October 29, 2026

**FCC FACT SHEET**[*]

**Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service, et al.**

Third Report and Order – IB Docket Nos. 17-95 and 18-315

**Background:** In this Third Report and Order, the Federal Communications Commission (Commission) would adopt measures to facilitate the deployment of Earth Stations in Motion (ESIM) operations through the efficient allocation of spectrum resources. In particular, the Third Report and Order would eliminate the restriction on non-geostationary orbit (NGSO) ESIM use of the 28.35-28.4 GHz band, thereby allowing NGSO ESIM operations across the entirety of the 28.35-28.6 GHz band, like geostationary (GSO) ESIM operations. Such concrete measures to facilitate efficient spectrum use by the growing NGSO ESIM industry would further U.S. leadership and expansion in the growing space economy by providing ubiquitous connectivity to ships, planes, drones, blimps, cars, and other critical on-the-go devices.

**What the Third Report and Order Would Do:**

- Change NG527A(iii) of the U.S. Table of Frequency Allocations in 47 CFR § 2.106 to permit NGSO ESIM operations in the 28.35-28.4 GHz band.
- Affirm that the Commission will continue to permit NGSO fixed-satellite service ESIM applications for operations in the 28.4-28.6 GHz band, reflecting the history of successful NGSO ESIM operations in this band.
- Ensure parity among GSO and NGSO ESIM operators.
- Provide greater regulatory certainty and spectrum availability for future NGSO ESIM operations.
- Promote deployment of mobile broadband services to reach remote and rural locations on land, as well as provide ubiquitous connectivity in the air and at sea.
- Decline to adopt additional out-of-band emission limits on NGSO ESIM operations or consider aggregate interference, including clutter, in this band for NGSO ESIM operations.

[*] This document is being released as part of a "permit-but-disclose" proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in IB Docket Nos. 17-95 and 18-315, which may be accessed via the Electronic Comment Filing System (https://www.fcc.gov/ecfs/). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. *See* 47 CFR § 1.200 *et seq*.

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

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| In the Matter of | ) | |
| | ) | |
| Amendments of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations Frequency Bands Allocated to the Fixed Satellite Service | ) | IB Docket No. 17-95 |
| | ) | |
| Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations | ) | IB Docket No. 18-315 |

**THIRD REPORT AND ORDER***

**Adopted: []** **Released: []**

By the Commission:

## I. INTRODUCTION

1. Earth Station in Motion (ESIM) operations continue to grow as satellite networks scale and operators expand availability of on-the-move services to consumers.[1] Such growth is also increasing demand for spectrum use by ESIMs. In this *Third Report and Order* (*Report and Order*), the Commission further facilitates the deployment of ESIMs by more efficiently allocating critical spectrum resources. Specifically, we permit non-geostationary orbit (NGSO) ESIM use of the 28.35-28.4 GHz band in order to allow NGSO ESIM operations across the entirety of the 28.35-28.6 GHz band. Doing so will facilitate the deployment of mobile broadband services to reach remote and rural locations on land, as well as provide ubiquitous connectivity in the air and at sea. Further, we decline to adopt any additional out-of-band emission (OOBE) limits on NGSO ESIM operations in this band beyond what already exists

* This document has been circulated for tentative consideration by the Commission at its November 19, 2026 open meeting. The issues referenced in this document and the Commission's ultimate resolution of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public's ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The FCC's *ex parte* rules apply and presentations are subject to "permit-but-disclose" *ex parte* rules. *See, e.g.*, 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. *See* 47 CFR §§ 1.1200(a), 1.1203.

[1] The term "ESIMs" is the collective designation for three types of earth stations that the Commission authorizes to transmit while in motion: Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs). *See generally* 25 CFR § 103 (Definitions). These earth stations communicate with space stations using frequencies allocated to the fixed satellite service (FSS). Broadly stated, ESVs refer to earth stations that communicate with a satellite while located on maritime vessels such as boats, cargo ships or cruise ships, whereas VMESs and ESAAs refer to earth stations that communicate with satellites while located on land-based vehicles or aircraft, respectively. *Id.*

in part 25 of our rules since these provisions sufficiently protect adjacent band Upper Microwave Flexible Use Service (UMFUS) operations.[2]

## II. BACKGROUND

2. In 2018, the Commission adopted rules governing communications for ESIMs with geostationary orbit (GSO) satellites.[3] The Commission also sought comment on allowing ESIMs to operate in all frequency bands in which fixed earth stations operating in GSO fixed-satellite service (FSS) networks are eligible for blanket-licensing.[4] Later that year, the Commission adopted a *Notice of Proposed Rulemaking* that sought comment on expanding the Commission's ESIM rules to cover communications with NGSO FSS satellites.[5] In 2020, the Commission adopted a *Report and Order* and *Further Notice of Proposed Rulemaking*, which deferred final decision on whether to allow NGSO ESIM operations in the 28.35-28.4 GHz band, but permitted NGSO ESIM operations in the 28.4-28.6 GHz band conditional on the outcome of this proceeding.[6] The Commission created a guard band in the 28.35-28.4 GHz—which excluded NGSO ESIM operations—pending final action in the proceeding, to ensure protection of terrestrial wireless operations in the adjacent band below 28.35 GHz. As part of the Further Notice, the Commission sought comment on allowing NGSO ESIM operations in the entire 28.35-28.6 GHz band in the future and what, if any, OOBE limitations should be adopted to protect UMFUS operations in adjacent bands from harmful interference.[7] The Space Bureau issued a Public Notice on December 10, 2025 to refresh the record on the *Further Notice*.[8]

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[2] On July 22, 2026, the Commission adopted the *Space Modernization for the 21st Century* Report and Order and Further Notice of Proposed Rulemaking. *Space Modernization for the 21st Century Report and Order*, SB Docket No. 25-306, Report and Order (rel. Jul. 23, 2026). The *Space Modernization Report and Order* established a new part 100 regime that replaced the existing part 25 framework. The new rules establishing part 100 are not yet in effect. The actions taken in this *Report and Order* will be implemented in the new part 100 rules when the part 100 rules become effective.

[3] *See Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, Report and Order and Further Notice of Proposed Rulemaking, 33 FCC Rcd 9327 (2018) (*GSO ESIMs Report & Order* or, when referring solely to the Further Notice of Proposed Rulemaking, *GSO ESIMs FNPRM*).

[4] *See GSO ESIMs FNPRM*, 33 FCC Rcd at 9354-55, para. 91.

[5] *See Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, Notice of Proposed Rulemaking, IB Docket No. 18-315, 33 FCC Rcd 11416 (2018) (*NGSO ESIM NPRM*).

[6] *See Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, Second Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 5137, 5147-5148 (May 14, 2020) (*2020 ESIMs R&O and FNPRM*).

[7] *Id.* Comments were filed by Kuiper Systems LLC (now "Amazon Leo"), the Satellite Industry Association (SIA), Verizon/U.S. Cellular, and Viasat, Inc. This decision will use the name "Amazon Leo" to reference the former "Kuiper" and its filings. Reply comments were filed by the original commenters as well as Kepler Communications and Global Mobile Suppliers Association (GSA). *Ex parte* notices have been filed in the docket by SIA (Oct. 19, 2020, May 7, 2025), Amazon Leo (Dec. 11, 2020, April 25 and 30, 2024), SES (March 24 and 31, and April 7, 2021), Verizon/U.S. Cellular (April 19, 2021), and Verizon (Nov. 3, 2023, Aug. 12, 2024).

