data services in the face of these varying environmental effects. A degraded throughput methodology would recognize that the mechanisms NGSO FSS systems use to tolerate signal degradation due to path-loss changes and link outages due to weather effects, and would also provide resilience to certain interference from other NGSO FSS systems. Further, degraded throughput analyses submitted on the record demonstrate that the analysis can be performed using widely available satellite system operational information, such as contained in an ITU filing or Commission space station application, and is not unduly difficult to perform. With respect to the issues of potential synchronization loss and taking into account GSO interference and aggregate interference from multiple NGSO FSS constellations, these will be explored through the Further Notice of Proposed Rulemaking and can be addressed within the framework of a degraded throughput methodology. Accordingly, we will require an NGSO FSS licensee or market access recipient that has not yet reached a coordination agreement with an earlier-round system to use a degraded throughput methodology in its demonstration that it will protect earlier-round systems.

18. In contrast, we are concerned that adopting an I/N limit for the protection of earlier-round systems, rather than as a band-splitting trigger for systems in the same processing round, may overprotect earlier-round systems by not taking into account ACM and other methods used by modern NGSO systems to tolerate certain amounts of interference while continuing to provide reliable service to consumers, and therefore weaken their incentives to complete coordination with new entrants. In addition, while a 75%/25% band-splitting procedure between earlier- and later-round systems would provide some incentive to both parties to coordinate, this option may not ensure the continuity of earlier-round operations with existing customer bases if the earlier-round operator were required to reduce its spectrum usage by 25% during an event surpassing the $\Delta T/T$ threshold with a later-round system with which it has not yet found an appropriate accommodation.

19. While we adopt a requirement to use a degraded throughput methodology in demonstrations of compatibility with earlier-round systems because it accounts for ACM and other techniques used by modern NGSO systems and holds the best potential proposed on the record to protect earlier-round systems without unduly burdening later-round systems, we recognize that certain details of its implementation may benefit from further comment, such as the final percentage criteria to be used. The Further Notice of Proposed Rulemaking is dedicated to finalizing these issues. However until the particular issues in the Further Notice are resolved, we conclude that using the degraded throughput methodology as a basis for inter-round protection is more promising than an I/N protection criteria or modified spectrum-splitting option proposed on the record for the reasons discussed above.

D. Good-Faith Coordination

20. Although the Commission has adopted default rules for spectrum sharing among NGSO FSS systems, it has consistently affirmed that coordination among NGSO FSS

operators in the first instance offers the best opportunity for efficient spectrum sharing. Accordingly, the NPRM proposed to adopt a rule providing that the good-faith coordination requirement applies among all NGSO FSS grantees, including those approved through different processing rounds.

21. All commenters on this issue support the Commission's proposal to require good-faith coordination among all NGSO FSS grantees, which we adopt. With this requirement, we make clear that all NGSO FSS operators approved by the Commission must engage in good faith when discussing and accommodating the shared use of spectrum with other NGSO FSS operators. We will review any allegations that an NGSO FSS operator has not met the good-faith coordination requirement and may take enforcement actions, including monetary forfeitures, modification, or termination of the NGSO FSS authorization. We discuss expectations for information sharing in the context of good-faith coordination below.

E. Information Sharing during Good-Faith Coordination

22. In addition to the overall need for good-faith coordination, the Commission has emphasized that information sharing among NGSO FSS operators is essential to their efficient use of spectrum. In the NPRM, the Commission invited comment on whether to require sharing of certain types of information, such as beam-pointing information, that may be necessary for the implementation of any spectrum-sharing solution or protection criteria between NGSO FSS systems. The NPRM also sought comment on any practical concerns associated with such information sharing, and how best to address any associated, potential, competitive harms. More broadly, the Commission inquired as to whether it should add a definition of "good faith" coordination in our rules and how it may better encourage efficiency among NGSO FSS systems.

