the first page of this document after publication in the **Federal Register**.

9. *It is further ordered* that the Commission's Office of the Secretary, Reference Information Center, *shall send* a copy of the Report and Order and Further Notice of Proposed Rulemaking and Notice of Proposed Rulemaking, and Order, including the associated Initial Regulatory Flexibility Analyses to the Chief Counsel for Advocacy of the Small Business Administration.

Federal Communications Commission.

Marlene Dortch,

Secretary, Office of the Secretary.

[FR Doc. 2023–13502 Filed 7–7–23; 8:45 am]

BILLING CODE 6712–01–P

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 2, 25, 27, and 101

[GN Docket No. 22–253; FCC 23–36; FR ID 149901]

Expanding Flexible Use of the 12.2–12.7 GHz Band

AGENCY: Federal Communications Commission.

ACTION: Final report and order.

SUMMARY: In this document, the Federal Communications Commission (Commission or FCC) finds that it is not in the public interest to add a mobile allocation to permit a two-way terrestrial 5G service in the 12.2 GHz band based on the current record.

DATES: The report and order is effective on July 10, 2023.

FOR FURTHER INFORMATION CONTACT: Madelaine Maior of the Wireless Telecommunications Bureau, Broadband Division, at *madelaine.maior@fcc.gov* or 202–418–1466; Simon Banyai of the Wireless Telecommunications Bureau, at *simon.banyai@fcc.gov* or (202) 418–1443; or Nick Oros of the Office of Engineering and Technology, at *nicholas.oros@fcc.gov* or (202) 418–2099.

SUPPLEMENTARY INFORMATION: This a summary of the Commission's *Report and Order (R&O)* in WT Docket No. 20–443 included in the *Report and Order and Further Notice of Proposed Rulemaking and Notice of Proposed Rulemaking and Order,* FCC 23–36, adopted on May 18, 2023 and released May 19, 2023. The full text of this document is available at *https://docs.fcc.gov/public/attachments/FCC-23-36A1.pdf.* The *R&O* and the *Further Notice of Proposed Rulemaking* (WT Docket No. 20–443), and the *Notice of Proposed Rulemaking* and the *Order* (GN Docket No. 22–352), *i.e.,* the four FCC actions in FCC 23–36, are published separately in the Rules and Regulations and the Proposed Rules sections, as applicable, of this issue of the **Federal Register**.

People with Disabilities: To request materials in accessible formats (braille, large print, computer diskettes, or audio recordings), please send an email to *FCC504@fcc.gov* or call the Consumer & Government Affairs Bureau at (202) 418–0530 (VOICE), (202) 418–0432 (TTY).

Regulatory Flexibility Act: The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice-and-comment rulemakings, unless the agency certifies that ''the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.'' In the Report and Order, the Commission declines to adopt rule changes and, therefore a Final Regulatory Flexibility Analysis has not been performed.

Congressional Review Act: The Commission will not send a copy of the Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review Act (CRA), *see* 5 U.S.C. 801(a)(1)(A), because it does not adopt any rule as defined in the Congressional Review Act, 5 U.S.C. 804(3).

Ex Parte Rules: This proceeding shall be treated as a ''permit-but-disclose'' proceeding in accordance with the Commission's ex parte rules. Persons making ex parte presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral ex parte presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the ex parte presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda, or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. In proceedings governed by § 1.49(f) or for which the Commission has made available a method of electronic filing, written ex parte presentations and memoranda summarizing oral ex parte presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.,* .doc, .xml, .ppt, searchable .pdf). Documents shown or given to Commission staff during ex parte meetings are deemed to be written ex parte presentations and must be filed consistent with § 1.1206(b). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules.

Synopsis

I. Report and Order

A. Background

1. In this *R&O,* the Commission takes steps to ensure current and future satellite services relied upon by millions of people across the country are preserved and protected in the 12.2–12.7 GHz band (12.2 GHz band) [1] The Commission finds that authorizing two-way, high-powered terrestrial mobile service in the 12.2 GHz band would impose a significant risk of harmful interference to existing and emergent services in the band, including satellite services. Such interference could undermine investments made by incumbent licensees and jeopardize their potential to provide new services to underserved communities, including rural communities. The 12.2 GHz band is allocated on a primary basis for non-Federal use for Broadcasting Satellite Service (BSS) (referred to domestically as Direct Broadcast Satellite (DBS)), Fixed Satellite Service (FSS) (space-to-Earth) limited to non-geostationary orbit systems (NGSO FSS), and Fixed Service.[2] While the three services are

[1] In order to distinguish references to the bands in this item, the Commission refers to the 12.2–12.7 GHz band as the 12.2 GHz band throughout. *See Expanding Flexible Use of the 12.2–12.7 GHz Band,* WT Docket Nos. 20–443 et al., Notice of Proposed Rulemaking, 36 FCC Rcd 606 (2021), (86 FR 13266 (March 8, 2021)) *(12.2 NPRM).*

[2] *See* 47 CFR 2.106, United States Table of Frequency Allocations, non-Federal Table for the band 12.2–12.7 GHz. NGSO FSS (space-to-Earth) operations are authorized pursuant to international footnote 5.487A (revised as 47 CFR 2.106(b)(487)(i), at 88 FR 37318, June 7, 2023, effective July 7, 2023), which provides additional allocations including in Region 2 as follows ''[The 12.2–12.7 GHz is] allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to application of the provisions of [International Telecommunication Union (ITU) Radio Regulations] No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-

co-primary, NGSO FSS and Fixed Service are allocated on a non-harmful interference basis to DBS.[3] Currently there are three services operating in the band: DBS providers operating under the primary BSS allocation, NGSO FSS licensees operating under the co-primary NGSO FSS allocation, and Multi-Channel Video and Data Distribution Service (MVDDS) licensees operating under the co-primary Fixed Service allocation.[4]

2. While DBS service began in 1994, and NGSO FSS systems were authorized in the early 2000s, the Commission permitted MVDDS to operate in the 12.2 GHz band starting in 2004 under technical rules to ensure that MVDDS stations do not cause harmful interference to DBS or earlier-in-time NGSO FSS fixed subscriber receivers.[5] To that end, MVDDS service was limited to a relatively low power, one-way, digital fixed non-broadcast service, including one-way direct-to-home/office wireless service with each proposed transmitter subject to detailed prior coordination requirements.[6] In April 2016, a coalition of MVDDS licensees filed a Petition for Rulemaking requesting reforms to the 12.2 GHz band rules, including permitting MVDDS licensees to use the band for two-way mobile broadband services.[7]

3. Later in 2016, the International Bureau opened a processing round to accept NGSO FSS applications and petitions for market access in several frequency bands [8] and the Commission reformed its NGSO FSS rules.[9] In 2017, the Commission granted the first of the new generation NGSO FSS requests—a petition for market access by WorldVu Satellites Limited (OneWeb) for a planned Low Earth Orbit (LEO) NGSO FSS satellite system of 720 satellites authorized by the United Kingdom in the 10.7–12.7 GHz Band (in addition to several other bands).[10] The Commission concluded that ''the pendency of the MVDDS 5G Coalition's Petition for Rulemaking was not a sufficient reason to delay or deny these requests to use the band under the existing NGSO FSS allocation and service rules.'' [11] In granting this request, however, the Commission conditioned access to the 12 GHz band on the outcome of the MVDDS 5G Coalition's Petition and any other rulemaking initiated on the Commission's own motion.[12] The Commission also agreed with comments of the MVDDS 5G Coalition that MVDDS should not have to protect any NGSO FSS earth stations in motion operations in the band, if authorized in the future, because such operations had not been contemplated under the longstanding first-in-time MVDDS/NGSO FSS sharing approach.[13] The NGSO FSS Report and Order adopted, among other things, spectrum sharing rules and a more flexible milestone schedule for NGSO FSS systems.[14] The Commission subsequently granted five additional NGSO FSS requests to use bands that include the 12.2 GHz band (among others).[15]

4. NGSO FSS systems have continued to deploy. In particular, SpaceX received modified authority for its first generation (Gen 1) system to decrease the altitude from the 1,100–1,300 km to the 540–570 km range for 2,814 satellites as well as approval of its updated orbital debris mitigation plan.[16] To date, SpaceX has deployed

geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the broadcasting-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the [ITU Radiocommunication] Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and [ITU Regulations] No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the [12 GHz band] shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.''

47 CFR 2.106, n.5.487A (n.5.487A revised as 47 CFR 2.106(b)(487)(i), at 88 FR 37318, June 7, 2023, effective July 7, 2023). When an international footnote is applicable without modification to non-Federal operations, the Commission places the footnote on the non-Federal Table. *See* 47 CFR 2.105(d)(5).

[3] *See* 47 CFR 2.106, n.5.490 (International Footnote) (n.5.490 revised as 47 CFR 2.106(b)(490), at 88 FR 37318, June 7, 2023, effective July 7, 2023). In Region 2, in the 12.2–12.7 GHz band, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in conformity with the broadcasting satellite Plan for Region 2 contained in Appendix 30. ''Harmful Interference'' is defined under the Commission's rules 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). *See* also Annex to the Constitution of the ITU, 1003 (defining harmful interference).

[4] 47 CFR 101.147(a) n.31.

[5] *See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2–12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates; and Applications of Broadwave USA, PDC Broadband Corporation, and Satellite Receivers, Ltd. to Provide A Fixed Service in the 12.2–12.7 GHz Band,* ET Docket No. 98–206, First Report and Order and Further Notice of Proposed Rule Making, 16 FCC Rcd 4096, 4177, para. 213 (2000) (*First Report and Order and FNPRM).*

[6] *See* 47 CFR 101.1407 (two-way services can be provided using spectrum in other bands for the return link). *See also Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range,* Memorandum Opinion and Order and Second Report and Order, 17 FCC Rcd 9614 (2002) (*MVDDS Second Report and Order*) (*aff'd Northpoint Technology, LTD et al.* v. *FCC,* 414 F.3d 61 (D.C. Cir. 2005)).

[7] Petition of MVDDS 5G Coalition Petition for Rulemaking, RM–11768, at 17–18 (filed Apr. 26, 2016), *https://www.fcc.gov/ecfs/document/60001658886/1* (MVDDS 5G Coalition Petition). *See also Petition for Rulemakings Filed,* Public Notice, Report No. 3042, at 8, 17–18 (May 9, 2016) (Petition Public Notice).

[8] *See Satellite Policy Branch Information; OneWeb Petition Accepted for Filing (IBFS File No. SAT–LOI–20160428–00041), Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 10.7–12.7 GHz, 14.0–14.5 GHz, 17.8–18.6 GHz, 18.8–19.3 GHz, 27.5–28.35 GHz, 28.35–29.1 GHz, and 29.5–30.0 GHz Bands,* Public Notice, 31 FCC Rcd 7666 (IB July 15, 2016).

[9] In September 2017, the Commission adopted the *NGSO FSS Report and Order,* updating several rules and policies governing NGSO FSS systems. *See Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters,* Report and Order (82 FR 59972 (Dec. 18, 2017)) and Further Notice of Proposed Rulemaking (82 FR 52869 (Nov. 15, 20217)), 32 FCC Rcd 7809 (2017) (*NGSO FSS Report and Order*).

[10] *See WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System,* Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017) (*OneWeb Order*).

[11] *Id.* at 5369, para. 6.

[12] *Id.* at 5378, para. 26 (''This grant of U.S. market access and any earth station licenses granted in the future are subject to modification to bring them into conformance with any rules or policies adopted by the Commission in the future.''). *See also id.* at 5369, para. 6 (''Accordingly, any investment made toward operations in this band by OneWeb in the United States assume the risk that operations may be subject to additional conditions or requirements as a result of such Commission actions.'').

[13] *Id.* at 5370, para. 8.

[14] *See NGSO FSS Report and Order,* 32 FCC Rcd at 7821–31, paras. 37–68.

[15] *Space Norway AS, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission,* Order and Declaratory Ruling, 32 FCC Rcd 9649 (2018) (*Space Norway Order*); *Karousel Satellite LLC, Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service,* Memorandum Opinion, Order and Authorization, 33 FCC Rcd 8485 (2018) (*Karousel Order*), *Space Exploration Holdings, LLC Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System,* Memorandum Opinion Order and Authorization, 33 FCC Rcd 3391 (2018) (*SpaceX Order*), *Kepler Communications Inc. Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System,* Order, 33 FCC Rcd 11453, (2018) (*Kepler Order*), *Theia Holdings A, Inc. Request for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth-Exploration Satellite Service,* Memorandum, Opinion and Authorization, 34 FCC Rcd 3526 (2019) (*Theia Order*).