[8] *Space Bureau Seeks to Refresh the Record on Proposed Rules to Permit the Use of Additional Frequency Bands for NGSO Satellites to Communicate with Earth Stations in Motion,* IB Docket Nos. 17-95 and 18-315, Public Notice, DA 25-1045 (2025) (*Public Notice*). *See also* Federal Communications Commission, 90 Fed. Reg. 59783 (December 22, 2025) (announcing the comment period ending on January 21, 2026, and the reply comment period ending on February 5, 2026). Five refresh comments and four refresh reply comments were filed in response.

## III. DISCUSSION

3. *NGSO FSS ESIM Operations in the 28.4-28.6 GHz Band.* To begin, we reaffirm the decision to permit NGSO ESIM operations in the 28.4-28.6 GHz band.[9] The record supports adoption of these measures.[10] After fully considering the rulemaking record, we are persuaded that commenters' interference concerns are speculative and NGSO ESIM operations are unlikely to interfere with UMFUS operations in the 27.5-28.35 GHz band.[11]

4. *NGSO FSS ESIM Operations in the 28.35-28.4 GHz Band.* Upon review of the expanded record in this proceeding,[12] we now change Footnote NG527A(iii) of the U.S. Table of Frequency Allocations in 47 CFR § 2.106 to permit NGSO ESIM operations in the 28.35-28.4 GHz band.[13] Taking this step will help ensure efficient use of this spectrum by operators without creating a risk of harmful interference to adjacent UMFUS operations.[14] As a result, NGSO FSS ESIM operations will be allowed to operate seamlessly across the entire 28.35-28.6 GHz band. Doing so will also ensure parity among GSO and NGSO ESIM operators and provide greater regulatory certainty for future operations.[15] As the Commission has previously recognized, parity and regulatory certainty will: (1) facilitate the spread of accessible, broadband mobility services; (2) promote global spectrum harmonization; (3) allow customers to take advantage of seamless connectivity; (4) increase investment in NGSO FSS capacity that can serve remote and rural areas and provide restoration if terrestrial networks are damaged due to natural disasters; and (5) ensure that antenna manufacturers are able to bring their antennas to the market quickly, enabling a faster return on their investment—making the United States a desirable market in which to introduce innovative new equipment.[16] These public interest benefits strongly support this action.

5. This change to Footnote NG527A(iii) is also based upon our finding that NGSO ESIM operations are unlikely to create harmful interference to UMFUS operations in the adjacent 27.5-28.35 GHz band. Specifically, we are unpersuaded by arguments that NGSO ESIMs inherently create a higher risk of interference than longstanding, existing NGSO fixed terminals and GSO fixed terminals/ESIM

[9] *2020 ESIMs R&O and FNPRM*, 35 FCC Rcd at 5159 para. 30.

[10] *See* SIA Refresh Comments at 3-4; SIA Comments at 2, SIA Reply at 2; Letter from Tom Stroup, President, Satellite Industry Association, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 at 4-5 (filed May 7, 2025) (SIA 2025 *Ex Parte* Letter); Amazon Leo Refresh Comments at 1-2; Amazon Leo Refresh Reply at 2-3; Amazon Leo Comments at 1; Amazon Leo Reply at 1-2; Letter from Catherine Kuersten, Senior Corporate Counsel, Amazon Leo Systems LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., at 1 (filed Apr. 24, 2024) (Amazon Leo 2024 *Ex Parte*); Viasat Comments at 1-2; Reply at 2-6; Kepler Reply at 1; Letters from Suzanne Malloy, Vice President Regulatory Affairs, O3b Limited, IB Docket No. 18-315 et al., at 2-3 (filed Mar. 23, Mar. 30, and Apr. 6, 2021) (SES *Ex Partes*).

[11] *See, e.g.,* Amazon Leo Refresh Comments at 2.

[12] *2020 ESIMs R&O and FNPRM*, 35 FCC Rcd at 5159 para 62 (explaining that an *ex parte* raised concerns regarding potential interference from out-of-band emissions of ESIMs in the 28.35-28.6 GHz band into the adjacent 27.5-28.35 GHz band used by UMFUS, meriting "further discussion and expansion of the record" regarding this issue).

[13] *See* 47 CFR § 2.106.

[14] *See e.g.* SIA Refresh Comments at 3-4; SIA Comments at 2; SIA Reply at 2; SIA 2025 *Ex Parte* at 4-5; Amazon Leo Refresh Comments at 1-2; Amazon Leo Refresh Reply at 2-3; Amazon Leo Comments at 1; Amazon Leo Reply at 1-2; Amazon Leo 2024 *Ex Parte* at 1; Viasat Comments at 1-2; Kepler Reply at 1; SES *Ex Parte* at 2-3.

[15] *2020 NGSO ESIMs FNPRM* at para. 27 ("As a general matter, we conclude that the public interest is served by adopting a regulatory framework for communications of ESIMs with NGSO FSS satellites that is analogous to that which exists for ESIMs communication with GSO FSS satellites and offers a similar streamlined path to deployment.").

[16] *NGSO ESIMs Order* at para 27.

operations in the 50 MHz band. First, we disagree that NGSO ESIMs pose a higher interference risk due to their double variable geometry of motion—*i.e.*, due to continuous movement of NGSO satellites communicating with moving ESIM terminals.[17] Indeed, the "double" movement characteristic of NGSO ESIM operations results in any potential interference being not only more transient in nature, but with a shorter duration compared to potential interference from current NGSO fixed terminals or GSO fixed terminals/ESIM operations. As SIA notes, "while both GSO and NGSO ESIMs antennas adjust pointing continuously to compensate for a moving platform (change in position, aircraft pitch and roll, etc.), NGSO ESIMs also reorient their beams to follow the movement of the NGSO satellite, ensuring that any potential interference would be even more transient."[18]

6. Second, we are unconvinced that NGSO ESIM elevation angles to satellites have the potential to be lower such that they can cause in-line events of interference.[19] Generally, NGSO ESIM operations require higher minimum elevation angles as there typically are multiple satellites visible in the sky and the "best link," with higher elevation angle/lower attenuation, is chosen.[20] This provides ample off-axis power discrimination in the direction of terrestrial-based UMFUS receivers.[21]

7. Third, in addition to their more transient links and higher elevation angles, NGSO ESIM terminals typically operate at lower power levels than GSO terminals already operating in the band—due to reduced path-loss with NGSO satellites orbiting at much lower altitudes than GSO satellites.[22] As a result, given these three considerations, there does not appear to be any greater chance of interference to adjacent band services than there is for already authorized GSO and NGSO FSS services in the band.[23]

8. In its most recent filing, CTIA notes that NGSO ESIMs now use adaptive array antennas, which it claims increase their interference potential when compared against traditional parabolic antennas.[24] However, GSO ESIMs, which already are authorized to operate in the 28.35-28.4 GHz band, also use adaptive array antennas, especially for aeronautical applications.[25] Further, CTIA argues that

[17] *See* CTIA Refresh Comments at 2-4; CTIA Comments at 3; Verizon Refresh Comments at 1-2; Verizon/US Cellular Comments at 1; Verizon/US Cellular Reply at 1-2; Letter from Daudeline Meme, Vice President & Associate General Counsel, Verizon, and Grant B. Spellmeyer, Vice President, U.S. Cellular, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., at 1 (filed Apr. 16, 2021) (Verizon/US Cellular Apr. 16 *Ex Parte*); Letter from Daudeline Meme, Vice President & Associate General Counsel, Verizon, and Grant B. Spellmeyer, Vice President, U.S. Cellular, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., at 1 (filed Apr. 19, 2021) (Verizon/US Cellular Apr. 19 *Ex Parte*); Letter from Daudeline Meme, Vice President & Associate General Counsel, Verizon, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., at 1-2 (filed Nov. 2, 2023) (Verizon Nov. 2 *Ex Parte*), Letter from Daudeline Meme, Vice President & Associate General Counsel, Verizon, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., at 1-2 (filed Aug. 12, 2024) (Verizon 2024 *Ex Parte*); GSA Reply at 1-2.

