

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

In the Matter of)	
)	
Space Bureau and Wireless Telecommunications)	GN Docket No. 23-135;
Bureau Seek Comment on Filings of SpaceX and)	ICFS File Nos. SAT-MOD-20230207-00021,
T-Mobile Requesting to Establish Supplemental)	SAT-AMD-20240322-00061
Coverage from Space)	
)	
Application for Authority for Modification of the)	Call Sign: S3069
SpaceX NGSO Satellite System to Add a Direct to)	
Cellular System)	

ORDER

Adopted: March 7, 2025

Released: March 7, 2025

By the Chief, Space Bureau, and the Acting Chief, Wireless Telecommunications Bureau:

I. INTRODUCTION

1. By this Order, the Space Bureau and Wireless Telecommunications Bureau conditionally grant the request of Space Exploration Technologies Corp. (SpaceX) for waiver of section 25.202(k)(1) of the Commission’s rules, thereby permitting aggregate out-of-band emissions (OOBE) in the United States at a power flux density (PFD) level up to -110.6 dBW/m²/MHz.¹ SpaceX asserts that the public interest is supported by allowing a waiver of the established PFD to this level, which “will protect adjacent band networks from harmful interference while ensuring that consumers and first responders can use an increasingly robust set of features even in the most challenging circumstances,” and will avoid placing artificial caps on the number of satellites used to provide supplemental coverage from space for terrestrial networks.² For the reasons discussed below, we find that there is good cause to grant SpaceX’s waiver request, subject to the conditions outlined herein, including requiring that SpaceX address any harmful interference to adjacent band terrestrial wireless networks or else cease operations under the waiver.

II. BACKGROUND

2. In March 2024, the Commission issued the *Single Network Future: Supplemental Coverage from Space* Report and Order and Further Notice of Proposed Rulemaking (SCS R&O), establishing a U.S. framework for supplemental coverage from space (SCS) that enables expanded coverage to a terrestrial licensee’s subscribers through a collaboration with a satellite operator.³ The SCS R&O laid out regulatory parameters and requirements for SCS, including changes to the table of frequency allocations to add a secondary allocation for SCS service in certain bands, applicability of

¹ See Letter from David Goldman, Vice President of Space Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 23-65, 23-135 et. al., (filed June 6, 2024) <https://www.fcc.gov/ecfs/document/10607127696881/1> (*SpaceX Waiver Request*). While SpaceX frames its waiver request to incorporate the concept of permitting aggregate out-of-band emissions up to the -6 dB I/N threshold, this order and waiver grant is focused on the metric incorporated in section 25.202(k)(1), which limits aggregate PFD levels to -120 dBW/m²/MHz.

² *Id.* at 2.

³ *Single Network Future: Supplemental Coverage from Space, Space Innovation*, GN Docket No. 23-65, IB Docket No. 22-271, Report and Order and Further Notice of Proposed Rulemaking, 39 FCC Rcd 2622 (2024) (*SCS R&O*).

existing satellite and terrestrial rules to SCS, and technical rules and other requirements to mitigate potential harmful interference to existing services.⁴ To mitigate the potential for harmful interference to existing terrestrial services, the SCS R&O established in section 25.202(k)(1) a uniform OOB limit for all SCS bands expressed as a terrestrial PFD limit of -120 dBW/m²/MHz measured 1.5 meters above ground level.⁵ In establishing this metric, the Commission considered the various band-specific OOB limits for SCS bands⁶ terrestrial services and the less stringent satellite OOB limits, and concluded that the limit represented a “middle ground between the positions expressed in the record.”⁷

3. On June 6, 2024, SpaceX requested a waiver of section 25.202(k)(1), stating that a higher OOB PFD level would “ensure that American consumers and first responders can enjoy robust supplemental coverage service wherever they are and will protect terrestrial operators from harmful interference.”⁸ The Commission sought public comment on SpaceX’s waiver request, among other SpaceX authorization requests related to SpaceX and T-Mobile’s planned SCS deployment in the PCS G Block.⁹ With a letter dated September 13, 2024, SpaceX supplemented its waiver rationale in response to an information request from the Space Bureau and the Wireless Telecommunications Bureau.¹⁰ SpaceX noted that a waiver would benefit the public interest by enabling faster and more reliable 911 emergency calling connectivity in remote locations.¹¹ SpaceX explained that as it approaches a satellite deployment point of about 1,500 satellites, it will need to take compensatory measures to comply with section 25.202(k)(1), including reducing the number of active beams on a satellite, reducing the power of those beams, or a combination of the two, and estimated that the power suppression methodology could result

⁴ *SCS R&O*, 39 FCC Rcd 2622.