[16] *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System,* Order and Authorization, 36 FCC Rcd 7995 (2021).

approximately 4,000 satellites.[17] The Commission also recently issued a partial grant to SpaceX to begin deploying its second generation (Gen 2) system, with a grant approving up to 7,500 satellites to operate in the Ka- and Ku-frequency bands.[18] OneWeb also recently received modified authority for its constellation [19] and, to date, it has deployed over 580 satellites.[20] On June 30, 2022, the International Bureau authorized SpaceX and Kepler to serve earth stations in motion (ESIMs) in the 12.2 GHz band on an unprotected, non-harmful interference basis.[21]

5. On January 15, 2021, the Commission released a notice of proposed rulemaking (*12.2 NPRM*) to allow interested parties to address whether it could add a mobile allocation and make other changes to expand terrestrial use of the 12.2 GHz band without causing harmful interference to incumbent licensees and, if so, whether such action would promote or hinder the delivery of next-generation services in the 12.2 GHz band given the existing and emergent services offered by incumbent licensees.[22]

B. 5G Use of the 12.2–12.7 GHz Band

6. By this *R&O,* the Commission finds that it is not in the public interest to add a mobile allocation to permit a two-way terrestrial 5G service in the 12.2 GHz band based on the current record.[23] The Commission finds that a new ubiquitous terrestrial 5G service introduced throughout the band would create a significant risk of harmful interference to Direct Broadcast Satellite (DBS) and Fixed Satellite Service (FSS) (space-to-Earth) limited to non-geostationary orbit systems (NGSO FSS) operators. Although the Commission declines to authorize two-way, high-powered terrestrial mobile use, the Commission seeks further comment in its related further notice of proposed rulemaking in WT Docket No. 20–443 (*see* FCC 23–36, paras. 48–57) (FR 2023–13501), published elsewhere in this issue of the **Federal Register**, on how best to maximize use of this 500 megahertz of mid-band spectrum. The Commission takes these actions with respect to the 12.2–12.7 GHz band in conjunction with its related action to issue a notice of proposed rulemaking in GN Docket No. 22–352 (*see* FCC 23–36, paras. 58–142) (FR 2023–13500), published elsewhere in this issue of the **Federal Register**, proposing to expand the use of the 12.7–13.25 GHz band for mobile broadband or other expanded use.

7. In April 2016, the MVDDS 5G Coalition, which included eleven of the twelve Multi-Channel Video and Data Distribution Service (MVDDS) licensees at that time, filed a Petition for Rulemaking requesting reforms to the 12.2 GHz band rules, including permitting MVDDS licensees to use the band for two-way mobile 5G broadband services.[24] In support of the Petition, the Coalition also provided two Coexistence Studies that it claimed illustrated that a new 5G service could coexist with DBS operators in the band but would be incompatible with NGSO FSS.[25] Subsequently, however, some members of the MVDDS 5G Coalition suggested the possibility of 5G terrestrial use and NGSO FSS sharing in the band.[26]

8. On January 15, 2021, the Commission released its *12.2 NPRM* to allow interested parties to address whether it could add a mobile allocation and make other changes to expand terrestrial use of the 12.2 GHz band without causing harmful interference to incumbent licensees and, if so, whether such action would promote or hinder the delivery of next-generation services in the 12.2 GHz band given the existing and emergent services offered by incumbent licensees.[27] In the *12.2 NPRM,* the Commission stated that it would proceed mindful of the

[17] *See, e.g.,* Mike Wall, SpaceX launches 56 Starlink satellites, lands rocket at sea, space.com (''SpaceX has now lofted more than 4,200 Starlink satellites overall, according to astrophysicist and satellite tracker Jonathan McDowell.'') (Mar. 29, 2023), *https://www.space.com/spacex-starlink-group-5-10-launch#:~:text=SpaceX%20launched%20another%20big%20batch,p.m.%20EDT%20(2001%20GMT).*

[18] *Space Exploration Holdings, LLC, Request for Orbital Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System,* IBFS File No. SAT–LOA–20200526–00055 and SAT–AMD–20210818–00105, Order and Authorization, FCC 22–91, 2022 WL 17413767, at *54, para. 135(ii) (Dec. 1, 2022) (*SpaceX Gen2 Order*) (stating that the ''authorization is subject to modification to bring it into conformance with any rules or policies adopted by the Commission in the future. [And, that] . . . any investments made toward operations in the bands authorized [by the] Order by SpaceX in the United States assume the risk that operations may be subject to additional conditions or requirements as a result of any future Commission actions . . . [including, but not limited to] . . . any conditions or requirements resulting from any action in the proceedings associated with. . .WTB Docket 20–443. . .'').

[19] *WorldVu Satellites Limited, Petition for Declaratory Ruling to Modify the U.S. Market Access Grant for the OneWeb Ku-band and Ka-Band NGSO FSS System,* Order and Declaratory Ruling, DA 22–970 (IB, rel. Sept. 16, 2022) (petition to modify grant of U.S. market access granted in part and deferred in part to approve minor adjustments to number of satellites per plane without exceeding previously-approved total of 720 satellites).

[20] *See, e.g.,* Letter from Kimberly M. Baum, Vice President, Spectrum Engineering & Strategy, WorldVu Satellites Limited, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 20–443 *et al.* at 1 (filed Mar. 20, 2023); *https://oneweb.net/resources/oneweb-confirms-successful-deployment-40-satellites-launched-spacex-1* (''OneWeb confirms successful deployment of 40 satellites launched with SpaceX. Launch 17 brings the total OneWeb constellation to 582 satellites. Third launch with SpaceX makes penultimate mission to achieving global coverage.'').

[21] *SpaceX Services, Inc. Application for Blanket Authorization of Next- Generation Ku-Band Earth Stations in Motion et al.; Kepler Communications Inc. Application for Blanket Authorization of Ku-Band Earth Stations on Vessels,* Order and Authorization, DA 22–695 (IB June 30, 2022) (*ESIMs Authorizations*). DISH and RS Access had argued that granting these applications would constrain the Commission's decision-making in the instant 12.2 GHz band rulemaking proceeding by injecting new ESIM encumbrances into the 12.2 GHz band. *ESIMs Authorizations* at 11–12, para. 22. DISH and RS Access also argued that authorizing ESIMs in the band on an unprotected basis would likely result in primary users in the band being required to assume the costs to prevent service interruptions to SpaceX customers. *Id.* at 11, para. 18. The International Bureau found that granting the applications served the public interest but also recognized that the introduction of a potentially significant number of additional end users in motion could affect the 12 GHz spectrum environment. Therefore the Bureau imposed conditions to ensure grant of those applications would not materially impact the outcome of the 12 GHz rulemaking proceeding. *ESIMs Authorizations* at 12–13, paras. 23–27. The Bureau imposed conditions on the grants related to the 12.2 GHz band including: (1) requiring operations to be on a non-interference basis; (2) subjecting the operations to the outcome of any future rulemaking including the instant 12.2 GHz band GHz proceeding, with the understanding that the presence of ESIMs is not anticipated to materially affect the analysis therein, and subject to modification to conform to any rules or policies adopted, including in the instant 12.2 GHz band proceeding, and assumption of this risk; (3) subjecting the grant to the applicants' representations, including that their NGSO systems have been engineered to achieve a high degree of flexibility to facilitate spectrum sharing with other authorized satellite and terrestrial systems. *Id.* In addition, the Bureau explained that its case-by-case analysis was limited to the applications before it and have no broader applicability. *See id.*

[22] *12.2 NPRM,* 36 FCC Rcd at 614, para. 2.

[23] In this *R&O,* record references and citations refer to WT Docket No. 20–443, unless otherwise noted.

[24] For brevity and convenience, the Commission refers to terrestrial, 2-way, high-power mobile operations herein as ''5G.''

[25] MVDDS 5G Coalition Petition Public Notice Comments, Attach. 1, MVDDS 12.2–12.7 GHz Co-Primary Service Coexistence (Coexistence 1) and MVDDS 5G Coalition Petition Public Notice Reply, Appx. A, MVDDS 12.2–12.7 GHZ Co-Primary Service Coexistence II (Coexistence 2) (collectively, Coexistence Studies).

[26] *See e.g.,* Letter from Martha Suarez, President, Dynamic Spectrum Alliance (DSA), to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, at 2 (filed Aug. 21, 2020) (DSA Aug. 21, 2020 *Ex Parte*); Letter from Trey Hanbury, Counsel, RS Access, to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, at 2–3 (filed Sept. 21, 2020) (RS Access Sept. 21, 2020 *Ex Parte*); Letter from Jeffrey Blum, Executive Vice President, External and Legislative Affairs, DISH, to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, at 4 (filed Nov. 12, 2020) (DISH Nov. 12, 2020 *Ex Parte*) (stating that ''since the 2016 studies, developments in the satellite industry indicate that NGSO FSS constellations possess geostationary-like functions and properties that could prove more compatible with 5G services in the 12 GHz Band than the last-generation NGSO earth stations.'').

[27] *12.2 NPRM,* 36 FCC Rcd at 614, para. 2.

significant investments made by incumbents and that it valued the public interest benefits that could flow from investments made to provide satellite broadband services, particularly in rural and other underserved communities that might be more expensive to serve through other technologies. The Commission initiated the instant 12.2 GHz band proceeding to allow interested parties to address whether additional operations can be accommodated in the band while protecting incumbent operations from harmful interference and to provide an opportunity for the Commission to assess the public interest considerations associated with adding a new mobile allocation.[28] In particular, the Commission sought information on the status of technologies that have been developed or are currently in development that would allow for two-way mobile communications in the 12.2 GHz band; whether standards have been set related to such technologies; whether there are any international agreements on a band plan or air interface for the 12.2 GHz band; and the impact (if any) on international rights for U.S.-licensed systems that might be affected as a result of the U.S. providing for expanded shared use of the band.[29] Comments were due May 7, 2021, reply comments were due July 7, 2021, and interested parties have added many *ex parte* filings to the rulemaking dockets since the comment deadlines.[30]

9. In response to the *12.2 NPRM,* several of the MVDDS licensees, and one DBS provider that is also a major MVDDS licensee, contend that 5G terrestrial and incumbent services can coexist in the band, the other DBS provider and the NGSO FSS commenters contend that such coexistence is not yet technically feasible. Multiple technical analyses were submitted into the record that purport to model the potential interference between a new 5G mobile terrestrial service and incumbent satellite services in the band.[31] These models rely on various technical assumptions about which the parties greatly disagree.

10. Based on the record in this proceeding, the Commission finds that a new ubiquitous 5G terrestrial mobile service cannot coexist with DBS operations in the band without a significant increase in the risk of harmful interference. The Commission is not persuaded by the assurances of one of the two nationwide DBS providers that DBS will be protected,[32] particularly given that the other nationwide DBS provider raises significant concerns.[33] The Commission finds that the study submitted by the 5G advocates is based on unsupported assumptions that undermine its reliability. As explained below, the 5G proponents have not demonstrated that a new 5G service will be able to meet the Equivalent Power Flux Density (EPFD) limits required to protect DBS receivers in the 12.2 GHz band. Also, the Commission finds that the 5G proponents have not adequately addressed the issues raised both in the *12.2 NPRM* and by commenters regarding the applicability of burden-shifting protection obligations, lower earth-station elevation angles, power limits, EPFD limits and receiver location information.

11. Further, the Commission also finds that ubiquitous two-way mobile broadband 5G service is likely to create a significant risk of harmful interference to ubiquitous NGSO FSS operations. The 5G terrestrial advocates' analysis rests on the speculative assumption that 5G and NGSO FSS operations will not be geographically near each other (*i.e.,* 5G advocates offer studies that assume NGSO FSS will largely serve rural areas, and 5G will serve urban/suburban markets) without pointing to any basis for this assumption. The Commission finds that this unsupported assumption, which is not in line with current deployment practices and plans, renders the technical studies offered by the 5G advocates unpersuasive, and therefore such studies cannot serve as a basis on which to conclude that the public interest would be best served by allowing a new, ubiquitous 5G service into the band at this time. The Commission specifically asked whether geographic sharing could allow higher-power terrestrial operations in certain areas, and if so, how such geographic sharing should be structured.[34] But apart from studies based on non-binding, hypothetical assumptions, the Commission notes that 5G proponents did not offer any rules to limit their proposed 5G operations to less than all of the geographic areas authorized by their MVDDS licenses.

1. 5G Interference to DBS

12. As a threshold matter, the Commission finds that a new ubiquitous

[28] *See, e.g., id.* Additionally, the Commission explained that Section 303(y) provides the Commission with authority to provide for flexible use operations only if: ''(1) such use is consistent with international agreements to which the United States is a party; and (2) the Commission finds, after notice and opportunity for public comment, that (A) such an allocation would be in the public interest; (B) such use would not deter investment in communications services and systems, or technology development; and (C) such use would not result in harmful interference among users.'' Balanced Budget Act of 1997, Public Law 105–33, 111 Stat 251, 268–69 sec. 3005 Flexible Use of Electromagnetic Spectrum (codified at 47 U.S.C. 303(y)). *See also* 47 CFR 2.106, 27.2, 27.3.