[18] *See* Letter from Tom Stroup, SIA, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-315 et al., Attachment B (filed June 23, 2026) (SIA June 2026 *Ex Parte* Letter).

[19] *See* Verizon Refresh Comments at 5-6; Verizon Reply at 3-6; CTIA Refresh Reply at 2-4.

[20] SIA June 2026 *Ex Parte* Letter at Attachment B; *see e.g.* Amazon Refresh Comments at 3-4, Refresh Reply Comments at 6-7; SIA Refresh Comments at 2-3; SpaceX Refresh Reply at 2-3.

[21] *See* Amazon Leo Comments at 4-5.

[22] *See* Amazon Leo Reply Technical Annex at 2.

[23] *See* Amazon Leo Refresh Comments at 3; Amazon Leo Refresh Reply at 6; SIA 2025 *Ex Parte* at 4; Amazon Leo 2024 *Ex Parte* at 2; Viasat Comments at 5, Exhibit A at 2-3 (GSO and NGSO fixed as well as GSO ESIM operations are already permitted in the band).

[24] CTIA Refresh Reply at 3-4.

[25] *See* SIA June 2026 *Ex Parte* Letter at Attachment B.

NGSO ESIMs could be operated in close proximity to UMFUS receivers.[26] Once again, however, there is nothing to distinguish NGSO ESIMs from already-operating GSO ESIMs. No evidence suggests that NGSO transmitters would be any closer to UMFUS receivers than GSO transmitters.

9. A number of technical studies have been submitted in the record.[27] The data and analysis submitted by Viasat and Amazon Leo support the conclusion that NGSO ESIMs would not cause harmful interference into the 27.5-28.35 GHz band. The Global Mobile Suppliers Association (GSA) provided a study reaching the opposite conclusion.[28] Of these studies, we find the Amazon Leo technical study to be most persuasive.[29] Amazon Leo's technical study used a Monte Carlo simulation of OOBE interference from NGSO ESIM operations in the 28.35-28.6 GHz band to UMFUS users operating in the 27.5-28.35 GHz band.[30] The study considered a variety of factors, including: "(i) the movement of the ESIM, NGSO satellites, and randomly-distributed UMFUS users positioned throughout a coverage area of seven UMFUS base stations, each with three sectors; (ii) base station and ESIM loading factors; and (iii) the variation of propagation fading due to clutter with an environment-appropriate representation of line-of-sight probability in conformance with 3GPP standardization."[31] Amazon Leo's technical annex demonstrates that UMFUS and NGSO ESIM systems operate in "different, non-aligning azimuth and elevation angles the vast majority of the time" and even the unlikely instances of coterminous operations will be short lived.[32] There is the additional possibility that the NGSO ESIM will not even be transmitting—or that the ESIM will not be receiving—at the exact moment the in-line event occurs.[33] NGSO ESIMs often operate in remote areas and transmit in high elevations, as opposed to UMFUS base stations' preferred pencil beam low-elevation angles.[34] The study concluded that the current regulatory limits set forth in section 25.202(f) are "more than sufficient" to protect UMFUS receivers in the adjacent band.[35]

10. CTIA offers several critiques of the Amazon Leo study, arguing that while Amazon considers several variables, it failed to: (1) disclose an adaptive array OOBE mask, (2) provide full side/back-lobe characterization versus scan angle, or (3) conduct parameter sweeps on UMFUS side-lobe/clutter assumptions.[36] CTIA also notes that the Amazon study reports time-averaged metrics without evaluating instantaneous exceedances and overload probabilities.[37] GSA's study concludes that more

[26] *See* CTIA Refresh Reply at 4.

[27] *See* Amazon Leo Reply Technical Annex; GSA Reply Technical Annex; Viasat Comments Technical Annex.

[28] GSA Reply Technical Annex at 9.

[29] *See* Amazon Leo Reply Technical Annex. *See also* Viasat Comments Technical Annex at 13. Viasat's study used a Monte Carlo simulation to evaluate the impact of an NGSO L-ESIM station employing a modern satellite modem while operating near a network of UMFUS stations. GSA asserts that Viasat's analysis assumes conservative and non-applicable system characteristics, including transmit power and corresponding OOBE levels significantly lower than the maximum permitted under existing rules, an unrealistic 0.6% duty cycle for NGSO ESIMs. *See* GSA Reply Technical Annex at 3-6. Given the sufficiency of the Amazon Leo study, which has not been similarly challenged, we do not address the validity of Viasat's study or these claims.

[30] Amazon Leo Refresh Comments at n.1.

[31] Amazon Leo 2020 *Ex Parte* at 2-3.

[32] Amazon Leo Reply Technical Annex at 3.

[33] *Id.*

[34] Amazon Leo Refresh Comments at 3.

[35] Amazon Leo Reply Technical Annex at 10.

[36] CTIA Refresh Comments at 5.

[37] *Id.*

stringent ESIM OOBE limits are required to protect UMFUS systems, such as the limit of -13 dBm/MHz that applies to UMFUS operations in the 27.5-28.35 GHz band.[38] GSA asserts that existing section 25.202(f) OOBE limits do not provide sufficient OOBE protection to UMFUS systems, UMFUS receivers are not capable of mitigating in-band interference from ESIMs, and that technical analysis shows that OOBE into the 27.5-28.35 GHz band should be limited to -13 dBm/MHz to limit harmful interference to UMFUS licensees.[39]

11. These critiques and the GSA study are unpersuasive. Because ESIMs communicating with NGSO satellite systems employ the same or similar hardware as ESIMs operating with GSO systems—and do so at lower power levels—requiring additional technical information is unwarranted. The Commission has previously concluded that the existing OOBE limits in section 25.202(f) sufficiently protect UMFUS operations in adjacent bands from fixed earth stations communicating with NGSO and GSO FSS satellites, as well as from ubiquitously deployed ESIMs communicating with GSO FSS satellites in the 28.35-28.4 GHz band.