23. The record produced a variety of views regarding information sharing requirements. Commenters generally recognize that more detailed technical discussions

may assist parties in reaching an operator-to-operator coordination agreement, but diverge on whether the types of information to be shared should be agreed to by the coordinating parties, or whether the Commission should specify types of information that must be shared in all coordination discussions. Some commenters recommend the development of a third-party clearinghouse or industry-run database to facilitate sharing of NGSO FSS operational information. Commenters raise particular concern that a requirement to share real-time beam-pointing information may be impracticable for systems that use dynamic beam pointing and reveal confidential and proprietary traffic trends whose competitive harm may be difficult to address by means such as non-disclosure agreements. Some commenters argue that information sharing requirements should be limited to operational NGSO FSS systems, or make other proposals.

24. We decline to codify specific information sharing requirements as part of good-faith NGSO FSS coordination at this time. As an initial matter, we are encouraged that some first-round and second-round NGSO FSS systems have already completed coordination agreements under the Commission's existing regulatory framework, and this demonstrates that systems can effectively coordinate, even absent a third-party clearinghouse or other database to facilitate information sharing. We expect that number will grow as systems proceed in development and deployment. For systems approved in the same processing round, we believe the prospect of splitting spectrum under the default sharing mechanism provides significant incentive for both parties to share the necessary technical information to conclude an agreement that ensures beneficial and stable access to spectrum. For systems approved in different processing rounds, the prospect of a later-round system operating on a non-interference basis after submitting a compatibility showing, which can be made using publicly available information, also may provide an incentive to the earlier-round operator to share additional technical information to ensure its ongoing operations are in fact protected. Beyond these

incentives, we expect that certain essential NGSO operating parameters and other information that is typically publicly available, such as the maximum number of satellites that can provide service simultaneously at the same location (Nco), exclusion angle to the GSO arc, minimum earth station elevation angle, and location of gateway earth stations, will not be withheld during good-faith coordination. We also recognize that satellite selection information, revealing which satellites will be transmitting in a given situation, can be especially important to efficient spectrum sharing between larger and smaller constellations to ensure the smaller constellation is not unnecessarily restricted. When evaluating whether an NGSO FSS operator has acted in good faith in refusing to provide information in coordination, we will consider the relative benefit of the information to the other party, which may increase if the other party is already operational, as well as the relative competitive or other risks to providing the information. However, coordination discussions typically do not begin only once the two systems are operational. With respect to sharing of real-time beam information, we note the practical difficulties raised in the record for advanced systems with dynamically repointable beams which, in addition to competitive concerns, may not be overcome by use of a third-party clearinghouse or industry-run database because introducing a third-party database between the operator that has changed its beam pointing plans in real time could only further delay the time until other operators receive the updated beam pointing data, adjust their own operations to reflect these changes, and then further de-conflict any interference issues that may arise from the other operators having adjusted their operations which must also be circulated via the third-party database. However, we will monitor the progress of NGSO FSS systems as they proceed in coordination and deployment and may revisit this issue in the future if ongoing coordination difficulties among operational systems suggest that more information sharing requirements are required. We note that the potential benefits for spectrum efficiency of dynamic beam

pointing would appear to require some level of information sharing in order to be realized by more than one system so that other operators are not required to protect links that could be used, but are not used at a given time. When earlier round systems do not share certain non-public information, later round systems may have to make assumptions regarding the operations of earlier round systems in order to plan operations and submit a compatibility showing.

25. Beyond a general good-faith coordination requirement, and any related information sharing requirements, OneWeb argues the Commission should adopt a definition of "good faith" that mandates, inter alia, "that both parties to the coordination agree to utilize all inherent flexibility and capabilities in the operation of their respective systems to avoid interference between the two systems." We believe good-faith coordination places obligations on both parties to promote spectral efficiency. OneWeb's proposed definition, however, could disincentivize investments in more advanced, spectrally efficient systems by requiring all those efficiencies to be used to accommodate systems that have been built with more limited sharing capabilities. We decline to require such a sharing outcome in all cases and therefore do not adopt the proposed definition. As noted above, we intend to monitor compliance with the foregoing requirements and will address the need for further steps in light of our experience.