⁵ *Id.* at 2712, para. 205. Specifically, section 25.202(k)(1) states: “Notwithstanding the emission limitations of paragraph (f) of this section, the aggregation of all space station downlink emissions outside a licensee’s SCS frequency band(s) of operation shall not exceed a power flux density of -120 dBW/m²/MHz at 1.5 meters above ground level.”

⁶ The SCS R&O established a secondary SCS allocation in the following terrestrial bands: 600 MHz: 614-652 MHz and 663-698 MHz; 700 MHz: 698-769 MHz, 775 MHz-799 MHz, and 805-806 MHz; 800 MHz: 824-849 MHz and 869-894 MHz; Broadband PCS: 1850-1915 MHz and 1930-1995 MHz; and AWS-H Block: 1915-1920 MHz and 1995-2000 MHz. *SCS R&O*, 39 FCC Rcd at 2634-35, para. 28.

⁷ *Id.* at 2712, para. 205.

⁸ *SpaceX Waiver Request* at 2. SpaceX also filed a Petition for Reconsideration asking the Commission to reconsider the SCS R&O’s adoption of a single, aggregate out-of-band PFD limit of -120 dBW/m²/MHz in section 25.202(k)(1) and instead to adopt band-specific limits. SpaceX Petition for Reconsideration, Single Network Future: Supplemental Coverage from Space, Space Innovation, GN Docket No. 23-65 (filed May 31, 2024) (SpaceX Petition for Reconsideration). We do not resolve SpaceX’s Petition for Reconsideration here.

⁹ See *Satellite Licensing Division and Satellite Programs and Policy Division Information Space Station Applications Accepted for Filing*, Public Notice, Report No. SAT-01836 (SB Jul 12, 2024); *Space Bureau and Wireless Telecommunications Bureau Clarify Filing Procedures for Recent Public Notice*, Public Notice, DA 24-726 (WTB/SB Jul. 26, 2024); *Space Bureau and Wireless Telecommunications Bureau Correct Reply Deadline for Recent Public Notice*, Public Notice, DA 24-819 (WTB/SB Aug. 14, 2024). The PCS G Block constitutes 10 MHz of paired spectrum at 1910-1915 MHz and 1990-1995 MHz.

¹⁰ See Letter from David Goldman, Vice President of Space Policy, SpaceX, to Merissa Velez, Chief, Satellite Programs and Policy Division, Space Bureau, FCC, Space Exploration Holdings LLC, GN Docket No. 23-135 et. al. (rec. Sept. 16, 2024) (*SpaceX Sept. 13, 2024 Supplemental Letter*). Among questions related to other aspects of the SCS application, the Bureaus asked about the measures that SpaceX would need to use to reduce its aggregate PFD levels to the level specified in section 25.202(k)(1). See Letter from Merissa Velez, Chief, Satellite Programs and Policy Division, Space Bureau, Kathryn Medley, Chief, Satellite Licensing Division, Space Bureau, and Roger Noel, Chief, Mobility Division, Wireless Telecommunications Bureau, to Mr. William M. Wiltshire, SpaceX Counsel, GN Docket 23-135 et. al. (SB/WTB Sept. 6, 2024).

¹¹ *SpaceX Sept. 13, 2024 Supplemental Letter* at 1, 4, 6, and 8.

in a 20% network throughput reduction.¹² SpaceX stated that without the waiver, compliance with the rule “would delay deployment of lifesaving emergency voice service” potentially by years, which it argues undermines “the core goal of the SCS Order.”¹³ Finally, SpaceX argued that the blanket OOB limit in section 25.202(k)(1) imposes a significantly greater restriction on higher bands, such as the PCS G Block, in comparison to lower frequency bands that the Commission has authorized for SCS.¹⁴

4. On November 26, 2024, the Space Bureau authorized SpaceX and T-Mobile to deploy SCS with the issuance of an order granting in part and deferring in part, with conditions, SpaceX’s modification application, as amended, to provide SCS within the United States and to operate on certain frequency bands for the purpose of performing direct-to-cell¹⁵ operations outside the United States using its previously authorized 7,500 Gen2 Starlink satellites.¹⁶ The Space Bureau deferred consideration of SpaceX’s request for waiver.¹⁷

5. Several parties submitted filings related to SpaceX’s waiver request. EchoStar contends that because the Commission addressed SpaceX’s arguments against imposing an aggregate PFD limit of -120 dBW/m²/MHz in the SCS R&O and determined that the PFD level selected would provide an appropriate level of protection for terrestrial networks, and SpaceX failed to provide new evidence showing that a higher PFD level would not result in harmful interference, then the Bureau is bound by the Commission’s determination that weakening the aggregate limit would harm adjacent band users.¹⁸ Verizon argues that the waiver request “fails to meet the very standards that it proposes to apply” because “[f]lagship wireless handsets have a noise floor of -108 dBm/MHz (equivalent to -110.8 dBm/m²/MHz isotropic at 2 GHz)” and “[a]ssuming a handset antenna gain of -3 dBi, SpaceX’s proposal still results in an interference to noise (I/N) ratio of -3 dB,” which it argues is insufficient to protect terrestrial

¹² *SpaceX Sept. 13, 2024 Supplemental Letter* at 4, 6.