12. Conversely, the Amazon Leo study used a Monte Carlo simulation based on a large multi-dimensional sample size, supporting the broad applicability of the test to a wider range of relevant real-world scenarios than the GSA study's "worst case" scenario that Verizon and U.S. Cellular propose the Commission refer to instead.[40] We disagree with Verizon that GSA's "worst case scenario" technical appendix provides a better portrayal of the challenges potentially faced by UMFUS operators operating in adjacent bands[41] and instead agree with commenters that the GSA study relies on a variety of factors that are not likely to manifest outside of the referenced hypotheticals.[42] In that regard, we note that GSA, CTIA, and Verizon do not offer studies based on parameters of actual UMFUS deployments (including point-to-point links).

13. In summary, we disagree with CTIA that eliminating the 50-megahertz guard band would "needlessly increase the potential for interference" by NGSO ESIMs.[43] The record provides no technical information to infer a greater risk of interference from NGSO ESIMs than current NGSO fixed terminals or GSO fixed terminals/ESIMs currently operating in this band. Additionally, retaining the current guard band would continue to unnecessarily constrain spectrum usage. Commenters note that the demand for ESIM expansion is greatly increasing.[44] Preserving the guard band would condemn the band to continued inefficiency in opposition to the Commission's goal of providing plentiful and efficiently used spectrum to the American public.

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[38] GSA Reply Technical Annex at 9; *ESIMS NGSO 2020 FNPRM* at para. 63.

[39] GSA Reply Technical Annex at 6-9.

[40] Amazon Leo 2020 *Ex Parte* at 2 ("The Commission routinely relies on probabilistic analyses when addressing spectrum-sharing concerns. *See, e.g.,* Unlicensed Use of the 6 GHz Band et al., Report et al., 35 FCC Rcd 3852 ¶¶ 135, 230 (2020) (stating that (i) spectrum-sharing analysis between fixed microwave and unlicensed services should 'take a statistical approach such as in Monte Carlo simulations so as to probabilistically account for many intertwined phenomena' and (ii) resulting spectrum-sharing rules weighed not only the probabilistic technical analysis but also the economic costs if harmful interference occurs and substantial economic benefits of making new spectrum available").

[41] *See* Verizon Reply at 6; Verizon/US Cellular Apr. 19 *Ex Parte* at 6.

[42] *See, e.g.,* Amazon Leo 2020 *Ex Parte* at 2 (explaining that the GSA study "failed to document how often the worst-case alignment would occur or how long the worst-case alignment would persist, nor did the study quantify the effect of the worst case alignment on UMFUS users").

[43] CTIA Refresh Reply at 1.

[44] *See* Amazon Leo Refresh Comments at 2.

14. *Minimum Elevation Angle for NGSO FSS ESIM Operations.* Additionally, we decline to adopt minimum elevation angles for ESIM operations in the band.[45] NGSO ESIMs largely transmit into high elevation, line of sight links to satellites to avoid ground clutter,[46] while UMFUS users in the adjacent 27.5-28.35 GHz band typically operate point-to-point beams at lower elevation angles.[47] Moreover, NGSO operators already provide technical details in their applications regarding how their systems will comply with equivalent power flux density (EPFD) requirements, including a minimum operation elevation angle of 25 degrees or greater to comply with required separation from ITU RR Art. 22 EPFD limits.[48] Lastly, no commenter suggested specific minimum elevation angles in the record. Accordingly, there is no need to adopt a minimum elevation angle for ESIM operations.[49]

15. *OOBE Limits for NGSO FSS ESIM Operations in the 27.5-28.35 GHz Band.* We also determine that the existing OOBE limits in section 25.202(f) are sufficient to protect UMFUS operations in the 27.5-28.35 GHz band.[50] This question was previously addressed regarding all other types of FSS stations, and there is no support in the record for the claim that NGSO ESIMs would behave differently.[51] Accordingly, we decline to require NGSO ESIM operators to meet the OOBE limit applied to UMFUS licensees.

16. Some commenters argue that the Commission should require NGSO ESIM OOBE limits in the 27.5-28.35 GHz adjacent band to comply with the -13 dBm/MHz OOBE limit for UMFUS licensees or that there is need for a more fulsome technical record before deciding on appropriate OOBE limits.[52] However, the Commission already addressed these concerns as it relates to other FSS services in the 28.35-28.6 GHz band and declined to establish different OOBE limits.[53] There is no significant technical difference for the purposes of OOBE limits between the NGSO fixed terminals, GSO fixed

[45] *See 2020 ESIMs R&O and FNPRM*, 35 FCC Rcd at 5159 para 60 (seeking comment on whether "setting a minimum elevation angle for ESIM operations with NGSO FSS space stations would be an effective way of achieving the desired balance between protecting UMFUS operations without over constraining FSS operations above 28.35 GHz" or, alternatively, "when transmitting to a NGSO FSS space station, should we limit the ESIM out-of-band EIRP density towards the horizon or within a certain range of elevation angles?").

[46] Amazon Leo Refresh Comment at 3.

[47] *Id.*

[48] ITU RR Art. 22; *see also* Viasat Comments at 3.

[49] Verizon/US Cellular noted that they see little value in specifying minimum elevation angles, while other commenters noted that NGSO ESIM must meet the minimum 25-degree angle to satisfy existing equivalent power flux density (EPFD) limits in the 27.5-28.6 GHz band regardless of any additional minimum requirements. *See* Verizon/US Cellular Comments at footnote 30; Viasat Comments Exhibit A at 3. Similarly, SIA proposed that the higher minimum elevation angles used frequently by NGSO ESIMs will likely provide "ample off-axis power discrimination in the direction of terrestrial-based UMFUS receivers." SIA Refresh Comments at 2.

[50] *See 2020 ESIMs FNPRM*, 35 FCC Rcd at 5159, para 62 (asking "whether the current out-of-band emission limits in section 25.202(f) would be sufficient to protect UMFUS operations in the 27.5-28.35 GHz band" and asking "for comments on what level of interference generated by out-of-band emissions from ESIM operations with NGSO space stations above 28.35 GHz would be acceptable for UMFUS receivers operating immediately below 28.35 GHz, while at the same time not unduly constraining ESIM operations above 28.35 GHz").

[51] *See* Amazon Leo Refresh Comments at 4-5; Amazon Refresh Reply Comments at 6, 7; Amazon Leo Comments at 1-2, 8-9; Amazon Leo Reply Comments at 1-2; Amazon Leo 2020 *Ex Parte* at 2; Amazon Leo 2024 *Ex Parte* at 1, 3; SIA Refresh Comments at 2-3; SIA Comments at 2-4; SIA Reply Comments at 2-3, 5-6; SIA 2025 *Ex Parte* at 4; Viasat Comments at 2-4; Viasat Reply Comments at 1-2; Kepler Reply Comments at 1-2; SES *Ex Partes* at 3.

[52] *See* Verizon Refresh Comments at 3-4; Refresh Reply Comments at 1-3, 10-12; Verizon/US Cellular Comments at 5, 10-11; *see also* CTIA Comments at 3, 4-5, 8.