[29] *See 12.2 NPRM,* 36 FCC Rcd at 616, para. 21, n.67 (citing Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, Attach. A, Questions Necessary to Balance the 12 GHz NPRM, at 3–4 (filed Jan. 6, 2021) (SpaceX Jan. 6, 2021 *Ex Parte*)).

[30] *See Expanding Flexible Use of the 12.2–12.7 GHz Band, et al.,* WT Docket No. 20–443, et. al., Order, 36 FCC Rcd 6534 (WTB 2021); *Expanding Flexible Use of the 12.2–12.7 GHz Band, et. al.,* WT Docket No. 20–443, et. al., Order, 36 FCC Rcd 9531 (WTB 2021); *see generally* WT Docket No. 20–443 and GN Docket 17–183.

[31] RS Access Comment, Appendix A, Assessment of Feasibility of Coexistence between NGSO FSS Earth Stations and 5G Operations in the 12.2–12.7 GHz Band, at 6 (filed May 7, 2021) (RS Access Comment RKF Study I); Letter from Noah Campbell, CEO, RS Access, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Attach. A, The Effect of 5G Deployment on NGSO FSS Downlink Operations in the 12.2–12.7 GHz Band (filed May 19, 2022) (RS Access May 19, 2022 RKF Study II); Letter from David Goldman, Senior Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Attach. A, SpaceX Analysis of the Effect of Terrestrial Mobile Deployment on NGSO FSS Earth Stations and 5G Operations in the 12.2–12.7 GHz Band (filed June 21, 2022) (SpaceX June 21, 2022 Analysis); Letter from V. Noah Campbell, CEO, RS Access, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Attach. A, Analysis of Starlink Submission Regarding the Effect of 5G Deployment on NGSO FSS (filed July 15, 2022) (RS Access July 15, 2022 RKF Response Study); Letter from Stacy Fuller, Senior Vice President, External Affairs, DIRECTV, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Attach. A, 12 GHz Co-Frequency Interference from Terrestrial Mobile into DBS (filed July 18, 2022) (DIRECTV July 18, 2022 DBS Analysis); Letter from Kimberly M. Baum, Vice President, Spectrum Engineering & Strategy, WorldVu Satellites Limited, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Annex, Monte Carlo Analyses of the Potential Impact of an Expanded Terrestrial Service on NGSO FSS Systems in the 12 GHz Band (filed July 11, 2022) (OneWeb July 11, 2022 Analyses); Letter from David Goldman, Senior Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Exh. A, Evaluation of SpaceX Study Related to 12 GHz Interference from Terrestrial Mobile into Starlink (filed Oct. 4, 2022) (SpaceX Oct. 4, 2022 SAVID Report).

[32] DISH states that the presence of higher-power two-way mobile and fixed services at 12 GHz are possible and fully consistent with protecting DBS in the band. *See* DISH Comment at 1.

[33] AT&T has argued on behalf of DirecTV that RKF has not established that expanded terrestrial mobile operations could be added without causing harmful interference to DBS operations—a service which RKF's Study completely ignores, and a factor which alone, it argues, should nullify the study. *See* AT&T Reply at 14. AT&T asserts exclusion and/or coordination zones are neither practical nor feasible in the 12 GHz band as a means of protecting DBS because millions of DBS receivers are spread throughout the U.S. and are constantly being added, moved, or relocated. *See id.* at 26. AT&T states its concerns are not lessened just because DISH is not concerned about the possibility of harmful interference posed by terrestrial mobile operations. *See id.* at 22.

[34] *See 12.2 NPRM,* 36 FCC Rcd at 624, para. 43.

5G terrestrial mobile service cannot coexist with DBS operations in the band without a significant increase in the risk of harmful interference. As noted above, pursuant to the Table of Allocations, both terrestrial and NGSO FSS services are obligated to protect DBS from harmful interference.[35] The Commission has long recognized the public interest benefits that incumbent DBS services provide to millions of subscribers, and has required the other co-primary services in 12.2 GHz band to operate on a non-harmful interference basis with respect to DBS.[36] Congress, too, sought to ensure that DBS would not be subject to harmful interference from any new terrestrial service by requiring that the Commission ''provide for an independent technical demonstration of any terrestrial service technology proposed by any entity that has filed an application to provide terrestrial service in the direct broadcast satellite frequency band to determine whether the terrestrial service technology proposed to be provided by that entity will cause harmful interference to any direct broadcast satellite service.'' [37] The Commission ultimately adopted rules for MVDDS based on the extensive record of a multi-year rulemaking proceeding,[38] which included the statutory mandates to avoid harmful interference to DBS [39] and an independent analysis [40] of potential MVDDS interference to DBS.[41] These rules include detailed frequency coordination procedures that require an MVDDS licensee to ensure that the EPFD [42] from a proposed transmitting antenna does not exceed the applicable EPFD limit [43] at any DBS receiving antenna of a ''customer of record.'' [44] The MVDDS rules also include other limitations on signal emissions, transmitter power levels, and transmitter locations.[45] When an MVDDS licensee proposes a new station, coordination with DBS is necessary to demonstrate that the relevant EPFD limit will not be exceeded at the DBS antenna of any DBS subscriber of record.[46] Once an MVDDS station has been successfully coordinated, however, the burden to ensure that DBS subscribers do not suffer interference from that MVDDS station shifts to the DBS operator—immediately for new subscribers [47] and after one year for customers of record.[48] The Commission determined that shifting this burden to DBS from MVDDS—only after successful coordination by the MVDDS operator in the first instance—was reasonable in light of the one-way, relatively low-power limit on MVDDS. In doing so, the Commission did not alter its previous finding that allowing two-way MVDDS operations in the band ''would unnecessarily complicate the sharing scenario'' and ''significantly raise the potential for instances of interference among the operations'' sharing the band.[49]

13. In its 2016 Petition for Rulemaking, the MVDDS 5G Coalition proposed that a new 5G mobile terrestrial service could also share with existing DBS in the 12.2 GHz band.[50] The Coalition provided two Coexistence studies that—through careful selection of mobile deployment areas, adjustments to radio frequency design parameters, use of geographic separation, clutter loss, and transmitter power constraints on terrestrial operations—purported to show that sharing with DBS would be possible.[51] In the first Coexistence Study, which studied three potential 5G use cases including point-to-point communications, mobile broadband, and indoor mobile use, the Coalition asserted that these potential uses could be engineered such that terrestrial users would not exceed the existing EPFD limit for MVDDS.[52] In its subsequent Coexistence 2 study, the Coalition studied a different building environment to show that even in a ''more challenging'' sharing environment, a new 5G service could protect DBS up to the level it ''enjoys

[35] *See supra* para. 1 & n.3.

[36] *See generally MVDDS Second Report and Order.*

[37] *See Prevention of Interference to Direct Broadcast Satellite Services,* Public Law 106–553, App. B., Title. X, 1012, 114 Stat. 2762, 2762A–128, 2762A–141 (2000) (*LOCAL TV Act* 1012); *see also Rural Local Broadcast Signal Act,* Public Law 106–113, App. I., Title II, sec. 2002, 113 Stat. 1501, 1501A–544 (1999). In December 2018, however, this provision the LOCAL TV Act was stricken. Public Law 106–553, 114 Stat. 2762, 265–66, sec. 1012, Prevention of Interference to Direct Broadcast Satellite Services, stricken by Public Law 115–334, 132 Stat. 4490, 4777–78, sec. 6603, Amendments to Local TV Act.

[38] *See* ET Docket No. 98–206.

[39] *See LOCAL TV Act* 1012(a).

[40] *Id.*

[41] *See, e.g., MVDDS Second Report and Order,* 17 FCC Rcd at 9635, para. 56 (citing MITRE Corporation, ''Analysis of Potential MVDDS Interference to DBS in the 12.2–12.7 GHz Band'' (Apr. 18, 2001) (*MITRE Report*)).

[42] The EPFD is the power flux density produced at a DBS receive earth station, taking into account shielding effects and the off-axis discrimination of the receiving antenna assumed to be pointing at the appropriate DBS satellite(s) from the transmitting antenna of a MVDDS transmit station. *See* 47 CFR 101.105(a)(4)(ii)(A).

[43] The Commission established different EPFD limits in four regions of the U.S., *see* 47 CFR 101.105(a)(4)(ii)(B), mainly due to differences in rainfall in each region. *See, e.g., MVDDS Second Report and Order,* 17 FCC Rcd at 9691, para. 197.

[44] *See* 47 CFR 101.105(a)(4)(ii) (referencing the procedures listed in 47 CFR 101.1440). Among other things, an MVDDS licensee must conduct a survey of the area around its proposed transmitting antenna site to determine the location of all DBS customers of record that may potentially be affected by the introduction of its MVDDS service and must coordinate with DBS. *See* 47 CFR 101.1440(a)–(d).

[45] *See, e.g., MVDDS Second Report and Order,* 17 FCC Rcd at 9634–9664, paras. 53–125; 9690–9695, paras. 196–209; 47 CFR 25.139 (NGSO FSS coordination and information sharing between MVDDS licensees in the 12.2 GHz to 12.7 GHz band); 25.208(k); 101.103; 101.105; 101.111; 101.113; 101.129; 101.1409; 101.1440. Notably, the rules limit the EIRP for MVDDS stations to 14 dBm per 24 megahertz. *See* 47 CFR 101.113(a) note 11; 101.147(p). In the *MVDDS Second Report and Order,* the Commission explained that ''placing a limit on MVDDS EIRP will ensure that DBS entities are not unduly hindered in their ability to acquire customers in areas in close proximity to MVDDS transmit facilities. Thus, we are not permitting higher powers over areas containing mountain ridges or over presently unpopulated regions because the higher power may cause too great of an exclusion zone for future DBS and NGSO FSS subscribers. The Commission recognizes that a higher power benefit for MVDDS providers would not offset the potential constraints placed on other service subscribers in the 12 GHz band. *MVDDS Second Report and Order,* 17 FCC Rcd at 9691–92, para. 198.''

See also id. at 9653, para. 88 (discussing the EIRP limit as a factor in adopting DBS mitigation obligations because ''this power limit will not inhibit the introduction of new DBS customers [near] the MVDDS transmitting system, *i.e.,* later-installed DBS receive antennas can be properly sited and shielded from the MVDDS signal'').

[46] ''DBS customers of record are those who had their DBS receive antennas installed prior to or within the 30 day period after notification to the DBS operator by the MVDDS licensee of the proposed MVDDS transmitting antenna site.'' 47 CFR 101.1440(a).

[47] ''DBS licensees are responsible for providing information they deem necessary for those entities who install all future DBS receive antennas on its system to take into account the presence of MVDDS operations so that these DBS receive antennas can be located in such a way as to avoid the MVDDS signal. These later installed DBS receive antennas shall have no further rights of complaint against the notified MVDDS transmitting antenna(s).'' 47 CFR 101.1440(e).

[48] Once the new MVDDS station is coordinated and begins operating, the MVDDS licensee must satisfy all complaints of interference to DBS customers of record received during a one-year period. 47 CFR 101.1440(g).

[49] *MVDDS Second Report and Order,* 17 FCC Rcd at 9668, para. 137.

[50] *See supra* para. 7.

[51] *See, e.g.,* Letter from Jeffrey H. Blum, Executive Vice President, External and Legislative Affairs, DISH, to Marlene Dortch, Secretary, FCC, Docket No. RM–11768, at 3 (filed Sept. 22, 2020) (DISH Sept. 22, 2020 Letter). *See also* Coexistence 1 at 35 (finding that ''coexistence between MVDDS 5G operations and DBS receivers is possible with modest adjustments to MVDDS site locations and radiofrequency design parameters''); Coexistence 2 (revalidating the original coexistence study in different topological use-cases); Petition of MVDDS 5G Coalition for Petition to Deny, WT Docket No. 10–112, Exh. 1, MVDDS 12.2–12.7 GHz NGSO Coexistence Study (filed Aug. 15, 2016), *https://www.fcc.gov/ecfs/document/10816077623256/1* (Coexistence 3 Aug. 15, 2016 Study).