F. Sunsetting of Inter-Round Protection Requirement

26. In conjunction with the proposal in the NPRM to require later-round NGSO FSS systems to protect earlier-round systems absent a coordination agreement, the Commission also inquired as to whether this inter-round protection requirement should sunset after a period of time, and what protection should apply to an NGSO FSS system after any sunsetting. We sought specific comment on how any sunset provision may affect investment in NGSO FSS systems and ongoing operations of earlier-round systems as well as competition and new market entry.

27. Commenters suggest a variety of sunset periods. Several oppose any sunsetting. Some commenters also encourage a further notice of proposed rulemaking on this issue. Proponents of sunsetting argue that it would encourage innovation and new entry, promote coordination by time limiting the advantages of incumbency, and is consistent with the iterative and dynamic approach of NGSO FSS operators upgrading and modifying their own systems. Opponents argue that any sunsetting provision would jeopardize quality and continuity of service by operational earlier-round systems, incentivize coordination delays by later-round systems until after an earlier round system's priority expires, and discourage investment by introducing regulatory uncertainty.

28. The proposed sunset periods are: 6 years after the application cut-off date in a processing round; 6 years after grant of the earlier-round system; at the 6-year, 50% deployment milestone of an earlier-round system if the milestone is not met, otherwise at the 9-year, full deployment milestone; less than 10 years after grant of the earlier-round system; less than the 15-year license term of the earlier-round system; at the expiration of the 15-year license term of the earlier-round system; 10 or 12 years after grant of the first application in a subsequent processing round; or 15 years commencing from release of this Order for the current Ku-/Ka-band processing rounds, and 15 years from the first authorization or market access grant in a subsequent processing round for future processing rounds. Commenters propose that after the sunset period has run, both earlier- and later-round systems would share spectrum on an equal basis under the spectrum-splitting procedure in section 25.261.

29. After review of the record and consideration of furthering development and competition in NGSO FSS systems, we adopt a sunset provision of 10 years after the first grant in a subsequent processing round. As the Commission has repeatedly stated, the purpose of the recent NGSO FSS processing rounds has been to establish a stable sharing

environment among authorized systems. But earlier-round advantages should not continue indefinitely.

30. We believe that the protection afforded to an earlier-round system by a later-round system should work in concert with our deployment milestones for NGSO systems to relieve earlier-round grantees of the uncertainty of near-term, equal sharing with new entrants while also giving later-round systems an equal opportunity after they have demonstrated their commitment to provide service and completed their final deployment milestone. To accomplish these goals, the sunset date should be tied to the date of authorization of systems in a subsequent processing round, and define the period during which they will be required to protect any earlier-round systems. With each new processing round, therefore, incumbents will be ensured of a period of time during which they will be protected by systems approved in that processing round, and may plan to accommodate those systems as they proceed through deployment, before the time that they will be required to share spectrum on an equal basis in the absence of a coordination agreement. Fixing a sunset date dependent on the authorization date of the earlier-round system could mean that after the sunset date, any approved later-round system would automatically be afforded equal spectrum sharing with existing, earlier-round systems, without the same lead time that would enable earlier-round systems to assess their likely sharing requirements with the systems that will actually proceed to deployment, and adjust accordingly. In addition, fixing a single date to sunset the protection between systems in two processing rounds simplifies the sharing expectations for all operators in both rounds. By fixing the sunset date at 10 years after the first grant in a subsequent processing round, many later-round systems will be near, or have already passed, their 9-year full deployment milestone depending on their grant date. Thus, later-round systems will be afforded equal spectrum sharing opportunities under the spectrum-splitting procedure once their full service constellations are operational, while earlier-round

systems will have had time to adjust to the constellations ultimately deployed by later-round grantees. We believe this period appropriately balances the need for stability for incumbent operations and the possibility for new entrants to compete on an equal footing once they have built out their systems.