[53] 33 FCC Rcd 9327 (2018) at para. 62; SIA Refresh Comments at 2.

terminals, and GSO ESIMs that currently follow part 25.202(f) of our rules and NGSO ESIMs other than NGSO ESIMs will be reorienting more frequently than the other services do. Both NGSO ESIMs and NGSO fixed stations usually employ similar antenna designs. NGSO ESIM transmitters will generally operate at or below the power output of other FSS operations, including GSO ESIMs, which are already authorized on an unrestricted geographic and numerical basis in the band.[54] And, as some commenters have noted, there have been no reported cases of harmful interference caused by these operations which are required to only meet the limit in section 25.202(f) of our rules.[55]

17. Accordingly, if these other services have been able to operate up to the edge of the adjacent 27.5-28.35 GHz band without the need for more stringent OOBE limits, there is no reason—nor does the record convince us—that there is a need for a differentiation to be made only for NGSO ESIM operations in this case.

18. *Aggregation of Interference Clutter Reflections.* We decline to adopt consideration of aggregate interference in this band for NGSO ESIM operations.[56] Other FSS operations in this band are not subject to this restriction, and since there is a dearth of evidence in the record indicating any difference between existing FSS operations (including other NGSO operations and GSO ESIMs) and NGSO ESIM operations, we decline to establish different criteria for NGSO ESIMs.

19. Verizon/US Cellular argues that we should consider clutter reflections among other specific factors when assessing interference risk between NGSO ESIM and UMFUS.[57] We decline to do so. Currently, we do not do this for other FSS operations in the 28.35-28.6 GHz band, and there is no reason to think it is necessary to do so for NGSO ESIMs based on the record before us.[58] Further, as Viasat points out, NGSO ESIMs will operate using the same multi-frequency, time division multiple access technology used by existing FSS operations in the band.[59] Because the technology used is the same as what is currently authorized for existing operations and because we see no reason to differentiate between NGSO ESIMs and other FSS services in the 28.35-28.6 GHz band, we are not persuaded to adopt our proposal or the clutter reflections proposed by Verizon/US Cellular.

20. *SpaceX Request to Broaden Scope.* In addition to the topics addressed in this *Report and Order*, SpaceX requests that the Commission also look to the Ku- and Ka- bands for additional ESIM spectrum use alongside our decision to open the 28.35-28.4 GHz guard band for NGSO ESIM operations.[60] This issue extends beyond the limited scope of the current proceeding.[61] Therefore we decline to consider this proposal as part of this proceeding.

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[54] *See* Amazon Leo Reply Technical Annex at 2.

[55] *See* Space X Refresh Reply at 2-4; SIA Refresh Comments at 3. Others caution against reading too much into the absence of complaints. *See* CTIA Refresh Reply at 5-6 (absence of interference complaints demonstrates that the guard band is achieving its purpose, and this type of interference may be hard to identify and attribute to its source, especially when the source is mobile); Verizon Refresh Reply at 3-6 (no proof that risk of interference is low or short-lived). We find these admonitions unpersuasive.

[56] *See 2020 ESIMs FNPRM*, 35 FCC Rcd at 5159, para 67 (seeking comment on whether "aggregation of interference, including that from clutter reflections, should be considered").

[57] Verizon Comments at 12.

[58] *See, e.g.*, Amazon Leo Comments at 9 ("NGSO ESIMs operations in fact, present less interference potential than GSO ESIMs and should be treated in a similar if not more permissive manner…. Including a guard band, a minimum elevation angle, or aggregate interference limits").

[59] Viasat Comments at 3.

[60] *See* SpaceX Refresh Comments at 1-3 (arguing that the Commission should not limit its consideration to allowing ESIMs to the Ka-band, but should consider other bands, including Ku-band spectrum, for NGSO ESIM use).

## IV. PROCEDURAL MATTERS

21. *Regulatory Flexibility Act.* The Regulatory Flexibility Act of 1980, as amended (RFA),[62] 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."[63] Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of rule and policy changes adopted in this Order on small entities. The FRFA is set forth in Appendix B.

22. *Paperwork Reduction Act Analysis.* This document does not contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198.[64]

23. The Office of Information and Regulatory Affairs, Office of Management and Budget, concurs, that this rule is "major" under the Congressional Review Act.[65] The Commission will send a copy of this Report and Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. § 801(a)(1)(A).

24. *Persons 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 and Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (tty).

25. For additional information on this proceeding, contact Gregory Coutros, Space Bureau, Earth Station Licensing Division, at gregory.coutros@fcc.gov or at (202) 418-2351.

## V. ORDERING CLAUSES

26. IT IS ORDERED, pursuant to Sections 4(i), 7(a), 301, 303, 307, 309, 310, 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 301, 303, 307, 309, 310, 332, that this Report and Order IS ADOPTED, the policies, rules, and requirements discussed herein ARE ADOPTED.[66]

27. IT IS FURTHER ORDERED that parts 2 and 100 of the Commission's rules ARE AMENDED as set forth in Appendix A and such rule amendments will become effective 60 days after publication in the Federal Register.

28. IT IS FURTHER ORDERED that the Office of the Secretary, SHALL SEND a copy of this Report and Order, including the Final Initial Regulatory Flexibility Analyses, to the Chief Counsel

(Continued from previous page)

[61] Some commenters have expressed concerns about SpaceX's request. *See generally* SES *Ex Partes*; *see also* CTIA Refresh Reply at 2 (opposing any expansion of the spectrum under consideration as outside the scope of this proceeding).

[62] 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).

[63] 5 U.S.C. § 605(b).

[64] *See* 44 U.S.C. § 3506(c)(4).

[65] 5 U.S.C. § 804(2).

[66] Pursuant to Executive Order 14215, 90 Fed. Reg. 10447 (Feb. 24, 2025), this regulatory action has been determined to be significant under Executive Order 12866, 58 Fed. Reg. 51735 (Oct. 4, 1993).

for Advocacy of the Small Business Administration, in accordance with Section 603(a) of the Regulatory Flexibility Act.[67]

29. IT IS FURTHER ORDERED that the 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.[68]

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

[67] *See* 5 U.S.C. § 603(a).

[68] *See* 5 U.S.C. § 801(a)(1)(A).

## APPENDIX A

## Final Rules

For the reasons stated in the preamble, the Federal Communications Commission amends 47 CFR parts 2 and 100 as follows:

### PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for part 2 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Amend § 2.106 by revising paragraph(d)(527) to read as follows:

* * * * *

(d) * * *

(527) NG527A Earth Stations in Motion (ESIMs), as regulated under part 25 of this chapter, are an application of the fixed-satellite service (FSS) and the following provisions shall apply:

(i) In the bands 10.7-11.7 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites, subject to the conditions that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service and that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(ii) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites on a primary basis.

(iii) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.5-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with non-geostationary satellites, subject to the condition that non-geostationary-satellite systems may not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(iv) In the band 17.8-18.3 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites on a secondary basis, subject to the condition that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(v) In the bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary and non-geostationary satellites, subject to the condition that geostationary-satellite networks may not cause unacceptable interference to, or claim protection from, non-geostationary satellite systems in the fixed-satellite service.

(vi) In the band 17.3-17.8 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary satellites and non-geostationary satellites on an unprotected basis.