[52] MVDDS 5G Coalition Petition Public Notice Comments at 4–6.

today from MVDDS licensees.'' [53] In the *12.2 NPRM,* the Commission sought comment on whether the approach proposed by the MVDDS 5G Coalition in the 2016 Coexistence studies was feasible and the costs and benefits of such an approach.[54] The Commission sought comment on whether, and to what extent, the MVDDS 5G Coalition's proposals to license two-way, mobile operations in the band, and to eliminate the equivalent isotropic radiated power (EIRP) limit, would substantially redefine the scope of DBS operators' obligations and potential burdens under the current regime.[55] Additionally, the Commission asked how other factors—such as geographic separation, transmitter power constraints on terrestrial operations, and other siting parameters for flexible-use base stations—could minimize the risk of interference to DBS users.[56]

14. The advocates for a new 5G service in the band did not directly address the *12.2 NPRM* questions but instead continued to rely on the 2016 Coexistence studies. Specifically, DISH stated that ''the feasibility of sharing between DBS and 5G is demonstrated by two studies commissioned by the MVDDS 5G Coalition and prepared by [an] expert satellite engineer.'' [57] Similarly, RS Access stated that, ''the coexistence studies submitted in the petition for rulemaking proceeding demonstrated that coexistence between DBS and terrestrial 5G is possible, even under a worst-case scenario.'' [58]

15. Opponents of the Coalition's proposals responded to the *12.2 NPRM* by criticizing the Coexistence studies. AT&T, which owned DIRECTV, the only current DBS operator that does not hold MVDDS licenses, argued that the 2016 Coexistence studies, ''too narrowly and simplistically defined the areas in which a DBS receiver could establish a direct line-of-sight path with DBS satellite orbital locations.'' [59] Moreover, AT&T argued that ''these studies made inaccurate baseline assumptions regarding the nature of deployments and relied upon cherry-picked use cases that are not representative of real-world deployments.'' [60] Subsequently, DIRECTV, which AT&T spun off in 2021,[61] argued that the 2016 Coexistence studies are ''outdated or irrelevant, and thus do not accurately reflect the characteristics of either a ubiquitous, modern, high-power terrestrial mobile service or DIRECTV's DBS service.'' [62] Moreover, SAVID LLC (SAVID), an engineering firm that DIRECTV hired to analyze 5G–DBS coexistence, found that, even if it made favorable assumptions of the terrestrial mobile systems, 5G service in the band would ''cause extensive harmful interference to DIRECTV receivers, exceeding the limits currently in place to protect DBS customers by a factor of 100 to 100,000 over areas extending well beyond the intended coverage area of the mobile base stations.'' [63]

16. Based on the record in this proceeding, the Commission finds that a new ubiquitous 5G terrestrial mobile service cannot coexist with DBS operations in the band without a significant increase in the risk of harmful interference to the DBS operations. In particular, 5G advocates have not shown how such new mobile operations could meet or exceed the metric upon which the Commission based regional EPFD limits (ranging from -172.1 to -168.4 dBW/m^2/4kHz) that the FCC adopted to protect DBS from a fixed, lower power MVDDS service at every existing DBS subscriber's dish. In addition, because MVDDS is a fixed service, the rules were able to take advantage of the discrimination between southern facing DBS antennas and MVDDS antennas; a mobile service does not provide for such accommodations and results in a much more challenging interference environment than MVDDS. Moreover, to meet the existing EPFD limits, it appears that a mobile terrestrial service would need to be restricted to such low power levels that it is unlikely that any given base station could provide substantial geographic coverage or significant 5G service.[64] According to the Coexistence 1 study, 5G services could meet these EPFD limits only when using ''newly available spectrum planning tools, and careful engineering of MVDDS systems'' to isolate them from DBS receivers, either through geographic separation or terrain blocking.[65] Given the careful and exacting engineering that would be needed to meet these conditions, it is not apparent that terrestrial mobile systems, if installed, could be expanded by adding new base station locations in the future to meet increased consumer demands without significantly impacting DBS service. It is not reasonable to assume that ubiquitous two-way 5G mobile terrestrial service would meet these conditions consistently with respect to ubiquitous DBS which serves millions of customers in all areas of the United States where the location of 5G mobile units could be anywhere in the operator's service area, including right next to the DBS antenna.[66]

17. When DIRECTV commissioned a study from SAVID using what it deemed more reasonable assumptions than those of the 5G advocates, that study found that at power levels of 69 dBm/100 MHz [67] ''mobile operations in the band would cause extensive and harmful interference to DIRECTV receivers.'' [68] DISH raises several criticisms of the SAVID study,[69] but even the MVDDS 5G Coalition's own study found that at 48 dBm/100 MHz in certain small areas actual harmful interference could occur if a DBS receive antenna were present.[70] The Commission notes that the power levels used in the Coexistence studies

[53] MVDDS 5G Coalition Petition Public Notice Reply at 8–9.

[54] *See 12.2 NPRM,* 36 FCC Rcd at 616–617, para. 24.

[55] *See 12.2 NPRM,* 36 FCC Rcd at 616, para. 23.

[56] S*ee 12.2 NPRM,* 36 FCC Rcd at 616, para. 23.

[57] DISH Comment at 3.

[58] RS Access Comment at 45.

[59] AT&T Reply at 11.

[60] AT&T Comment at 8.

[61] *See* AT&T, AT&T & TPG Close DIRECTV Transaction (Aug. 2, 2021), *https://about.att.com/story/2021/att_directv.html;* AT&T, AT&T Completes Acquisition of DIRECTV (July 24, 2015), *https://about.att.com/story/att_completes_acquisition_of_directv.html.*

[62] DIRECTV July 18, 2022 DBS Analysis at 1.

[63] DIRECTV July 18, 2022 DBS Analysis at 1.

[64] *See, e.g.,* DIRECTV July 18, 2022 DBS Analysis at 6. Largely to protect DBS receivers installed after an MVDDS transmitter is successfully coordinated with DBS, the MVDDS transmit power limit is 14 dBm/24 MHz (or 20 dBm/100 MHz). By comparison, the 2016 MVDDS 5G Coalition coexistence study assumed two-way terrestrial operations at 48 dBm/100 MHz, and the most recent RKF Study assumed a new 5G system would operate at 65 dBm/100 MHz, however, 5G advocates have not proposed any rules regarding power limits that they would deem reasonable to provide 5G service while still protecting incumbent DBS subscribers. The Commission notes that a 28–45dB higher transmit power for the proposed 5G service would make meeting the regional EPFD limits to existing DBS subscribers much more challenging and would significantly increase the burden on DBS operators to protect new or modified DBS subscriber receivers.

[65] MVDDS 5G Coalition Petition Public Notice Comments at 4–6.

[66] *See* DIRECTV July 18, 2022 DBS Analysis at 1 (the assumptions made by the Coexistence Studies ''do not accurately reflect the characteristics of either an ubiquitous, modern, high-power terrestrial mobile service or DIRECTV's DBS service.'').

[67] The base station EIRP is 75 dBm/100 MHz but the base station EIRP density is reduced by the base station TDD activity factor of 75% to 69dBm/100 MHz. *See* DIRECTV July 18, 2022 DBS Analysis at 4–5.

[68] DIRECTV July 18, 2022 DBS Analysis at 1.

[69] *See* Letter from Pantelis Michalopoulos, Counsel, DISH, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, at 2–3 (filed August 8, 2022) (DISH Aug. 8, 2022 Letter). Among other things, DISH questioned SAVID's assumptions about 5G transmit power and DBS dish location; its decision to ''ignore'' the potential for horizon nulling and time variability; and its failure to use LIDAR data to accurately account for clutter loss. *Id.* at 2–3.

[70] Coexistence 1 at 21.

are substantially lower than the 62 dBm/MHz (82 dBm/100 MHz) generally permitted in most other terrestrial mobile bands which operate at lower frequencies with more favorable propagation characteristics and even less than the maximum 47 dBm/10 MHz (57 dBm/100 MHz) permitted in the Citizens Broadband Radio Service (CBRS) service designed specifically for small cell coverage. While the Coexistence studies and the SAVID study do not reach identical conclusions due to differing assumptions, collectively they illustrate that two-way mobile terrestrial 5G operations could not ubiquitously meet the regional EPFD limits that the FCC adopted to protect DBS. As DBS receivers may be located anywhere (and can be either roof-mounted or installed on the ground), and as the Coalition's own Coexistence studies shows the potential for harmful interference from 5G into DBS in some instances, the Commission finds that a new 5G service cannot adequately protect incumbent DBS operators in the band from a significant risk of harmful interference. Moreover, the Commission notes that DISH and other 5G advocates have not proposed or agreed to rules or limits on 5G operations (such as horizon nulling) that DISH suggests might reduce some risk of harmful interference into DBS. However, even if the 5G advocates agreed to use advanced techniques for interference mitigation, that would not solve the underlying problem that a new ubiquitous 5G terrestrial service poses a significant risk of harmful interference to DBS given the ubiquitous nature of both the existing DBS service and the proposed 5G service.

18. The 5G advocates do not address the increased coordination and DBS interference mitigation burdens that would be placed on DIRECTV and its tens of millions of subscribers if the Commission was to permit mobile 5G operations in the 12.2 GHz band.[71] The original Coexistence study proposed to eliminate the MVDDS EIRP limit as duplicative of the EPFD limits, suggesting that keeping terrestrial signals below the applicable EPFD limit at all DBS antenna locations generally could avoid harmful interference to existing DBS subscribers regardless of the EIRP or whether the terrestrial operations were fixed or mobile, or one- or two-way.[72] However, the proposal to eliminate the EIRP limit would substantially redefine the scope of the burden on DBS operators, particularly for the deployment of additional DBS antennas in the future. While the current rules place the burden to ensure that new DBS subscribers do not suffer interference from previously coordinated MVDDS stations on DBS operators, the Commission is not convinced that similarly shifting this burden from 5G to DBS, going forward, would be reasonable because protecting DBS receivers installed in the future from previously coordinated higher-power, two-way, 5G base and mobile stations would be significantly more burdensome—and in some scenarios impossible—than protecting new DBS receivers from previously coordinated, one-way, low-power, fixed MVDDS transmitters. Due to the mobile nature of the proposed 5G service, the location of devices cannot be determined and therefore cannot be avoided through coordination. Also, a two-way service requires the DBS operator to consider both incoming and outgoing signals. Finally, at higher powers, even using advanced techniques, a DBS receiver might not be able to coordinate operation near a 5G base station.

19. Additionally, given that all DBS earth stations look toward the southern sky for communication with geostationary orbit (GSO) space stations orbiting at the equatorial plane, and given that high-gain antennas are necessary for base stations, the *12.2 NPRM* sought comment on whether base station location or antenna orientation can be adjusted to provide greater protection to DBS earth stations.[73] The 5G advocates did not address this issue in their comments, replies, or additional studies, though DIRECTV, in its SAVID study, pointed out that lower earth-station elevation angles generally increase the potential for harmful interference from line-of-sight terrestrial transmitters while higher angles generally result in off-axis attenuation.[74] 5G terrestrial advocates did not address how DBS subscribers in the far northern U.S. could be protected from 5G interference, given the relatively low elevation angles required for subscriber dishes in these regions to point at DBS GSO satellites over the equator. For example, to point a dish in Fairbanks, AK, at a DIRECTV satellite at 95.1° W, an elevation angle of 6.47° is required. Even if the Commission excluded Alaska (as it did in addressing the 3.7 GHz band), an elevation angle of 12.21° is required to point a customer's dish in Bangor, ME, at a DISH satellite at 129° W, and an elevation angle of 17.67° is required in Seattle, WA, to point at a DISH satellite at 72.7° W. That failure of the 5G advocates to acknowledge or address the challenge of adequately protecting DBS customers whose location may render them uniquely susceptible to interference from 5G adds weight to the Commission's conclusion that the record does not support a finding that 5G can coexist with ubiquitous DBS dishes.

20. RS Access and DISH contend that concerns about interference to DBS should be given little weight because DISH is one of the country's two DBS providers and one of the advocates of a new 5G terrestrial service in the band. As such, RS Access and DISH state, ''DISH would not join a proposal that endangers its own service to about 14 million households.'' [75] Admittedly, DISH expresses willingness to accept any resultant increase in coordination and DBS interference mitigation burdens in return for new authority to use its 82 MVDDS licenses for two-way mobile broadband.[76] This is not a case,

[71] *See* Letter from Michael P. Goggin, Assistant Vice President—Senior Legal Counsel, AT&T, to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, Appx. A, AT&T Response to the MVDDS 5G Coalition Technical Studies, at 4 (filed June 14, 2018) (AT&T June 14, 2018 *Ex Parte*) (arguing that eliminating the EIRP limit would render the EPFD analysis impossible to model and have the effect of shifting the burden of interference mitigation from MVDDS licensees to DBS licensees because the EIRP limits were established specifically to mitigate the potential impact of MVDDS operations on future DBS customers).

[72] *See* MVDDS 5G Coalition Petition at 19; MVDDS 5G Coalition Comments at 6, n.21 (citing Coexistence 1 at 4). AT&T had argued that there may be potential statutory issues including whether proposed two-way, mobile use of the band would require an independent technical analysis showing that DBS would be protected. AT&T Opposition at 2, n.4 (citing section 1012 of the LOCAL TV Act). In December 2018, however, this provision of the LOCAL TV Act was stricken. Public Law 106–553, 114 Stat. 2762, 265–66, sec. 1012, Prevention of Interference to Direct Broadcast Satellite Services, *stricken by* Public Law 115–334, 132 Stat. 4490, 4777–78, sec. 6603, Amendments to Local TV Act.

[73] *See 12.2 NPRM,* 36 FCC Rcd at 617, para. 25.