31. The length of this sunset period also addresses several concerns on the record. First, we do not expect the sunset period to introduce significant coordination delays because the period is long enough that a later-round grantee would not wish to operate for years, including at near its full constellation size, without an agreement with earlier-round grantees. Second, the iterative nature of NGSO FSS systems, and relatively shorter lifetime of NGSO satellites when compared to GSO satellites, undermines arguments that sunsetting would jeopardize existing services. Rather than maintaining a fixed system design, our experience has been that NGSO FSS operators have proposed to modify and expand their NGSO FSS systems. As earlier-round grantees propose to expand and update their constellations, including through participation in subsequent processing rounds, any burden imposed by sunsetting their inter-round protection rights should be offset by benefits to the later-generations of their systems. Sunsetting also will not upset existing expectations of interference protection because, under Commission policy in effect prior to this Order, later-round applicants were considered on a case-by-case basis as to whether they will be entitled to share spectrum on an equal basis with earlier-round systems – as such there was never a guarantee that earlier-round grantees would be entitled to protection from all later-round systems. Nor do we believe that sunsetting will discourage overall investment in NGSO FSS systems or hamper efforts to promote broadband in underserved areas – on the contrary, we expect that increased competition facilitated by sunsetting inter-round protections will spur investment and development of new systems while providing appropriate returns for earlier-round systems initial constellations. Finally, the iterative development of NGSO FSS systems and evolving

spectrum sharing requirements counsels in particular in favor of a sunsetting provision in this instance, as compared to other instances where the Commission has preferred to maintain incumbent protections indefinitely. As noted, many earlier-round grantees have proposed updated, second-generation systems filed in a later processing round that will enhance the services these grantees intend to provide. Therefore, incumbents themselves will benefit from sunsetting for their second-generation systems. The nature of NGSO FSS systems, which must be designed to endure changing environmental effects, also renders them more capable of sharing spectrum than other system designs. After sunsetting, incumbents will be subject to co-equal spectrum sharing with the new entrants; but they will have had a significant period of time during which to reach a coordination agreement through good faith discussions that improves both operators' spectrum usage possibilities. Given the dynamic nature of NGSO FSS systems and the benefits of competition and new entry, we conclude that a 10-year sunset period beginning on the date of the first grant in a subsequent processing round appropriately balances the interests involved.

G. Application of Rule Changes

32. The NPRM invited comment on whether to apply all, or some, of the rule changes adopted in this proceeding to existing grantees and pending applicants or only to new license applications, license modification applications, application amendments, and market access petitions filed after the new rules go into effect.

33. Most commenters on this issue support the general applicability of rule changes in this proceeding to existing grantees and applicants as well as future applicants. Some argue that applying certain rule changes to already approved systems would be onerous, as it may require reconsideration of the design and operation of the systems.

34. We will apply all rule changes adopted in this final rule to current NGSO FSS licensees and market access grantees, pending applicants and petitioners, as well as future

applicants and petitioners. 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. 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 NGSO FSS licensees and market access grantees, none of the actions we take here (that is, limiting the default spectrum-splitting procedure to NGSO FSS systems approved in the same processing round (subject to a sunset), requiring later-round systems to coordinate with or protect earlier-round systems, and requiring all NGSO FSS grantees to coordinate with each other in good faith), 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. While some commenters claim that some of the rule changes here, such as the sunsetting of interference protections, upset their expectations, NGSO FSS grants have been conditioned upon the outcome of future rulemakings and thus licensees and grantees have been on notice that the regulatory environment in which they are operate was subject to change. Moreover, even under the rules in effect prior to this Order, first round systems were not guaranteed protection from later round systems; rather, this issue was to be considered on a "case-by-case" basis. Accordingly, applying these rule changes to existing licenses and grants of market access will not upset any grantee's reasonable expectations. Further, we have crafted the sunset provision to provide incumbent NGSO FSS grantees sufficient time to evaluate and adapt to the eventual, equal sharing environment with systems ultimately deployed in each subsequent processing round. Not applying the sunset provision to existing grantees, while applying the other rule changes to them, would substantially frustrate the purpose

of sunsetting by locking in incumbent protections that are not assured under the current, case-by-case regime. Sunsetting the inter-round protection requirement, and allowing later-round systems an opportunity to share spectrum on an equal basis with earlier-round systems after the sunset period, removes a barrier to entry and therefore promotes competition and will favor technological innovation among earlier-round systems that facilitates their sharing with new entrants. Whereas exempting first-round systems from sunsetting, which includes some large constellations, would destroy these benefits for all new entrants in second and later processing rounds for as long as the first-round systems remain active.