¹³ *Id.* at 8-9. SpaceX further explained that reducing power by 50% in the PCS G block (in which it intends to deploy SCS) will have major throughput and coverage limitations, particularly for voice communications, “which require a higher SINR and reliability than text-only communications.” *Id.* at 11.

¹⁴ *See id.* at 1, n.1; *see also SpaceX Petition for Reconsideration* (elaborating on SpaceX’s arguments in support of band-specific OOB limits).

¹⁵ SpaceX and other parties often use the term “direct-to-cell” to mean communications directly from satellites to mobile devices such as cellular phones.

¹⁶ *See SpaceX Request for Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System, Application for Authority for Modification of the SpaceX NGSO Satellite System to Add a Direct to Cellular System, Application for Modification of the SpaceX V-band Satellite System, and Space Bureau and Wireless Telecommunications Bureau Seek Comment on Filings of SpaceX and T-Mobile Requesting to Establish Supplemental Coverage from Space*, Order and Authorization, DA 24-1193 (Nov. 26, 2024). The Order and Authorization also granted in part and deferred in part, with conditions, SpaceX’s amended application to construct, deploy, and operate a constellation of second generation non-geostationary orbit fixed-satellite service satellites, known as its Gen2 Starlink constellation, and granted SpaceX’s modification application to operate using V-band frequencies at altitudes ranging from 340 km to 360 km.

¹⁷ *See id.* at 14, para.22.

¹⁸ *See EchoStar Corporation Petition to Deny Amended Waiver Request and Issue Protective Order*, GN Docket 23-135 et. al., at 3 (filed Sept. 10, 2024). *See also* Letter from Pantelis Michalopoulos, Counsel to EchoStar Corporation, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 23-65, 23-135 et. al., at 2 (filed June 26, 2024) (requesting public notice for SpaceX’s amended filings and arguing that grant of SpaceX’s amended waiver would cause harmful interference).

networks.¹⁹ AT&T also opposes the waiver, presenting a network performance analysis developed based on a PCS C Block market area that predicts an 18% reduction in average network throughput.²⁰

6. SpaceX and T-Mobile both filed consolidated responses to waiver opponents.²¹ SpaceX argues that failure to waive the rule would not support the public interest and “would decimate an innovative service that may be a consumer’s only recourse during an emergency.”²² It argues that Verizon’s interference model “would allow a supplemental coverage provider at 700 MHz to meet the -120 dBW/m²/MHz threshold while subjecting adjacent bands to an I/N of -3.7 dB, well in excess of the globally accepted -6 dB I/N threshold for terrestrial networks,” and that this advantages providers at lower frequencies such as Verizon.²³ It also argues that Verizon failed to consider polarization loss in its analysis, as that would contribute an additional 3 dB loss and result in a -6 dB I/N sufficient to protect terrestrial networks from harmful interference.²⁴ SpaceX argues that the aggregate PFD in itself is unduly burdensome, and that no other provider has demonstrated that they could meet the established threshold for a fully deployed constellation while “providing the sort of robust, continuous service on the ground” that was envisioned for SCS.²⁵

7. T-Mobile also responded to opposition commenters.²⁶ T-Mobile argues that SpaceX’s -110.6 dBW/m²/MHz PFD level would protect adjacent band users, and notes that T-Mobile operates in adjacent terrestrial frequency bands, and thus shares an interest in avoiding harmful interference from SpaceX operations.²⁷ It provides a technical defense of the reasonableness of SpaceX’s assumptions in concluding that a PFD level up to -110.6 dBW/m²/MHz would not cause harmful interference.²⁸ T-Mobile also critiques AT&T’s submission, noting that it failed to provide details about the network parameters or details about the market used for the analysis.²⁹ T-Mobile conducted a competing throughput analysis which predicts network throughput degradation rates of .2% to 1.8% with an outdoor use case.³⁰ T-Mobile also defends SpaceX’s 3 dB polarization loss assumptions.³¹ T-Mobile challenges Verizon’s use of -108 dBm/MHz as the user equipment receiver noise floor to be unrealistic and based on an idealized receiver, but argues that the PFD level sought in SpaceX’s waiver is nonetheless reasonable because “SpaceX’s analysis appropriately included a 3 dB polarization loss due to the polarization

¹⁹ See Verizon Opposition to Petition for Waiver, GN Docket No. 23-135 et. al., at 4 (filed Aug. 12, 2024) (*Verizon Opposition to Petition*).