[74] *See* DIRECTV July 18, 2022 DBS Analysis at 6 (noting SAVID's Study assumed that all DBS antennas were pointed toward DIRECTV's central orbital location at 101° W.L.—an assumption that ensures high elevation angles and does not, like the Peters Studies, seek out the worst possible angle over the full range of DBS orbital locations available); *see also* DIRECTV July 18, 2022 DBS Analysis at 3 (noting its deployments were modeled at Orlando, FL, which has high elevation angles to DBS satellites, adding conservatism to the analysis by tending to reduce indicated interference levels).

[75] MVDDS 5G Coalition Reply at 4.

[76] AT&T June 14, 2018 *Ex Parte* at 5–6 (arguing that because DISH holds MVDDS licenses in most of the major markets and has developed an alternative means of video distribution that does not require DBS capabilities, DISH may have less incentive to protect DBS operations than it once did). ''At a minimum, DISH would now balance the impact of the Coalition's proposals on its existing and future DBS subscriber base against the advantages—arguably very profitable ones for existing MVDDS licensees—that would flow to its other services if the request is granted.'' *Id.* at 6. The Coalition responds that ''DISH would have never been member of the Coalition if 5G terrestrial mobile services posed a meaningful risk of harmful

however, where the Commission can conclude—as with DISH's position as the sole licensee with respect to both services in connection with Advanced Wireless Services (AWS)-4 service—that the concerns about harmful interference are capable of resolution by one party. Here, as previously noted, DISH is not the only DBS provider in the band.[77] DISH's support for a new 5G service in the band does not address the potential for harmful interference to DIRECTV's tens of millions of subscribers. For instance, the Commission notes that DISH and DIRECTV dishes may not have an equal susceptibility to harmful interference in any given locale, because their respective subscribers may use different types of dishes (*e.g.,* varying in size) aimed at one or several satellites at different orbital slots in the GSO arc. In short, DISH's DBS system architecture and structure, not to mention its motivations and business plans, may be very different from DIRECTV's. Thus, DISH's lack of concern about and/or willingness to work around potential harmful interference from 5G service in the band cannot be viewed as probative of the question of likely interference to DBS service.[78]

21. Finally, DISH argues that DIRECTV does not use the 12.2 GHz band extensively and mostly relies on other spectrum bands to provide service to its customers. Specifically, DISH claims that ''[a] review of DIRECTV's satellites and orbital slots suggests that DIRECTV has more bandwidth outside the 12 GHz band than DISH has in the 12 GHz band.'' [79] DISH goes on to claim that DIRECTV serves its customers mainly using the Ka-band and Reverse Band working Broadcasting-Satellite Service payloads on its satellites at 99°, 101°, and 103° W.L. slots.[80] DIRECTV responds to this claim by pointing out that it ''continues to rely heavily on the 12 GHz band'' for delivery of its video service to a majority of its DBS customers throughout all fifty states, including customers receiving services on aircraft, boats and RVs, as well as through set-top boxes.[81] The record reflects that DIRECTV continues to use the 12.2 GHz band, having deployed a ''12 GHz payload on a relatively new T16 satellite at 101° W.L.'' [82] Similarly, the Commission finds DISH's arguments about the recent decline of DBS subscribers—both DISH and DIRECTV—unavailing.[83] Regardless of overall subscription trends, each DBS operator continues to add new subscribers that can be located anywhere in the United States, and there continue to be millions of existing DBS customers whose service is entitled to protection from harmful interference.

2. 5G Interference to NGSO FSS

22. The Commission also finds that ubiquitous two-way mobile broadband 5G service is likely to create a significant risk of harmful interference to ubiquitous and increasing NGSO FSS operations.[84] While deployment of NGSO FSS service in the 12.2 GHz band is still developing, terrestrial 5G service in the band is hypothetical. For this reason, the 5G advocates supported their arguments by submitting Monte Carlo simulation analyses that attempt to model the coexistence of the two services.[85] However, 5G advocates did not then use the assumptions underlying their models as a basis for proposing specific rules that would enable coexistence. NGSO FSS operators responded by submitting their own Monte Carlo analyses which sought to correct various assumptions they claim to be erroneous. While the studies provided by the opposing sides contain many contradictory assumptions, ultimately they all agree on the fundamental point that there will be a significant risk of harmful interference to NGSO FSS operations without some geographic separation between a new two-way mobile broadband 5G service and NGSO FSS. The 5G advocates, however, do not propose to limit such new 5G terrestrial service geographically, nor is it clear how such limitations could be consistent with the nature of the 5G service for which they seek authorization. Neither are the authorizations granted to existing NGSO FSS operators limited to specific geographic areas. The Commission therefore finds it would not be in the public interest to allow for a new 5G service in the band as it would cause a significant risk of harmful interference to NGSO FSS where these services are deployed ubiquitously.

23. Significantly, the Commission notes that initially, the MVDDS 5G Coalition (*i.e.,* the petitioners for a new 5G service in the 12.2 GHz band) argued that coexistence with NGSO FSS was not possible. Specifically, the Coexistence studies concluded that 5G terrestrial operations and NGSO FSS operations could not co-exist in the 12.2 GHz band and therefore, the MVDDS 5G Coalition Petition proposed to delete or demote the NGSO FSS allocation to a lower regulatory status with respect to 5G.[86] 5G advocates subsequently shifted their argument to claim that co-existence is possible with the new generation of NGSO FSS systems.[87] When the Commission issued the 12.2 Notice in response to the Petition, it noted the public interest in protecting the significant investments made by NGSO FSS operators in the band. To determine whether NGSO FSS operations could coexist with a new 5G service, the 12.2 Notice sought comment on what technical criteria would be necessary to protect NGSO FSS from harmful interference from high-powered, two-way mobile operations.[88]

interference to its DBS operations.'' Letter from MVDDS 5G Coalition to Marlene H. Dortch, Secretary, FCC, Docket No. RM–11768, at 3–4 (filed Aug. 29, 2018) (MVDDS 5G Coalition Aug. 29, 2018 *Ex Parte*).

[77] In the 12.2 GHz band, as one of two DBS providers, DISH is in a different position than in the 2000–2020 and 2180–2200 GHz bands, where in 2011 it became the only Mobile Satellite Service (MSS) authorization holder. *See Service Rules for Advanced Wireless Services in the 2000–2020 MHz and 2180–2200 MHz Bands,* WT Docket 12–70, Report and Order and Order of Proposed Modification, 27 FCC Rcd 16102, 16109–16110, para. 14 (2012). In that context, despite concerns that multiple satellite and terrestrial operators could not coexist in the same frequency band without interference, the Commission granted DISH authorization to use the 2 GHz MSS bands for terrestrial mobile operations, reasoning that a single operator could manage potential interference between two different systems in the band. *See id.* at 16165–16167, paras. 164–168.

[78] *See* AT&T Reply at 22 (''the fact that DISH may not worry about harmful interference from terrestrial, mobile, flexible-use operations does not lessen AT&T's concerns.'').

[79] Letter from Pantelis Michalopoulos, Counsel, DISH, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, at 1 (filed Apr. 4, 2022); DISH Aug. 8, 2022 letter at 7.

[80] DISH Aug. 8, 2022 letter at 7.

[81] Letter from Stacy Fuller, Senior Vice President, External Affairs, DIRECTV, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, at 2 (filed May 3, 2022).

[82] DISH Aug. 8, 2022 letter at 8.

[83] DISH Aug. 8, 2022 letter at 6–7.

[84] *See* OneWeb July 11, 2022 Analyses at 2 (''Regardless of the assumptions made with respect to NGSO FSS and two-way terrestrial deployments, harmful interference from the proposed terrestrial service will not only exceed the existing interference envelope for MVDDS in the 12 GHz band, but will cause additional harmful interference''); *See also* SpaceX June 21, 2022 Analysis at 2 (''Yet even with . . . favorable assumptions, SpaceX customers could expect to experience harmful interference in the 12 GHz band the vast majority of the time, which would essentially preclude a consumer-oriented commercial satellite service in the band'').

[85] A Monte Carlo (probabilistic) analysis is a simulation that uses random sampling and statistical modeling to estimate mathematical functions and mimic the operations of complex systems. RS Access Comment RKF Study I at 3, n.8 (citation omitted).

[86] The earlier MVDDS 5G Coalition studies found ''MVDDS and NGSO [FSS] cannot effectively share the [12] GHz band, either under the current rules or under any new rules that may be added in response to the Coalition's petition.'' *See* Coexistence 3 Aug. 15, 2016 Study at 18.

[87] *See supra* paras. 3–4 for a discussion of NGSO FSS systems authorized by the Commission in recent years.

[88] *See 12.2 NPRM,* 36 FCC Rcd at 619–620, para. 30.

Specifically, the *12.2 NPRM* asked which maximum power levels could be granted to new terrestrial operations within a framework of service-rule sharing that would still protect incumbents from harmful interference.[89] The *12.2 NPRM* further inquired as to whether applying the existing MVDDS interference criteria [90] to new terrestrial systems would be sufficient to protect NGSO FSS operations.[91] Notably, it specifically inquired about whether subscribers of satellite services were typically located in more rural areas, the propagation characteristics and cell coverage areas that could be expected from 5G base stations in the band, and whether smaller-sized cells could mitigate potential interference from terrestrial services into DBS and NGSO FSS services.[92]

24. In response to the questions raised in the *12.2 NPRM,* RS Access commissioned RKF, a systems engineering firm, to conduct a nationwide simulation of how NGSO FSS and terrestrial 5G systems might interact.[93] Ultimately, RKF provided two studies, both probabilistic Monte Carlo analyses meant to show that terrestrial 5G can coexist with NGSO FSS. In its first study, submitted in May 2021, RKF used the 406 Partial Economic Area (PEA) geographic license areas [94] in the contiguous United States (''CONUS'') to define where the 5G network will be deployed, and broke these into urban, suburban, and rural based on their population density thresholds.[95] Because the May 2021 RKF Monte Carlo analysis assumed the new 12.2 GHz terrestrial 5G service was likely to be deployed in the most densely populated areas with high demand for broadband service, RKF modeled deployment of 5G in census tracts with a population density greater than 7,500 people per square mile in each PEA. It explained, however, that if deployment in these ''urban'' density census tracts did not result in deployment to areas that encompassed 10% of a market's population, it added the most densely populated census tracts in each PEA until the area of deployment covered 10% of the market population.[96] RKF's terrestrial model assumed a 5G network of 49,997 terrestrial macro-cell base stations,[97] 89,970 fixed small-cell base stations,[98] 1,949,760 simultaneously active mobile devices [99] and 6,999 point-to-point backhaul links across CONUS.[100]

25. RKF then modeled the distribution of only SpaceX's NGSO FSS satellite terminals, although there are multiple NGSO FSS operators in the band. RKF's satellite model assumed SpaceX would deploy 2,500,000 satellite user terminals in both urban and rural areas,[101] but for this model, it used a different definition of rural and urban areas than it did for modeling terrestrial 5G operations.[102] RKF assumed the majority of NGSO FSS systems, or 1.65 million Starlink user terminals, would be dropped in random locations in non-metropolitan Rural Digital Opportunity Fund (RDOF) blocks [103] either won by Starlink or won by another bidder,[104] and that the remaining 850,000 Starlink terminals would be deployed in non-RDOF but also 'rural areas.' [105] Starlink terminals were allowed to be within 5 meters of 5G base stations, and the possibility technically exists that RKF's modeling could place NGSO FSS user terminals near 5G terrestrial base stations.[106] However, such proximity appears unlikely because the study endeavored to separate terrestrial 5G and satellite equipment.

26. In RKF's study, the potential for harmful interference to NGSO FSS from multiple elements of 5G systems is aggregated.[107] With respect to each of

[89] *See 12.2 NPRM,* 36 FCC Rcd at 624, para. 42.

[90] *See* 47 CFR 101.113(a) n.11, (f)(1); 101.147(p). *See also* 47 CFR 101.105(a)(4)(i) (limiting the PFD level beyond 3 km from an MVDDS station to -135 dBW/m^2 in any 4 kHz measured and/or calculated at the surface of the earth), 101.129(b) (prohibiting location of MVDDS transmitting antennas within 10 km of any qualifying NGSO FSS receiver absent mutual agreement of the licensees).

[91] *See 12.2 NPRM,* 36 FCC Rcd at 619–620, para. 30.

[92] *See 12.2 NPRM,* 36 FCC Rcd at 624, para. 43.

[93] RS Access Comment at 33.

[94] *See Wireless Telecommunications Bureau Provides Details About Partial Economic Areas,* GN Docket No. 12–268, Public Notice, 29 FCC Rcd 6491 (2014).

[95] Urban has a population more than 7,500, suburban between 7,500 and 600, and rural fewer than 600. RS Access Comment RKF Study I at 6.

[96] RS Access Comment RKF Study I at 26–27.