H. Digital Equity and Inclusion

35. The Commission, as part of its continuing effort to advance digital equity for all, including people of color, persons with disabilities, persons who live in rural or Tribal areas, and others who are or have been historically underserved, marginalized, or adversely affected by persistent poverty or inequality, invited comment on any equity-related considerations and benefits (if any) that may be associated with the proposals and issues discussed in the NPRM.

36. Commenters support the Commission's ongoing efforts to bridge the digital divide and highlight the role of satellite services in providing broadband access to underserved communities. They support technology inclusive policies that ensure regulatory certainty and spectrum access for satellite operators. We believe that the rule amendments in this Report and Order will encourage a more stable and competitive environment for the development of NGSO FSS systems well suited to reaching underserved areas with new broadband capacity, and therefore that this rulemaking will enhance digital equity and inclusion.

I. Other Issues Raised in Comments

37. Some commenters also suggest the Commission pursue broader rule changes regarding NGSO FSS systems to tackle a variety of issues, including addressing orbital debris concerns, verifying NGSO compliance with equivalent power-flux density limits for the protection of GSO networks, revisiting the spectrum-splitting procedure in section 25.261, updated in 2017, or the NGSO milestone requirements, revised in 2015 and 2017, or taking up other suggestions not treated in the NPRM. Other commenters caution against expanding the scope of the current proceeding. Given the complexity and diversity of issues raised and their differing procedural statuses, some reiterating arguments in petitions for reconsideration or petitions for rulemaking, we decline to create an "omnibus" NGSO rulemaking at this time and instead move immediately in a Further Notice of Proposed Rulemaking to propose to finalize the remaining key issue raised in the NPRM.

IV. Final Regulatory Flexibility Analysis

38. As required by the Regulatory Flexibility Act of 1980 (RFA), as amended, an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Revising Spectrum Sharing Rules for Non- Geostationary Orbit, Fixed-Satellite Service Systems, Notice of Proposed Rulemaking (NPRM) in December 2021 in this proceeding. The Commission sought written public comment on the proposals in the NPRM, including comment on the IRFA. No comments were filed addressing the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.

A. Need for, and Objectives of, the Final Rule

39. In recent years, the Commission has received an unprecedented number of applications for non-geostationary satellite orbit (NGSO) space station licenses, including for NGSO fixed-satellite service (FSS) systems. Traveling closer to the Earth than a traditional GSO satellite, low- and medium-orbit NGSO FSS satellite constellations are capable of providing broadband services to industry, enterprise, and residential customers

with lower latency and wider coverage than was previously available via satellite. This final rule continues to facilitate the deployment of NGSO FSS systems capable of providing broadband and other services on a global basis, and will promote competition among NGSO FSS system proponents, including the market entry of new competitors.

40. The Order amends the Commission's rules governing the treatment of NGSO FSS systems filed in different processing rounds. In particular, the Order adopts rules specifying that the Commission's existing spectrum sharing mechanism for NGSO FSS systems will be limited to those systems approved in the same processing round. The Order also adopts a rule providing that later-round NGSO FSS systems will have to protect earlier-round systems by using a degraded throughput methodology. In addition, the Order adopts a sunset provision after which earlier-round grantees and later-round grantees will share spectrum on an equal basis under the existing spectrum sharing mechanism for NGSO FSS systems.

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

41. There were no comments filed that specifically addressed the proposed rules and policies presented in the IRFA.

C. Legal Basis

42. The proposed action is authorized under 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.

D. Response to Comments by the Chief Counsel for Advocacy of the Small Business

43. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed

statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

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

44. 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 rules adopted herein. The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act. 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 Small Business Administration (SBA). Below, we describe and estimate the number of small entities that may be affected by the adoption of the final rules.