* * * * *

### PART 100 – SPACE AND EARTH STATION SERVICES

3. The authority citation for part 100 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.

4. Amend § 100.275 by revising paragraph (n) to read as follows:

**§ 100.275 Earth station coordination requirements.**

* * * * *

(n) As it relates to NGSO FSS earth stations individual and Nationwide, Non-Site license or blanket license applications may be filed for operation in the 10.7-12.7 GHz, 12.7-13.25 GHz, 14-14.5 GHz, 17.3-17.7 GHz, 17.7-17.8 GHz, 17.8-18.6 GHz, 18.8-19.4 GHz, 19.6-20.2 GHz, 28.35-29.1 GHz, or 29.5-30.0 GHz bands; blanket licensing in the 10.7-11.7 GHz, 17.7-17.8 GHz, 17.8-18.3 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz bands is on an unprotected basis with respect to current and future systems operating in the fixed service. Individual license and Nationwide, Non-Site license applications only may be filed for operation in the 13.75-14 GHz or 27.5-28.35 GHz bands. Individual license applications only may be filed for gateway or feeder link operations in the 12.7-13.25 GHz band.

* * *

## APPENDIX B

## Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] the Federal Communications Commission (Commission) incorporated an Initial Regulatory Flexibility Analysis (IRFA) in the *Expediting Initial Processing of Satellite and Earth Station Applications* Report and Order and Further Notice of Proposed Rulemaking (Further Notice) released in September 2023.[2] The 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 and it (or summaries thereof) will be published in the Federal Register.[3]

### A. Need for, and Objectives of, the Rules

2. In the *Third Report and Order*, the Commission adopts rules permitting non-geostationary orbit (NGSO) Earth Stations in Motion (ESIM) use of the 28.35-28.4 GHz band to allow such operations to operate across the entirety of the 28.4-28.6 GHz band. In doing so, the Commission furthers its primary objective of meeting the increasing demand for spectrum used by ESIMs by allocating usable spectrum for efficient use by NGSO operators, while maintaining and ensuring compatible operations with existing nearby operators. Moreover, the rules we adopt in the *Third Report and Order* will foster and improve the deployment of mobile broadband services to reach remote and rural locations on land and provide ubiquitous connectivity in the air and at sea. In addition, we revise these rules to create regulatory equity between geostationary orbit (GSO) and NGSO Fixed Satellite Service (FSS) systems and to adequately address the growing deployment of ESIMs by decreasing regulatory burdens on NGSO ESIM communications. Lastly, the *Third Report and Order* also declines to adopt additional out-of-band emission (OOBE) limits on NGSO ESIM operations in this band beyond what already exists in part 25 of our rules[4] as the existing provisions already provide sufficient protection of Upper Microwave Flexible Use Service (UMFUS) operations in adjacent bands.

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

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

[1] 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).

[2] *See Expediting Initial Processing of Satellite and Earth Station Applications*; *Space Innovation*, IB Docket Nos. 22-411 and 22-271, Report and Order and Further Notice of Proposed Rulemaking, 38 FCC Rcd 8838 (2023) (*Further Notice*).

[3] 5 U.S.C. § 604.

[4] 47 CFR § 25.208(c). On July 22, 2026, the Commission adopted the *Space Modernization for the 21st Century* Report and Order and Further Notice of Proposed Rulemaking. *Space Modernization for the 21st Century Report and Order*, SB Docket No. 25-306, Report and Order (rel. Jul. 23, 2026). The *Space Modernization Report and Order* established a new part 100 regime that replaced the existing part 25 framework. The new rules establishing part 100 are not yet in effect. The actions taken in this *Report and Order* will be implemented in the new part 100 rules when the part 100 rules become effective.

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

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA,[5] the Commission is required to respond to any comments filed by the Chief Counsel for the Small Business Administration (SBA) Office of Advocacy, and also provide a detailed statement of any change made to the proposed rules as a result of those comments.[6] The Chief Counsel did not file any comments in response to the proposed rules or policies in this proceeding.

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

7. 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.[7] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[8] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[9] 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.[10] 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.[11]

8. 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.[12] In general, a small business is an independent business having fewer than 500 employees.[13] These types of small businesses represent 99.9% of all businesses in the United States, which translates to 34.75 million businesses.[14] Next, "small organizations" are not-for-profit enterprises that are independently owned and operated and are not dominant in their field.[15] 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

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

[6] 5 U.S.C. § 604(a)(3).

[7] 5 U.S.C. § 604.

[8] *Id*. § 601(6).

[9] *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."

[10] 15 U.S.C. § 632.

[11] 13 CFR 121.903.

[12] 5 U.S.C. § 601(3)-(6).

[13] *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.

[14] *Id*.

[15] 5 U.S.C. § 601(4).

employees.[16] Finally, "small governmental jurisdictions" are defined as cities, counties, towns, townships, villages, school districts, or special districts with populations of less than fifty thousand.[17] 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.[18]

9. The rules adopted in the *Third Report and Order* will apply to small entities in the industries identified in the chart below by their six-digit North American Industry Classification System (NAICS)[19] codes and corresponding SBA size standard.[20] Where available, we also provide additional information regarding the number of potentially affected entities in the identified industries below.

**TABLE 1. 2022 U.S. CENSUS BUREAU DATA BY NAICS CODE**

| **Regulated Industry (Footnotes specify potentially affected entities within a regulated industry where applicable)** | **NAICS Code** | **SBA Size Standard** | **Total Firms[21]** | **Total Small Firms[22]** | **% Small Firms** |
|---|---|---|---|---|---|
| Wireless Telecommunications Carriers (except Satellite)[23] | 517112 | 1,500 employees | 1,184 | 1,081 | 91.30% |

[16] *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/.

[17] 5 U.S.C. § 601(5).

[18] *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.

[19] 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.

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

[21] *U.S. Census Bureau*, "*Selected Sectors: Employment 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 EC2200SIZEEMPFIRM, 2025, "*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.

[22] *Id.*

[23] Affected Entities in this industry include 1.4 GHz Band Licensees, 1670–1675 MHz Services, 2.3 GHz Wireless Communications Services, 218-219 MHz Service, 220 MHz Radio Service – Phase I and Phase II, 3650-3700 MHz Band, 39 GHz Service, 600 MHz Band, 700 MHz Guard Band Licensees, Advanced Wireless Services - AWS Services, Aeronautical en route Services, Aeronautical Fixed Radio Services, Air-Ground Radiotelephone Services, Aviation and Marine Radio Services, Broadband Personal Communications Service, Broadband Radio Service and Educational Broadband Service, Carrier RespOrgs, Cellular Radiotelephone Service, Experimental Radio Service (Other Than Broadcast), Fixed Microwave Services, Future 24 GHz Licensees, Government Transfer Bands, Incumbent 24 GHz Licensees, Local Multipoint Distribution Service (LMDS), Location and Monitoring Service (LMS), Low Power Auxiliary Station (LPAS) Licensees, Lower 700 MHz Band Licenses, Marine Radio Services, Multichannel Video Distribution and Data Service (MVDDS), Multiple Address Systems, Narrowband Personal Communications Services, Offshore Radiotelephone Service, Paging Services, Personal Radio Services, Private Land Mobile Radio - 900 MHz Band, Private Land Mobile Radio Licensees (PLMR), Public Safety Radio Licensees, Rural Radiotelephone Service, Specialized Mobile Radio Licenses, Upper 700 MHz Band Licenses, Wireless Broadband Internet Access Service Providers, Wireless Carriers and Service Providers, Wireless Communications Services, Wireless Telephony.

| Regulated Industry (Footnotes specify potentially affected entities within a regulated industry where applicable) | NAICS Code | SBA Size Standard | Total Firms[21] | Total Small Firms[22] | % Small Firms |
|---|---|---|---|---|---|
| Satellite Telecommunications[24] | 517410 | $44 million | 332 | 195 | 58.73% |
| All Other Telecommunications[25] | 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

10. 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.[26]

11. In the *Third Report and Order*, the Commission amends rules applicable to NGSO ESIM operators that permits NGSO ESIMs to use the 28.35-28.4 GHz band, thereby making the entire 28.35-28.6 GHz band available for NGSO ESIM use. The *Third Report and Order* amends rules affecting parts 2 and 100 of title 47 of the Code of Federal Regulations, specifically amending NG527A to permit NGSO ESIM use of the 28.35-28.4 band and section 100.275(n) to allow individual or blanket license applications to be filed for operation in the 28.35-28.4 GHz band.