[97] RS Access Comment RKF Study I at i, 13. Macro cells were deployed by multiplying the capped total of almost 50,000 macro cells by the ratio of the high population density area in a given PEA divided by the total such population in 12.2 GHz eligible areas in all PEAS—*i.e.,* each PEA got a percentage of Macro-cell base stations equal to its proportion of the high population density areas across CONUS. *Id.* at 31. The model deployed Macro-cell base stations in three consecutive waves of decreasing inter site distances between them ranging from 500 meters to 200 meters between base stations for urban areas and 1732 meters between base stations for rural areas. *Id.* at 32.

[98] RS Access Comment RKF Study I at i, 34. Small cell base stations were deployed in the same manner as the macro cell base stations but with smaller distances between these and other small-cell base stations and or macro-cell base stations. *See id.* at 34–35.

[99] RS Access Comment RKF Study I at i, 38. The mobile devices were dropped uniformly but randomly within the base stations' coverage areas, and 80% of the mobile devices were assigned as indoor and 20% as outdoor. *Id.* at 37. Outdoor mobile devices were assumed to have a height above ground level (HAGL) of 1.5m. *Id.* at 37.

[100] RS Access Comment RKF Study I at i, 39. The Study estimated that there were a total of 2,500 macro-cell base stations and 4,499 small-cell base stations without fiber access and required microwave backhaul via the 12.2 GHz band, for a total of 6,999 links. *See id.* at 39. The Study assumed that in 2025, less than 5% of the cell-sites will use microwave backhaul in the 7 GHz to 40 GHz band and hence it distributed such use so that 5% of rural macro-cell base stations, 5% of other macro-cell base stations and 5% of small-cell base stations all use microwave backhaul. *See id.* at 38–39.

[101] RS Access Comment RKF Study I at 16–17.

[102] *Compare* RS Access Comment RKF Study I at 6 *with id.* at 8. RKF adopted the Census Bureau's definition of metropolitan areas as ''urban areas'' which include both cities and surrounding suburbs and it assumed and weighted deployment of satellite terminals to whatever was not metropolitan but instead a ''rural'' area. RS Access Comment RKF Study I at 8.

[103] RDOF blocks are census blocks made available by the Commission's Rural Digital Opportunity Fund auction where no provider is offering, or has committed to offer service of at least 25/3 Mbps. *See* FCC, Rural Digital Opportunity Fund Auction Information, Fact Sheet, *https://www.fcc.gov/auction/904#:~:text=The%20Rural%20Digital%20Opportunity%20Fund%20will%20ensure%20that%20networks%20stand,applications%20as%20well%20as%20today's.*

[104] RS Access Comment RKF Study I at 17. RKF states that for purposes of this analysis, the study assumes that SpaceX would have a penetration rate of 60% in non-metropolitan RDOF areas (or 327,511 terminals) in which they won funding. *Id.* Likewise, the study assumes a 30% penetration rate in non-metropolitan RDOF areas (or 1.3 million Starlink terminals) where another auction participant won funding. *Id.* For those metropolitan RDOF areas that SpaceX won, the study assumes a penetration rate of 15%, which amounts to an assumed 14,600 total Starlink terminals. *Id.* These assumptions, along with metropolitan RDOF areas that SpaceX did not win, resulted in an assumed 1.65 million Starlink terminal deployments. *Id.*

[105] RS Access Comment RKF Study I at 18. In this case of NGSO FSS terminals dropped over ''non-RDOF'' rural areas, 'rural' is defined for NGSO FSS operations the same as for 5G terrestrial deployments—less than 600 people per square mile. *Id.* at 17. NGSO FSS terminals are placed using the Gridded Population of the World (GPW) population density database in proportion to the population density in more populous rural areas, which is similar to how the model sites 12 GHz terrestrial base stations. *Id.* In other words, the model's siting methodology for Starlink terminals in non-RDOF regions is more likely to place terminals in the more populous census tracts in rural areas, where they are deployed in proportion to the population therein using a population density database similar to the method used for siting terrestrial 5G equipment. *Id.* at 17–18, n.39.

[106] RS Access Comment RKF Study I at 18. 5G terrestrial base stations and NGSO FSS user terminals could be near each other, for example if the latter were placed in 'non-urban' areas from a Census Bureau perspective but if these areas still had populations greater than 7,500 persons and were ''urban'' under RKF's standards and therefore also receiving terrestrial 5G equipment. *Id.* at 11.

[107] RS Access Comment RKF Study I at 13. Each macro-cell base station beamforms a narrow beam toward each mobile device, and 5G transmissions are assumed to operate in time-division-duplex (TDD) mode with all the base stations coordinated such that uplink and downlink transmissions are synchronized. *Id.* The study assumes 5G backhaul operates in frequency-division-duplex (FDD) mode,

the NGSO FSS terminals modeled, RKF computed the aggregate interference power from all 5G emitters within 50 km, and compared the result to the interference-to-noise ratio (I/N) threshold to determine the extent to which the threshold would be exceeded.[108] RKF asserted the objective of the simulation was to model a large number of statistically significant interference paths to evaluate the risk of interference to the Starlink terminals.[109] Initially, RKF found that about 0.888% of Starlink user terminals over CONUS could experience an event that exceeded a nominal ITU threshold of −8.5 dB.[110]

27. NGSO FSS operators, especially SpaceX, criticized many of the assumptions underlying RKF's 2021 study. As a result, in May 2022, RS Access submitted a revised study from RKF that modified certain parameters and specific assumptions to respond to the criticism.[111] RKF's revised study still relied heavily on geographic separation to find that a new 5G service could avoid causing harmful interference to incumbent NGSO FSS operations. The study still assumed that new 12.2 GHz 5G deployment and satellite terminals would have limited geographic overlap due to RKF's assessment of their respective use-cases—namely, that 12.2 GHz 5G services will be deployed most heavily in denser population centers, while satellite services are most useful in lower density population centers.[112] RKF's second study modeled the same number of base stations, mobile devices and point-to-point links,[113] and reached the conclusion that there would be no impact to 99.85% of NGSO FSS terminals by the terrestrial deployment it modeled. In particular, it asserted its study now found that only 0.15% of Starlink terminals which might hypothetically be deployed in the future throughout CONUS experienced an exceedance of the ITU's I/N threshold of −8.5 dB I/N from 5G operations in the 12.2–12.7 GHz portion of the NGSO FSS downlink band.[114] RKF asserted that several other factors contributed to the ''highly favorable environment'' for the coexistence of NGSO FSS and 5G systems, including the large antenna discrimination resulting from NGSO FSS antennas pointing with high elevation angle and the 5G base stations down tilted; interference mitigation achieved through 5G base station sidelobe suppression and antenna nulling toward the horizon; and, relatively localized 5G coverage due to the 12.2 GHz band's propagation characteristics.[115]

28. Both SpaceX and OneWeb submitted Monte Carlo analyses in response to the May 2022 RKF study commissioned by RS Access. SpaceX's Monte Carlo study modified certain key assumptions including basing buildout in an actual SpaceX market area in Las Vegas, Nevada upon its own asserted user data,[116] and buildout requirement for terrestrial mobile services of 70 percent of population, among other assertions.[117] SpaceX asserted its study showed an impact from interference from terrestrial mobile service that would degrade service to SpaceX's Starlink broadband terminals operating in the 12.2 GHz band more than 77 percent of the time, resulting in full outages 74 percent of the time.[118] Furthermore, SpaceX stated its study showed the impact of this harmful interference would extend at least 21 km (more than 13 miles) from the macro base station in unobstructed conditions even for best-case far-sidelobe-to-far-sidelobe coupling.[119] SpaceX used an antenna receiver pattern based upon the applicable ETSI standard (ETSI_EN_303_981 Class B WBES),[120] and the SpaceX analysis is based on seven 240 megahertz channels with 250 megahertz spacing from 10.95–12.7 GHz.[121] OneWeb's study similarly concluded that NGSO FSS user terminals cannot be deployed within the coverage area of a suburban macro-cell base station deployment without suffering from very high probability of harmful interference.[122]

29. While the analyses submitted by SpaceX and OneWeb have very little accord with the RKF analyses, all of these analyses agree, on some level, on one point: NGSO FSS user terminals will suffer harmful interference if they are operating in close proximity to 5G transmissions in the 12.2 GHz band. The RKF analyses come to this conclusion tacitly because rather than providing a calculation of the separation distance that would be necessary to protect NGSO FSS terminals from harmful emissions from 5G transmitters, these RKF analyses simply assume that in most situations 5G and NGSO FSS services will not be used by consumers

and both uplink and downlink paths transmit continuously. *Id.* The base station antenna has 256 elements with a peak gain of 27.7 dBi which beamforms toward each mobile device but is constrained by the minimum antenna down tilt levels designed so that the gain directed toward a mobile device at 1.5m HAGL at the edge of coverage of the cell is 10 dB below the peak gain—allowing service at the edge of coverage; smalls cells have a peak gain of 15 dBi. RS Access May 19, 2022 RKF Study II at 11. Starlink terminal selects a random pointing direction from the distribution of simulated pointing directions. RS Access Comment RKF Study I at 13. Then the aggregate interference from all simultaneously active macro base station beams and small-cells on the downlink or all active mobile devices on the uplink, as well as the point-to-point backhaul uplink and downlink transmissions to each of the Starlink terminal receivers within 50 kilometers is computed. *Id.* RKF states the model calculates the emissions from macro-cell base stations as they beamform a transmission path toward each mobile device within the coverage area of each base station. Small-cell emissions are also calculated; these emissions are not beamformed to specific mobile devices, but are instead transmitted omnidirectionally with fixed down tilt and nulling. RS Access May 19, 2022 RKF Study II at 9. Then the model performs two separate aggregate interference power calculations: (1) from all simultaneously active macro base station beams, all small cells on the downlink, and all point-to-point backhaul transmissions, which continually transmit in FDD mode in both directions; and (2) from all active mobile devices on the uplink and all point-to-point backhaul transmissions. *Id.* at 9–10.

[108] RS Access May 19, 2022 RKF Study II at 9–10.

[109] RS Access Comment RKF Study I at 10.

[110] RS Access Comment RKF Study I at 2.

[111] RS Access May 19, 2022 RKF Study II at 6.

[112] RS Access May 19, 2022 RKF Study II at iii.

[113] RS Access May 19, 2022 RKF Study II at 2–3.

[114] RS Access May 19, 2022 RKF Study II at 25. RKF asserts that the exceedance threshold of −12.2 dB, suggested by some critics, would not materially affect this study's findings. *Id.* at 26. Furthermore, it noted that any exceedance event that might occur would also affect no more than two of the up to eight available 250-megahertz Ku-band NGSO FSS channels at 10.7–12.7 GHz. *Id.* at 5, 25.

[115] RS Access May 19, 2022 RKF Study II at 7. There are several additional differences from the May 2021 and 2022 RKF Studies, albeit RKF emphasized three. First, whereas in its 2021 Study, RKF assumed Starlink terminals would point at satellites with look angles or elevation angels between 55° and 85°, in response to Starlink criticism, it assumes terminals will more frequently employ a lower elevation angle closer to the minimum authorized angle of 25°. *Id.* at 19. Second, RKF has changed the height above ground level for Starlink terminals from 20% sited at 4.5 meters and 80% at 1.5 meters, instead to 55% at 4.5 meters and 45% at 1.5 meters, in response to claims by Starlink that most users install their terminals ''as high as possible.'' *Id.* at 20. Third, in response to a Starlink claim, a maximum off-axis antenna gain pattern from an European Telecommunications Standards Institute (ETSI) standard for user terminals is used even though RKF asserts no party expressly claims that Starlink terminals perform at this standard and ETSI formulas results in a larger assumed off-axis gain, which in turn makes Starlink terminals more prone to exceedance events. *Id.* at 21–22. Other differences between the two studies include changes in the macro-cell and small-cell base station antenna patterns used, the peak EIRP of the macro cells decreased from 75 dBm/100 MHz to 65 dBm/100 MHz with gain of 27.7 dBi (small-cell base stations likewise increased their EIRP from 45 to 48 dBm/100 MHz but with an increased gain of 18 dBi and not 15 dBi which is accomplished through including horizon nulling and beamforming technologies), and the application of end-point clutter loss at the user equipment (UEs) with an HAGL of less than 3m and at small-cell base stations (typically deployed on poles in the vicinity of buildings), incorporating horizon nulling into macro cell base stations. *Id.* at 2.

[116] SpaceX June 21, 2022 Analysis at 3.

[117] SpaceX June 21, 2022 Analysis at 4.

[118] SpaceX June 21, 2022 Analysis at 2.

[119] SpaceX June 21, 2022 Analysis at 3.

[120] SpaceX June 21, 2022 Analysis at 8.

[121] SpaceX June 21, 2022 Analysis at 9.