²⁰ See AT&T Petition to Deny, GN Docket 23-135 et. al., at 3-6 (filed Aug. 12, 2024) (*AT&T Petition to Deny*).

²¹ See Consolidated Response to Petitions and Response to Comments of Space Exploration Holdings LLC, GN Docket No. 23-135 et. al. (filed Aug. 22, 2024) (*SpaceX Consolidated Waiver Response*); Response of T-Mobile USA, Inc., GN Docket No. 23-135 et. al. (filed Aug. 22, 2024) (*T-Mobile Consolidated Waiver Response*).

²² *SpaceX Consolidated Waiver Response* at 3.

²³ *Id.* at 4.

²⁴ *SpaceX Consolidated Waiver Response* at 13.

²⁵ *Id.* at 5.

²⁶ See *T-Mobile Consolidated Waiver Response*.

²⁷ *Id.* at 2, 4.

²⁸ *Id.* at 2-5.

²⁹ *Id.* at 5.

³⁰ *Id.* at 6-7.

³¹ *Id.* at 9.

mismatch between SpaceX's satellites in the PCS G Block spectrum, which will be circularly polarized, and terrestrial networks, which are linearly polarized."³²

8. EchoStar and the Rural Wireless Association submitted reply comments, both arguing that SpaceX failed to meet its legal burden under the Commission's waiver standards.³³ Following the filing deadline, EchoStar submitted an additional letter questioning SpaceX's SCS use case.³⁴ Additionally, several European mobile phone network operators submitted a letter arguing that any relaxation of section 25.202(k)(1) could be in violation of Article 4.4 of the ITU Radio Regulations.³⁵

III. DISCUSSION

9. Generally, the Commission may waive any rule for good cause shown.³⁶ Waiver is appropriate only if both (1) special circumstances warrant a deviation from the general rule, and (2) such deviation better serves the public interest.³⁷ In making this determination, we may take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.³⁸

10. Here, SpaceX argues that (1) a one-size-fits-all out-of-band emissions limit imposes a significantly greater restriction on higher bands such as the PCS G Block at issue here,³⁹ (2) allowing an aggregate OOB PFD level of up to -110.6 dBW/m²/MHz will not cause harmful interference to terrestrial networks, and (3) adherence to section 25.202(k)(1) will slow deployment and decrease the benefits of SpaceX's SCS service, "rendering . . . communications unreliable both in critical and in common circumstances, increasing risk in emergency situations."⁴⁰ Several parties, including AT&T and Verizon, oppose the waiver, arguing that it could result in harmful impacts to adjacent band terrestrial users.⁴¹

11. We find good cause to waive the rule, subject to conditions that will protect terrestrial wireless carrier operations. SpaceX has provided engineering analyses in support of its claim that harmful interference in adjacent bands is unlikely.⁴² Further, T-Mobile, an adjacent band terrestrial operator, endorses the waiver and presents its own technical analyses in which it concludes that the waiver poses a low likelihood of harmful interference.⁴³ SCS service is at a nascent stage of development, and we find that strict application of the rule risks hindering the widespread deployment of

³² *T-Mobile Consolidated Waiver Response* at 10-11.

³³ EchoStar Reply Comments, GN Docket No. 23-135 et. al., at 2-3 (filed Aug. 27, 2024); Rural Wireless Association, Inc. Reply Comments, GN Docket No. 23-135 et. al., at 3-4 (filed Aug. 29, 2024).

³⁴ See Letter from Pantelis Michalopoulos, Counsel to EchoStar Corporation, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 23-65 et. al. (filed Sept. 26, 2024).

³⁵ See Letter from Manuel Kohnstahmm, Chief Corporate Affairs Officer, Liberty Global et. al. to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 23-65 et. al. (filed Sept. 30, 2024).

³⁶ 47 CFR § 1.3.

³⁷ *NetworkIP, LLC v. FCC*, 548 F.3d 116, 125-128 (D.C. Cir. 2008) (citing *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990)).

³⁸ *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), cert. denied, 409 U.S. 1027 (1972); *Northeast Cellular*, 897 F.2d at 1166.

³⁹ *Id.* at 1, n.1.

⁴⁰ *Id.* at 1.