12. The Commission expects that all filing, recordkeeping, and reporting requirements associated with the adopted rules will be the same for small and other entities and that due to the limited nature of the rule changes made and the rule reductions we adopt, we do not believe small entities will have to hire additional professionals to comply with the *Third Report and Order*. We note that the comments in the existing record do not indicate concerns by small entities regarding the cost of compliance with the adopted rules. Moreover, in reaching our conclusions in the *Third Report and Order*, we considered the potential concerns of small entities and note that any costs are necessary to effectuate the purpose of the Communications Act, namely, the efficient use of spectrum resources. While small and large entities must equally comply with the adopted rules, we have taken steps beyond those discussed above to help alleviate potential compliance burdens on small entities. For example, we utilize existing systems and processes that small businesses should be familiar with and make changes that require the minimum information necessary to achieve the above stated goals. By adopting such an approach, we take into account the concerns of small entities while meeting critical Commission objectives.

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

13. 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

[24] Affected Entities in this industry include Fixed Satellite Small Transmit/Receive Earth Stations, Fixed Satellite Very Small Aperture Terminal (VSAT) Systems, Mobile Satellite Earth Stations.

[25] Affected Entities in this industry include Earth Stations (except Satellite Telecommunications Carriers), Internet Service Providers (Non-Broadband), Non-Carrier RespOrgs, Non Licensee Owners of Towers and Other Infrastructure, Online Access Service Providers, Radar Station Operations, Satellite Telemetry Operations, Satellite Tracking Stations, Telecommunications Relay Service (TRS) Providers, Telemetry and Tracking System Operations and VoIP Service Providers (via Client-Supplied Telecommunications Connections).

[26] 5 U.S.C. § 604(a)(5).

other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.[27]

14. As discussed above, in the *Third Report and Order*, the Commission amends rules for NGSO ESIM operators that permit them to use the 28.35-28.4 GHz band. The Commission does not believe that its adopted rule changes will have a significant impact on small entities, however, in reaching our conclusions we have taken steps to minimize potential significant economic impact on small entities and considered alternative possibilities. For example, we adopt a change to NG527A(iii) of the U.S. Table of Allocations to permit NGSO ESIM operations in the 28.35-28.4 GHz band, thereby removing a guard band that excluded NGSO ESIM operations. This change will help ensure efficient use of this spectrum by operators without creating a risk of harmful interference to adjacent UMFUS operations, thereby providing additional regulatory certainty and spectrum for NGSO ESIM operators. While we considered concerns raised about potential interference should the guard band be eliminated, we determined that there does not appear to be any greater chance of interference to adjacent band services than there is for already authorized GSO and NGSO FSS services in the band. In addition, while we considered comments in favor of it, we decline to adopt any additional OOBE limits on NGSO FSS ESIM operations in the 27.5-28.35 GHz band beyond what already exists in part 25 of our rules, as we conclude these existing provisions sufficiently protect adjacent band UMFUS operations.

### G. Report to Congress

15. The Commission will send a copy of the *Third Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[28] In addition, the Commission will send a copy of the *Third Report and Order*, including this FRFA, to the Chief Counsel for the SBA Office of Advocacy and will publish a copy of the *Third Report and Order*, and this FRFA (or summaries thereof) in the Federal Register.[29]

[27] 5 U.S.C. § 604(a)(6).

[28] 5 U.S.C. § 801(a)(1)(A).

[29] *Id.* § 604(b).

## APPENDIX C

### List of Commenters

**Commenters**
Amazon Leo Satellite Industry Association
Verizon & US Cellular
Viasat, Inc.

**Reply Commenters**
CTIA
Global Mobile Suppliers Association (GSA)
Kepler Communications
Amazon Leo
Satellite Industry Association (SIA)
Verizon & US Cellular
Viasat, Inc.

**Refresh Commenters**
CTIA
Amazon Leo
Satellite Industry Association (SIA)
Space Exploration Holdings, LLC
Verizon

**Refresh Reply Commenters**
CTIA
Amazon Leo
Space Exploration Holdings, LLC
Verizon

# APPENDIX D

## Regulatory Impact Analysis

### A. Need for Regulatory Action

1. The Report and Order (R&O) would permit non-geostationary orbit (NGSO) Earth Station in Motion (ESIM) use in the 28.35-28.4 GHz band, thereby allowing NGSO ESIM operations across the entirety of the 28.35-28.6 GHz band. Doing so would facilitate the deployment of ubiquitous mobile broadband services that would primarily benefit remote locations and the aviation and maritime sectors.

2. This regulatory impact analysis is submitted to the Office of Information and Regulatory Affairs (OIRA) for interagency review. Consistent with Executive Order 12866, this analysis presents an assessment of the costs and benefits, including regulatory compliance costs, associated with the proposals in this notice. We conclude that the rules being proposed would result in significant benefits and cost savings that outweigh associated costs. We also tentatively conclude that the actions being proposed are deregulatory under Executive Order 14192.

### B. Benefits

3. We find that the rules being adopted would increase economic welfare by allowing ESIMs to make better use of spectrum resources to improve the quality of satellite services. We measure the welfare gain by estimating the increase in producer surplus using information on the revenues of the managed satellite services over FSS bands. The Satellite Industry Association estimates associated U.S. revenues in 2025 are $7.1 billion, with an annual growth rate from 2021 of 18.5% on average.[1] Assuming that growth rate continued into 2026, we estimate U.S. managed satellite services over FSS bands to be $8.4 billion by the end of 2026.[2] Some of the managed services over FSS bands may not pertain to ESIMs.[3] Additionally, we do not have data on the share of ESIM revenues attributable to NGSO services.[4] We therefore make the conservative assumption that 50% of total revenues relate to ESIMs, and that 50% of ESIM revenues pertain to NGSOs services, resulting in 2026 revenues of $2.1 billion. To estimate producer surplus, we net out producer costs using the 2026 first quarter EBITDA percentage of Starlink related revenues, 64.1%.[5] We therefore estimate that ESIM-related producer surplus of $1.35 billion in 2026. We project further years of producer surplus, assuming a constant 18.5% growth rate.