[122] *See* OneWeb July 11, 2022 Analyses at 8–9.

in the same locations. Specifically, the RKF studies assume that 5G will most likely operate only in denser, more urban markets and NGSO FSS services will most likely serve only more rural subscribers. Satellite operators, and other parties in the record, have provided more express analyses than RKF of the potential for harmful interference to NGSO FSS operations from 5G operations in close proximity. For example, Google noted in its reply comments that although RKF's report did not separately present the potential interfering impact of a single UE (handset) located in the vicinity of a satellite terminal—because it assumed it was unlikely a handset would be near a satellite terminal—Google's calculations showed that when such a situation inevitably occurs, harmful interference can be expected out to a distance of as much as 0.2–1 km under realistic propagation assumptions, and as far as 3 km under worst-case conditions.[123] For its part, SpaceX asserted that satellite user terminals would be subjected to significant interference whenever located in the line of sight of a 5G base station. Further, SpaceX states that even for best-case far-sidelobe-to-far-sidelobe coupling, the effect of harmful interference (I/N > −12.2dB) between these two operations will extend up to 21.4 km (more than 13 miles) from the macro base station in unobstructed conditions.[124] According to SpaceX, its satellite user terminal is about 16 dB more sensitive to the interfering signal coming into its far sidelobes than the mobile UE is for its desired signal.[125] As a result, if a SpaceX user terminal is located in an area where a mobile device can receive a signal from the base station, the interfering signal its terminal receives will be much stronger than the desired signal received by the user device.[126] Because of their sensitivity, SpaceX states that even if its satellite terminal antennas are pointing only at high elevation angles so that terrestrial mobile signals are only received at large off-axis angles, interference will be overwhelming within the coverage area of a terrestrial base station.[127] SpaceX asserts that RKF recognized this point when it admitted that ''Starlink terminals within the 5G coverage area typically suffered an exceedance.'' [128]

30. Although RKF did not provide specific analysis of the separation distances necessary to protect NGSO FSS user terminals from 5G transmissions, it argued that there would be a natural geographic separation between the two services, based on constraints on the number of user terminals an NGSO FSS system can deploy to one area. For example, the RKF study asserted that while an NGSO FSS licensee can deploy terminals in metropolitan areas, such as New York City or Los Angeles, satellite capacity constraints limit the total number of terminals NGSO FSS licensees can support in any one of these densely populated zones.[129] To illustrate this point, RKF has pointed to statements by Starlink's CEO that its service is not well suited to urban areas.[130] SpaceX does not directly address RKF's capacity argument but it responds that in the very few areas where RKF does consider terrestrial and NGSO FSS systems operating in close proximity, its model finds I/N ratios of 50 dB or more.[131] Furthermore, SpaceX argues that, by assuming only 1.07 percent of SpaceX user terminals would be deployed in urban areas, RKF significantly underestimated the effect of the proposed system on the existing Starlink customers.[132] OneWeb agrees that terrestrial separation of NGSO FSS and 5G terminals is an unrealistic assumption,[133] and states that it intends to focus its initial service on enterprise, government, and mobile network operator customers, which will require connectivity across metropolitan, suburban, and rural areas.[134]

31. The Commission finds that the 5G proponents' arguments that a new 5G service could adequately protect NGSO FSS operations from harmful interference rely too heavily on the unsupported assumption that there will be geographic separation between the services. Neither the FCC's rules governing NGSO FSS operations in the band nor the authorizations that the FCC has granted to NGSO FSS operators place any limitations of the sort assumed by 5G proponents on where these NGSO FSS services may operate.[135] NGSO FSS systems are not restricted to rural areas; indeed, SpaceX is currently authorized to deploy satellites throughout CONUS and for an unlimited number of its second-generation user terminals anywhere within the United States.[136] At this time, satellite operators' plans for, and rollout of service using, this band are still in the early stages, and operators have stated their intentions to serve urban and suburban areas.[137] Based on the current record, and the Commission's experience, the Commission concludes that authorizing separate, ubiquitous satellite and terrestrial mobile systems in the same band would be significantly likely to result in harmful interference. Although the technical analyses that 5G advocates submitted made a number of

[123] Google Reply at 14.

[124] SpaceX June 21, 2022 Analysis at 11. SpaceX used RKF's assumption that the macro base station has an input power of 41.3 dBW per 100 MHz per user and that the SpaceX user terminal has a −2 dBi far sidelobe gain and 200 K system noise temperature. SpaceX also assumed that the far sidelobe level of the macro base station is −2.3 dBi. RKF assumed a −30 dBi sidelobe performance for macro base stations. And, in its later Monte Carlo simulation, SpaceX used the same −30 dBi sidelobe floor for an individual sector antenna pattern, although SpaceX states this value is highly optimistic. *Id.*

[125] SpaceX June 21, 2022 Analysis at 13.

[126] SpaceX June 21, 2022 Analysis at 13. SpaceX argues that even for a mobile UE with a very modest signal-to-noise ratio of only 0 dB (*i.e.,* at the UE noise floor), for the SpaceX user terminal, this mobile signal becomes an interferer that is 16 dB above the noise floor of the user terminal (I/N = 16 dB) and completely wipes out the desired signal. *Id.*

[127] SpaceX June 21, 2022 Analysis at 13.

[128] SpaceX June 21, 2022 Analysis at 13–14 (citing Letter from V. Noah Campbell, CEO, RS Access, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20–443, Attach. A, Bringing 5G to the 12 GHz Band, at 11 (filed June 1, 2022)).

[129] RS Access Comment RKF Study I at 8.

[130] RS Access May 19, 2022 RKF Study II at 25, n.65 (citing Jon Brodkin, *Elon Musk: Starlink latency will be good enough for competitive gaming,* Ars Technica (Mar. 10, 2020), *https://bit.ly/3dUrbbu* (quoting Elon Musk: ''The challenge for anything that is space-based is that the size of the cell is gigantic . . . it's not good for high-density situations. We'll have some small number of customers in LA. But we can't do a lot of customers in LA because the bandwidth per cell is simply not high enough.'')).

[131] SpaceX June 3, 2022 Response to Revised RKF Report at 3, n.9 (citing RS Access May 19, 2022 RKF Study II at 27 and Fig. 3–3).

[132] SpaceX June 21, 2022 Analysis at 9. SpaceX argues its actual distribution as based on the Las Vegas PEA is places 17% in urban areas, 37% in suburban areas and 46% in rural areas. *Id.*

[133] OneWeb has argued that suburban macro-cell base station deployments will result in harmful interference to NGSO FSS User Terminals when considering real world deployment scenarios. Letter from Brian D. Weimer, Counsel, OneWeb, to Marlene H. Dortch, WT Docket No. 20–443, Attach. B, 12 GHz NGSO FSS Earth station and Terrestrial Study, at 10 (filed Oct. 7, 2022). *See also* OneWeb July 11, 2022 Analyses at 3 (notes omitted) (''The principle defect of the [RKF Study attached to Comments of] RS Access] is the assumption of geographical separation: that NGSO FSS user terminals will be deployed with a heavy bias towards rural areas while mobile base stations and devices will be heavily skewed towards urban areas. There is no real world justification for this bias.'').

[134] OneWeb July 11, 2022 Analyses at 3, n.8.

[135] *See, e.g., Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters,* Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017), recon. pending (*NGSO FSS Report and Order*).

[136] *See Space Exploration Holdings, LLC, Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, et al.,* Memorandum Opinion and Order and Authorization, 33 FCC Rcd 3391, para. 1 (2018); SpaceX June 21, 2022 Analysis at 14, n.41 (citing Radio Station Authorization, Call Sign E210127 (issued Nov. 10, 2021)).

[137] *See, e.g., supra* para. 30.

hypothetical assumptions about how both a new 5G service and NGSO FSS service would be deployed, including 5G operating parameters that could reduce or mitigate interference, 5G proponents did not propose or agree to be bound by any specific rules to codify these assumptions. Given the Commission's conclusion that NGSO FSS terminals will experience harmful interference if placed in close proximity to terrestrial 5G deployment, and the lack of apparent disagreement by 5G advocates, the Commission declines to authorize a new terrestrial 5G service in the 12.2 GHz band based on the current record.

32. As noted, the Monte Carlo analyses provided by the 5G advocates incorporate a set of assumed operating parameters intended, in addition to geographic separation, to reduce the possibility of harmful interference to NGSO FSS user terminals. These assumptions have become objects of criticism from NGSO FSS interests who argue that their adjustment can skew the interference picture away from showing the significant risk of harmful interference NGSO FSS systems would suffer. Below, the Commission discusses some of the major disagreements on assumptions the parties have raised in the record. The Commission cautions, however, that these assumptions do not change the Commission's bottom-line decision declining to permit 5G operations in the 12.2 GHz band, due to the risks of harmful interference into NGSO FSS user terminals when the two services are in close proximity. Accordingly, other than in a few instances where the Commission has pointed out that certain debates about assumptions may be missing critical information, the Commission declines to weigh in concerning the relative merits of particular assumptions.

33. *Ignoring Access to Other Bands and Other NGSO Deployments.* The RKF study assumed that Starlink is assigned eight 250 MHz channels from 10.7–12.7 GHz.[138] SpaceX argues its model did not incorporate use of the 10.7–10.95 GHz portion of the band due to regulatory constraints imposed to protect Radio Astronomy activity in the adjacent 10.6–10.7 GHz band.[139] Accordingly, the SpaceX analysis is based on seven 240 MHz channels with 250 MHz spacing from 10.95–12.7 GHz, whereas RKF appears to assume access to all bands. RS Access argues SpaceX's failure to incorporate the entire 10.7–12.7 GHz range into its calculations, and its use of only the 12.2–12.7 band for downlink increases the probability of interference exceedance experienced by Starlink terminals by a factor of four. RS Access finds this one of the most critical assumptions causing SpaceX's interference results to differ from its own. Furthermore, SpaceX argues RKF only models SpaceX terminal deployments and omits studies of any interference created by deployment of other NGSO FSS operations.[140]

34. *Height of Fixed Subscriber Antennas.* The height at which users mount their SpaceX user terminals has a dramatic effect on the interference to which they are subject—higher placement also means that they are more likely to receive more direct interference from mobile system base stations and UEs.[141] The May 2021 RKF Study assumed a distribution of NGSO FSS fixed subscriber terminals more heavily weighted toward ground installations—80% of Starlink terminals would have an HAGL at 1.5m, and 20% would have an HAGL of 4.5m. RKF's May 2022 study modified this assumption and instead assumed that 45% of Starlink terminals would be installed near ground level with an HAGL of 1.5m, and 55% of Starlink terminals would be installed on rooftops with an HAGL of 4.5m.[142] In response, SpaceX argued this modification still failed to reflect that the majority of SpaceX's customers deployed their antennas on rooftops to avoid obstructions, which significantly increases the likelihood of an unobstructed path for interference from a mobile service base station.[143] SpaceX argued its own informal customer surveys showed that most consumers mounted their antennas on a roof, and accordingly, SpaceX argued that 10% of its user terminals would be deployed at a height of 1.5m and 90% would be deployed at a height of 4.5m.[144] OneWeb agrees most NGSO FSS user terminals are expected to be deployed on rooftops and that such installation practices are consistent with decades of satellite infrastructure deployments.[145]

35. *Number of Macro Cells Deployed.* RKF's May 2022 study models 49,997 5G macro base stations throughout CONUS, distributed in the most densely populated areas of each PEA, comprising at least 10% of the population of the PEA.[146] SpaceX has criticized RKF's 10% coverage, contending that RKF's 10% minimum buildout assumption falls far below the 70% to 80% population coverage requirement the Commission has routinely applied to other recently allocated flexible use spectrum, and it asserts the lower percentage buildout results in less interference, thus skewing the results of RKF's study.[147] SpaceX assumed 3,215 macro base stations in the Las Vegas market in its study,[148] which RKF criticized as being a vast overestimation of typical 5G deployment.[149] However, SAVID, which SpaceX hired to review the RKF studies, later argued that the number of macro base stations assumed in the SpaceX analysis did not have a material impact on the interference analysis results.[150] The Commission notes that looking at the Upper Microwave Flexible Use Service (UMFUS) requirements for bands such as 24 GHz and above, licensees may fulfill their performance requirements in various ways, including providing mobile service to 40% of the population of the license area or by demonstrating coverage of at least 25% of their license's geographic area, or by showing the presence of equipment transmitting or receiving on the licensed spectrum in at least 25% of census

[138] RS Access May 19, 2022 RKF Study II at 11. Thus, a ''fully loaded'' 12 GHz sector can serve a maximum of 20 mobile devices simultaneously. *Id.*

[139] SpaceX June 21, 2022 Analysis at 9.

[140] SpaceX June 21, 2022 Analysis at 4.

[141] SpaceX June 21, 2022 Analysis at 7.

[142] RS Access May 19, 2022 RKF Study II at 20.

[143] SpaceX June 21, 2022 Analysis at 8.

[144] SpaceX June 21, 2022 Analysis at 8.