45. *Satellite Telecommunications.* This industry comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications." Satellite telecommunications service providers include satellite and earth station operators. The SBA small business size standard for this industry classifies a business with $38 million or less in annual receipts as small. U.S. Census Bureau data for 2017 show that 275 firms in this industry operated for the entire year. Of this number, 242 firms had revenue of less than $25 million. Additionally, based on Commission data in the 2021 Universal Service Monitoring Report, as of December 31, 2020, there were 71 providers that reported they were engaged in the provision of satellite

telecommunications services. Of these providers, the Commission estimates that approximately 48 providers have 1,500 or fewer employees. Consequently using the SBA's small business size standard, a little more than half of these providers can be considered small entities.

46. *All Other Telecommunications.* The "All Other Telecommunications" category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry. The SBA has developed a small business size standard for "All Other Telecommunications," which consists of all such firms with annual receipts of $35 million or less. For this category, U.S. Census Bureau data for 2012 show that there were 1,442 firms that operated for the entire year. Of those firms, a total of 1,400 had annual receipts of less than $25 million and 15 firms had annual receipts of $25 million to $49, 999,999. Thus, the Commission estimates that the majority of "All Other Telecommunications" firms potentially affected by our action can be considered small.

F. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

47. The final rule amends rules that are applicable to space station operators requesting a license or authorization from the Commission, or entities requesting that the Commission grant a request for U.S. market access. Specifically, the final rule adopts changes to the spectrum sharing requirements among NGSO FSS satellite systems and

requires space station licensees and market access grantees that were authorized through a later processing round to submit a technical demonstration that they will not cause harmful interference to space station licensees and market access grantees that were authorized through an earlier processing round, prior to the sunsetting period, if the later-round grantees have not certified that they have reached a coordination agreement with the earlier-round grantees. The technical demonstration of compatibility between the later-round system and the earlier-round system is based on a degraded throughput methodology that consists of three steps. The first step is to establish a baseline of performance. To do this, an operator models the earlier-round NGSO system's performance without any additional interference by computing the earlier-round NGSO system's probabilistic carrier-to-noise (C/N) level using its published system parameters and a rain-attenuation model. This provides the baseline: (1) the earlier-round system's time-weighted average throughput (derived by computing the spectral efficiency from the C/N results), and (2) the earlier-round system's link unavailability time percentage (i.e., the percentage of time when the earlier-round system's expected C/N will fall below its minimum usable level). The second step is to repeat the analysis above, adding in the effect of the later-round system's interference into the earlier-round system. This produces a second measurement of time-weighted average throughput and link unavailability time-percentage. The third step is to compare these two sets of figures to measure the effect of any additional interference. If the resulting performance impact exceeds the permissible limits, then the later-round system must adjust its operations to mitigate interference to a permissible level.

48. Because of the costs involved in developing and deploying an NGSO FSS satellite constellation, we anticipate that few NGSO FSS operators affected by this rulemaking would qualify under the definition of "small entity."

G. Steps Taken to Minimize the Significant Economic Impact on Small Entities

49. The RFA requires an agency to describe any significant alternatives that it has considered in developing its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."

50. The final rule adopts a requirement for NGSO FSS systems authorized through a later processing round to either complete a coordination agreement with, or submit a technical demonstration using a degraded throughput methodology that they will not interfere with, NGSO FSS systems authorized through an earlier processing round. The Commission adopted this requirement to ensure that earlier-round NGSO FSS systems will continue to have their services protected as new entrants deploy their systems. The Commission selected a degraded throughput methodology as the basis for the technical demonstration because it offers the most promising technical path for protection of earlier-round systems without unduly burdening the operations of later-round systems. The Commission also considered use of an interference-to-noise ratio (I/N) as a protection criteria for earlier-round systems, or use of a modified band-splitting approach in which earlier-round systems and later-round systems would have to operate in different spectrum bands, with the earlier-round system entitled to more spectrum than the later-round system, in the event that an interference threshold is surpassed. The Commission did not adopt an I/N protection criteria because it may unduly burden the operations of later-round systems, and did not adopt a modified band-splitting approach because the Commission preferred a technically grounded inter-round sharing solution. While a technical demonstration using a degraded throughput methodology might be more

burdensome to produce than a demonstration using an I/N level, the record demonstrated the feasibility of degraded throughput analyses and their superior ability to model contemporary NGSO FSS systems and more precisely account for the likelihood of harmful interference.