4. To estimate the effect of the new rules, we assume the percentage increase in spectrum available for NGSO ESIM services is proportional to the gain in NGSO ESIM throughput starting the end of 2027. Compared to the total amount of NGSO ESIM spectrum, the 50 megahertz in the 28.35-28.4 GHz band represents a 1.1% increase in spectrum.[6] Based on an April 2024 analyst report estimating

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[1] United States revenues from managed services over FSS bands were $3.6 billion in 2021. The implied growth rate over the four years between 2021 and 2025 is therefore 18.5% = ($7.1 billion / $3.6 billion)$^{1/4}$. Satellite Industry Association Reply, GN Docket No. 26-78, at 17 (rec. June 22, 2026) (SIA Reply, GN Docket No. 26-78).

[2] $8.4 billion = 118.5% × $7.1 billion.

[3] We note however, that this figure already excludes fixed end-user broadband services as well as services provided using MSS bands. SIA Reply, GN Docket No. 26-78, at 17.

[4] We note, however, that by 2023, NGSO available throughput substantially outpaced that of GSO operators and was projected to continue to grow at a faster rate. *See* 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/.

[5] Space Exploration Technologies Corp., SEC Form S-1, at F-94 (filed May 20, 2026).

[6] There are 4,700 megahertz available for primary use by ESIMs, so 1.1% = 50/4,700. *See* 47 CFR § 2.106 (Table of Frequency Allocations) at 386-387.

NGSO and GSO High-Throughput Satellite (HTS) capacity in 2023 and 2028, NGSO and GSO capacity will grow between 2023 and 2028 at compound annual growth rates (CAGR) of 59.1% and 22.2%, respectively, leading to a total HTS CAGR of 56.1%.[7] Using this CAGR together with our assumption that ESIM-related producer surplus will grow at a CAGR of 18.5% into the foreseeable future, we estimate the impact of the additional 1.1% of spectrum under two methods.

5. *Method 1:* First, we assume that analyst projections do not anticipate the capacity increase that we attribute to the rules that we adopt, such that 2027 throughput would be 1.1% more than the initial projections.[8] We then calculate the new CAGR of capacity implied by the new 2030 level of capacity and then use the new CAGR to estimate the increase in the producer surplus of U.S. data services for the years 2026-2030.[9] We treat the present value increase in producer surplus as a public benefit. Total HTS throughput CAGR is 57.4%, compared to the original CAGR of 56.1% for every year from 2026 to 2030, resulting in an additional $187.5 million in net present value at a 3% discount rate or $162.3 million in NPV at a 7% discount rate.[10]

6. *Method 2:* In the alternative, we assume that the industry analysts anticipate some sort of regulatory change to achieve the projected supply increase. In this scenario, we assume that the Report and Order is part of these anticipated regulatory changes, so that a fraction of the increase in annual throughput supply over 2025 to 2027 is attributable to the Report and Order. Based on the 2025 capacity of 60,009 Gbps, this is 660 Gbps (equal to 1.1% of 60,009 Gbps). By comparison, a projection based on analyst reports indicates that total HTS capacity will increase by 94,423 Gbps from 2025 to 2027 (using a CAGR of 56.1%). This implies that 660 Gbps / 94,423 Gbps = 0.7% is due to the Report and Order. We then assume that the Report and Order is responsible for the same fraction (0.7%) of the increase in producer surplus each year between 2026 and 2030 and calculate the present value gain associated with that fraction of the increase in market value: $9.6 million in benefits using a 3% discount rate, or $8.5 million using a 7% discount rate.

7. We note that our estimates of welfare gains are likely conservative because we lack information to estimate gains in consumer surplus, which is also likely to increase because of the

[7] 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:

$$CAGR = \left(\frac{Value_{EndingYear}}{Value_{StartingYear}}\right)^{\frac{1}{EndingYear - StartingYear}} - 1$$

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.

[8] In other words, we assume that, because of the Order, the projected HTS NGSO capacity of 151,938 Gbps in 2027 would expand by 1.1%, yielding 153,609 Gbps. The value of 151,938 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 projections of the GSO HTS 2023 capacity based on the 22.2% CAGR because the Report and Order does not change the rules for GSO operators.

[9] 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 2027 is 60.0%. Using this to estimate new NGSO supply from 2026-2029, implies a CAGR range of 57.4% for total HTS supply.

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

incremental improvements in quality that the adopted rules are expected to facilitate.

### C. Costs

8. The R&O finds that NGSO ESIM operations have even less potential to cause interference to adjacent band Upper Microwave Flexible Use Service (UMFUS) operations than the fixed and ESIM GSO operations because, compared to these other services: (1) NGSO ESIM satellites and earth stations would both be in motion; (2) NGSO ESIM transmission angles would be more vertical; and (3) NGSO ESIM allowed power levels would be lower. We therefore conclude that the current part 25 interference rules applicable to NGSO ESIM operations are sufficient to protect adjacent UMFUS operations and in-band GSO and NGSO fixed operations so that the Report and Order would not result in interference-related costs.

9. We recognize that satellite operators would need to familiarize themselves with the revised rules. We estimate familiarization costs by using needed labor hours worked by engineers and attorneys to make sure that satellite operators understand and comply with the new rules. We estimate that telecommunications aerospace engineers are compensated at a rate of $102.11/hour and telecommunications attorneys are compensated at $157.65/hour.[11] We estimate that 54 satellite operators may be impacted by our rules, and conservatively assume that all 54 will require familiarization with the rules.[12] For familiarization, we assume that reading and understanding the rule changes will take 6 engineer hours of work and 2 lawyer hours of work for each regulatee, implying $50,000 of one-time costs across regulatees in 2026.[13] Because these rules replace existing rules, future entrants 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.

### D. Alternative Policies

10. Alternatively, the Commission could choose to retain the current rules in the 28.35-28.4 GHz band. This would result in no benefits or costs, with no net effect. No alternative allocations were considered for this band during the proceeding.

### E. Justification Determination

11. Given that the present value of additional producer surplus estimated for 2026-2030 falls in the range $8.5 million to $162.3 million using a 7% discount rate ($9.6 million to $187.5 million using a 3% discount rate) (not taking into account any additional consumer surplus) and that one-time costs are estimated to be only $50,000, we find the Report and Order to have substantial net positive benefits relative to the status quo.

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[11] The Bureau of Labor Statistics reports May 2025 hourly mean wages for aerospace engineers and lawyers in the telecommunications industry as $69.94/hour and $107.98/hour, respectively. Bureau of Labor Statistics (BLS), *Occupational Employment and Wage Statistics Query System*, https://data.bls.gov/oes/#/industry/517000 (accessed July 15, 2026). According to the Bureau of Labor Statistics, as of December 2025, civilian wages and salaries averaged $33.72/hour and benefits averaged $15.60/hour. Using these figures, benefits constitute a markup of $15.60/$33.72 ~ 46%. Taking 46% for cost of benefits, we arrive at an hourly compensation of $102.11/hour ($69.94/hour × $146%), and $157.65/hour ($107.98/hour × $146%), for engineers and attorneys, respectively. *See* Press Release, Bureau of Labor Statistics, Employer Costs for Employee Compensation—March 2026 (June 12, 2026), https://www.bls.gov/news.release/pdf/ecec.pdf (*Benefit Markup*).

[12] *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. This estimate is conservative because not all operators will choose to revise their operations to enable usage of the new spectrum.

[13] (6 hours of engineering work × $102.11/hour + 2 hours of legal work × $157.65) × 54 regulatees = $50,111 ~ $50,000.