⁴¹ See *AT&T Petition to Deny* at 3-6; *Verizon Opposition to Petition for Waiver* at 1.

⁴² See *SpaceX Sept. 13, 2024 Supplemental Letter* at 9; *SpaceX Petition for Reconsideration* at 11-15.

⁴³ See *T-Mobile Consolidated Waiver Response* at 4-5.

this particular SCS network. Based on the record before us, we grant the waiver subject to a condition that SpaceX address any harmful interference, if it occurs. This approach provides an opportunity for SCS service to develop while protecting terrestrial wireless services in their current and future configurations. We further note that wireless networks operating in adjacent bands are subject to flexible technical rules, and are free to change their parameters or configurations (and thus the potential for SCS interference to those services). SpaceX's obligations regarding harmful interference under this waiver apply regardless of future uses and configurations by terrestrial users.

12. For the reasons noted above, we condition relief on SpaceX addressing instances of harmful interference resulting from operation under this waiver.⁴⁴ While commenters present an assortment of technical arguments and assumptions, the likelihood of harmful interference represents the core issue underlying the key technical disputes in the waiver record, and including this condition is vital to the special circumstances that provide our path to waiver grant. We note that, throughout this waiver proceeding and in the corresponding discussion of the aggregate OOB PFD limit in the SCS R&O rulemaking process, SpaceX has represented that allowing aggregate OOB PFD levels of up to -110.6 dBW/m²/MHz for its PCS G Block SCS operations will not cause harmful interference to terrestrial networks. We also note that this condition is linked to ITU international obligations as well as domestic requirements.⁴⁵ If SpaceX fails to satisfy this condition, including by addressing harmful interference to terrestrial licensees, it may no longer operate under the waiver and must immediately adjust its operations to meet the limits specified in section 25.202(k)(1).

13. Additionally, the scope of the waiver is limited to the 5 megahertz band segments immediately adjacent to the PCS G Block in which SpaceX is operating. This will mitigate potential harm by limiting the number of terrestrial stakeholders affected.

14. The Commission determined that deployment of SCS will serve important public interest goals for the nation—expanding the reach of communications services, including emergency services, to more remote places, spurring advancements in cutting-edge, space-based technologies that will position the United States as a global leader in this arena, and continuing to promote the innovative and efficient use of our nation's spectrum resources in ways that foster creative collaborations among users.⁴⁶ SpaceX described its waiver request as crucial to its widespread deployment of SCS, and emphasized the need to enable faster and more reliable voice communications in remote locations.⁴⁷ As discussed, we protect against the potential for disruptions to adjacent terrestrial networks with conditions. Thus, we find that it is in the public interest to grant the SpaceX request for a waiver of section 25.202(k)(1) subject to the conditions described herein.

15. For the reasons discussed above, we grant SpaceX's request for a waiver of section 25.202(k)(1) in the United States to allow for an aggregate OOB PFD level up to -110.6 dBW/m²/MHz subject to the following conditions, which are consistent with the operations described in the waiver request.⁴⁸

- (1) Operations under the waiver must not cause harmful interference to authorized terrestrial licensee(s). If SpaceX's operations under this waiver cause harmful interference, SpaceX

⁴⁴ Harmful interference is defined as “[i]nterference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with [the ITU] Radio Regulations.” 47 CFR § 2.1(c).

⁴⁵ See ITU Radio Regulations, Article 4.4, Edition of 2020.

⁴⁶ SCS R&O at 2623 para. 2.

⁴⁷ SpaceX Sept. 13, 2024 Supplemental Letter at 1, 4, 6, and 8.

⁴⁸ SpaceX must comply with all other conditions covering operations of its Gen2 constellation, including obligations to protect terrestrial wireless operations in other countries.

must address the situation in a timely manner, or else cease operations under the waiver until the situation is addressed.

- (2) The scope of this waiver's relaxation of section 25.202(k)(1) is limited to the 5 megahertz band segments immediately adjacent to the downlinks for SpaceX's proposed SCS service; i.e., the waiver applies to 1985-1990 MHz and 1995-2000 MHz. In all other bands, SpaceX must comply with section 25.202(k)(1).

IV. ORDERING CLAUSES

16. Accordingly, IT IS ORDERED that the request filed by SpaceX for waiver of section 25.202(k)(1) of the Commission's rules is GRANTED with the conditions specified herein.

17. This action is taken under delegated authority pursuant to sections 0.51, 0.131, 0.261, and 0.331 of the Commission's rules, 47 CFR §§ 0.51, 0.131, 0.261, and 0.331.

FEDERAL COMMUNICATIONS COMMISSION

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