51. As noted above, because of the high costs typically involved in the development of NGSO FSS constellations, we anticipate that few small entities will be required to submit such technical demonstrations. However, for small entities seeking to operate NGSO FSS systems, adoption of a sunset provision combined with use of a degraded throughput methodology will provide operators incentive to innovate and to coordinate with other systems, which will increase spectral efficiency and permit entities to implement newer socially-valuable technologies.

H. Report to Congress

52. The Commission will send a copy of theReport and Order, including the FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act. In addition, the Commission will send a copy of the Report and Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Second Report and Order and FRFA (or summaries thereof) will also be published in the *Federal Register*.

V. Ordering Clauses

53. IT IS ORDERED, pursuant to Sections 4(i), 7(a), 10, 303, 308(b), and 316 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 157(a), 160, 303, 308(b), 316, that theReport 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 below.

54. IT IS FURTHER ORDERED that the Report and Order SHALL BE effective 30 days after publication in the *Federal Register*, except § 25.261(d) which contains new or modified information collection requirements and will be submitted for approval by the

Office of Management and Budget under the Paperwork Reduction Act and shall become effective after the Commission publishes a notice in the *Federal Register* announcing such approval and the relevant effective date.

55. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center will send a copy of the Report and Order to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with Section 603(a) of the Regulatory Flexibility Act, 5 U.S.C. 601 et seq.

56. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of the 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).

List of Subjects in 47 CFR Part 25

Administrative practice and procedure, Satellites.

Federal Communications Commission.

Marlene Dortch,

Secretary.

Final Rules

For the reasons discussed in the preamble, 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. Effective **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER], a**mend § 25.151 by revising paragraphs (a)(10) through (12) and adding paragraph (a)(13) to read as follows:

§ 25.151 Public notice.

(a) * * *

(10) The receipt of space station application information filed pursuant to § 25.110(b)(3)(iii);

(11) The receipt of notifications of non-routine transmission filed pursuant to § 25.140(d);

(12) The receipt of EPFD input data files from an NGSO FSS licensee or market access recipient, submitted pursuant to § 25.111(b) or § 25.146(c)(2); and

(13) The receipt of NGSO FSS compatibility showings filed pursuant to § 25.261(d).

* * * * *

3. Effective **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER], a**mend § 25.261 by revising paragraph (b) and the first sentence in paragraph (c)(1), adding reserved paragraph (d), and adding paragraph (e) to read as follows:

§ 25.261 Sharing among NGSO FSS space stations.

* * * * *

(b) *Coordination.* NGSO FSS licensees and market access recipients must coordinate in good faith the use of commonly authorized frequencies regardless of their processing round status.

(c) * * *

(1) Each of n (number of) satellite networks involved that were licensed or granted market access through the same processing round, except as provided in

paragraph (e) of this section, must select 1/n of the assigned spectrum available in each of these frequency bands. * * *

* * * * *

(d) [Reserved]

(e) *Sunsetting.* Ten years after the first authorization or grant of market access in a processing round, the systems approved in that processing round will no longer be required to protect earlier-rounds systems, and instead will be required to share spectrum with earlier-round systems under paragraph (c) of this section.

4. Delayed indefinitely, further amend § 25.261 by adding paragraph (d) and revising paragraph (e) to read as follows:

§ 25.261 Sharing among NGSO FSS space stations.

* * * * *

(d) *Protection of earlier-round systems.* 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. If an earlier-round system becomes operational after a later-round system has commenced operations, the later-round licensee or market access recipient must submit a certification of coordination or a compatibility showing with respect to the earlier-round system no later than 60 days after the earlier-round system commences operations as notified pursuant to § 25.121(b) or otherwise.

(1) Compatibility showings will be placed on public notice pursuant to § 25.151(a)(13).

(2) 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.

(e) *Sunsetting.* Ten years after the first authorization or grant of market access in a processing round, the systems approved in that processing round will no longer be required to protect earlier-rounds systems under paragraph (d) of this section, and instead will be required to share spectrum with earlier-round systems under paragraph (c) of this section.

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