[145] OneWeb July 11, 2022 Analyses at 5.

[146] RS Access Comment RKF Study I at 9.

[147] SpaceX June 3, 2022 Response to Revised RKF Report at 2. SpaceX has argued RKF's 10% buildout is also inconsistent with the economic study submitted by terrestrial mobile proponents, which ''assume the terrestrial mobile operations in the 12 GHz band will be available ubiquitously''[. . .]and is also inconsistent with the public interests claimed by members of its coalition that mobile services in 12 GHz band be required to serve rural customers, left behind by other 5G deployments.'' SpaceX June 21, 2022 Analysis at 11 (notes omitted).

[148] SpaceX June 21, 2022 Analysis at 15.

[149] *See* RS Access July 15, 2022 RKF Response Study at 9–10 (''If a 5G operator sought to meet Starlink's assumptions and built-out a nationwide 5G network that scaled the 540 POPs per cell Starlink modeled, the operator would have to deploy 610,000 base stations. By contrast, AT&T uses approximately 75,000 towers . . . to support a fully nationwide network . . . .''). However, RKF also modeled 89,970 fixed small-cell base stations. RS Access Comment RKF Study I at 34. OneWeb notes that 12 GHz terrestrial mobile deployments, should they be allowed, would mostly be on small-cell base stations like the C-band and Ka-band flexible-use deployments for in-fill where more capacity is desired, and according to CTIA, up to 800,000 small cells could be deployed within the next 5 years. *See* OneWeb Reply at 19–20. OneWeb states that even if half of these projected small cells included the 12 GHz band, it would represent a five-fold increase over the RKF study's small-cell deployment assumptions, and the number of affected Starlink terminals could be 9 times higher than predicted for the small-cell base stations. *Id.* at 20–21.

[150] SpaceX Oct. 4, 2022 SAVID Report at 12.

tracts within the license area.[151] Accordingly, the relevant percentage buildout that would be required at 12 GHz may be different than either side's assumptions.[152]

36. *Technical Advancements.* SpaceX argues that the RKF studies incorporated unreasonable technical advancements into their models of 5G handsets, lowering the estimated interference received. For example, the May 2022 RKF study incorporated horizon nulling into the performance of 5G macro-cell base stations whereby 5G antennas can null the gain pattern at the horizon at all azimuth angles to mitigate ground-based interference to NGSO FSS terminals.[153] SpaceX argued ''[this] is a neat trick when the terrestrial operator does not know where the NGSO FSS antennas are located.'' [154]

37. *Transmitter Power and Path Loss.* As noted previously, RKF changed its transmitter power from 75 dBm to 65 dBm in its second study.[155] SpaceX has supplied its own engineering report arguing that ITU WP 5D which studied terrestrial mobile in the 10–11 GHz bands also assumes 72.6 dBm/100 MHz as a typical base station EIRP value, making 75 dBm the more likely number.[156] OneWeb agrees that 75 dBm/100 MHz is more realistic.[157] Furthermore, the OneWeb study uses the probabilistic clutter model found in Recommendation ITU–R P.2108, which provides a clutter assumption that is expected to be greater than predicted in 10% of the cases, and applies clutter only at the user terminals and only for those terminals deployed at ground level (as opposed to those presumed to be clutter-free on rooftops). Tailored in this manner, OneWeb can temper the recommendation's potentially overly aggressive prediction of clutter losses, yet model expected clutter losses at a range of geographic locations.[158]

38. Furthermore, both the RKF and SpaceX analyses model path loss using 3rd Generation Partnership Project (3GPP) Specification 38.901, applying the Urban Macro-Cell model for both urban and suburban macro-cells at 30 meters to 1 km distance, the Rural Macro-Cell model for rural macro-cells at 30 meters to 5 km, and the Micro-Cell (''Umi'') model for small-cells at 30 meter to 1 km distance.[159] However, SpaceX argues, RKF subtly understates the high interference line of sight cases in the 3GPP 38.901 model by using a single weighted average between NLOS (non-line of sight) and LOS (line of sight) path loss to represent both cases.[160] SpaceX argues RKF's approach of employing a weighted average to represent two distinctly different cases dramatically understates the line of sight cases that would actually occur under the 3GPP 38.901 model.[161] SAVID asserts that while the parties debate either −8.5 dBm or −12.2 dBm I/N, an alternative interference protection criterion based on the Power Flux Density (PFD) limit set by 47 CFR 101.105(a)(4)15 should be considered.[162] In this regard, SAVID points out that the FCC specifically set the maximum PFD limit from an MVDDS service transmitting antenna in NGSO FSS stations at 12.2–12.7 GHz at −135 dBW/m2 in 4 kHz at 3 km, which is the equivalent of an I/N threshold of −10.8 dB.[163] SAVID asserts this means that even for Starlink terminals in the most favorable location in the BS antenna pattern, there must be at least 25.5 dB of clutter loss to meet the FCC MVDDS PFD limit at 3 km separation.[164]

39. The parties' disagreements about the above assumptions underlying how two-way 5G mobile broadband and NGSO FSS user terminals should be modeled does not change the Commission's fundamental conclusion that there will be a significant risk of harmful interference to NGSO FSS where these services are deployed without adequate geographic separation. Even if the parties could agree about the values that should be assigned to each of the models' more minor assumptions, it would not change the models' more fundamental flawed assumption that the 5G and NGSO FSS services will be geographically separated. Rather, these disagreements present even more evidence of the difference in opinion between the parties as to the envisioned technical specifications of their respective operations. NGSO FSS continues to evolve and there is not enough data in the record on how these systems are currently configured and how the technical parameters will change over time as NGSO FSS systems add additional subscribers and continue to refine satellite technology.

---

[151] *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.,* Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8088, para. 206 (2016) (stating that a licensee providing mobile service must provide coverage to 40 percent of the population of the license area); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.,* Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd 5576, 5580, para. 8 (2018) (stating that licensees may fulfill the requirements of [the geographic area performance] metric either by demonstrating mobile or point-to-multipoint coverage of at least 25% of their license's geographic area, or by showing the presence of equipment transmitting or receiving on the licensed spectrum in at least 25% of census tracts within the license area . . . maintain[ing] parity with the 40% population coverage metric.).

[152] *See, e.g.,* Notice of Proposed Rulemaking at section V.C.6 (Performance Requirements) (seeking comment on the appropriate coverage percentages for the 12.7 GHz band) in associated GN Docket No. 22–352 (FCC 23–36).

[153] RS Access May 19, 2022 RKF Study II at 12.

[154] SpaceX argues RKF assumptions about nulling technology rely on letters from NOKIA, Ericsson, and Samsung, but it states that first none of these materials refer to any specific level of sidelobe suppression capability from nulling and only Samsung mentions nulling at all, and only as a means of avoiding interference to other mobile user equipment. SpaceX June 3, 2022 Response to Revised RKF Report at 5, n.23 (discussing RS Access May 19, 2022 RKF Study II at 12, n.40 (citing Letter from Jeffrey Marks, Vice President, Nokia, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18–122 (filed Sept. 21, 2021); Letter from Mark Racek, Sr. Director of Spectrum Policy, Ericsson, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18–122 (filed Sept. 13, 2021); Letter from Robert Kubik, Sr. Director, Samsung, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18–122 (filed Sept. 20, 2021)). Second, SpaceX argues these letters were filed in the C-band proceeding and that RKF provides no explanation to justify its approach to scaling for the much higher frequencies at 12 GHz. SpaceX June 3, 2022 Response to Revised RKF Report at 5. Furthermore, SpaceX notes there is no 12 GHz equipment and no ITU, 3GPP, or other performance standard for 12 GHz and RKF does not explain how it came up with its assumptions for this band. *Id.* Third, SpaceX argues the letters from Ericsson and Samsung mention grating lobes, but RKF does not consider their effects in its model. *Id.* Fourth, even if nulling were feasible in the 12 GHz band, SpaceX argues it is expensive technology that operators are unlikely to deploy voluntarily—yet no one has proposed to make such technology a regulatory requirement, making RKF's assumption that it will be deployed facially unreasonable. *Id.* And SpaceX argues that, fifth, RKF assumes that the macro base stations use a 256-element antenna, while both Nokia and Ericsson indicate that they contemplated the use of much smaller 96-element antennas, which would result in lower gain, wider beam width, worse sidelobes, and reduced nulling ability. *Id.*

[155] RS Access May 19, 2022 RKF Study II at 12.

[156] SpaceX Oct. 4, 2022 SAVID Report at 4 (citing Report on the 38th meeting of Working Party 5D (e-Meeting 7–18 June 2021), Annex 4.4 to Document 5D/716–E, *https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-0716!H4-N4.04!MSW-E.docx,* Table 3–1 entry 4.5 applicable to the 10–11 GHz band refers to Table 10 entry 1.9 which defines the typical values for antenna element input power of 22 dBm. Using the array parameters in Table 10 results in a typical BS EIRP of 72.6 dBm (in 100 MHz) which is comparable to the 75 dBm/100 MHz maximum EIRP density used in this analysis based on the FCC limit defined in 47 CFR 30.202(a)).

[157] OneWeb July 11, 2022 Analyses at 6.

[158] OneWeb July 11, 2022 Analyses at 5–6.

[159] SpaceX June 21, 2022 Analysis at 9–10.

[160] SpaceX June 21, 2022 Analysis at 10.

[161] SpaceX June 21, 2022 Analysis at 10.

[162] SpaceX Oct. 4, 2022 SAVID Report at 5–6.

[163] SpaceX Oct. 4, 2022 SAVID Report at 6.

[164] SpaceX Oct. 4, 2022 SAVID Report at 6. OneWeb stated its OneWeb July 11, 2022 Analyses uses the probabilistic clutter model found in Recommendation ITU–R P.2108, which provides a clutter assumption that is expected to be greater than predicted in 10% of the cases, and applies clutter only at the user terminals and only for those terminals deployed at ground level (as opposed to those presumed to be clutter-free on rooftops). OneWeb July 11, 2022 Analyses at 5–6.

Furthermore, this band is not internationally harmonized for terrestrial 5G use and there is significant disagreement about what an operable 5G system would look like in this band. 5G terrestrial advocates have not demonstrated that it is in the public interest to restrict or impact NGSO FSS operations in urban/suburban markets—especially given that NGSO FSS systems are already serving customers. At this time, the Commission does not see a path forward for adding a terrestrial mobile allocation to the band that adequately protects the incumbent satellite operators.

C. MVDDS Construction Filings

40. While the Commission declines to adopt service rules to allow 5G terrestrial use of the 12.2 GHz band as originally proposed by the MVDDS coalition, the Commission recognizes that many of the MVDDS licensees in the band have filed the required buildout showings for the licenses they hold under the current framework. In the accompanying further notice of proposed rulemaking (WT Docket No. 20–443) (FR 2023–13501) in FCC 23–36, the Commission seeks comment, among other things, on the possibility of changes to the existing framework. The Commission finds it's appropriate at this juncture to address any uncertainty as to the status of the existing MVDDS licenses under the current rules.

41. Eight companies (10 legal entities) hold 191 MVDDS licenses: two DISH subsidiaries hold 82 licenses; RS Access, a subsidiary of a Dell investment fund, holds 60 licenses; two Go Long Wireless entities hold a total of 25 licenses; and five smaller companies hold a total of 24 licenses.[165] As a construction requirement, MVDDS licensees must make a showing of substantial service at the end of five years into the license period and ten years into the license period.[166] The Commission is aware of only one current commercial MVDDS deployment,[167] and most MVDDS licensees received two extensions of the MVDDS buildout requirement, which resulted in final deadlines in 2019.[168] All of the existing licensees have had buildout showings pending since 2019 for each of their licenses, which are available to view in the Commission's Universal Licensing System (ULS).[169] In the 191 pending filings, each licensee reports that it met the 2019 buildout requirement for each license, mostly by satisfying the safe harbor that the Commission established for MVDDS in 2002 of operating at least four transmitters per one million pops in each license area.[170] The Wireless Telecommunications Bureau staff's preliminary review of these construction filings is that they likely meet the safe harbor standard. Accordingly, the Commission directs the Wireless Telecommunications Bureau to finalize the determination of whether the construction filings meet the safer harbor standard and if so to accept each of the pending MVDDS construction filings subject to the following condition: the Commission reserves the right to adopt additional buildout requirements for MVDDS if appropriate based on any revisions to the MVDDS rules adopted in response to the further notice of proposed rulemaking.

42. The Commission further directs the Bureau to reconsider its denials of 2016 requests to extend buildout deadlines for 22 MVDDS licenses, and to extend the buildout deadlines for these licenses for 18 months from the effective date of this item, subject to the same condition above.[171] The Commission believes that the unique circumstances of this proceeding, namely the uncertainty created by the MVDDS 5G Coalition's request for 5G terrestrial use, makes strict application of the buildout deadlines contrary to the public interest.[172] Eliminating the uncertainty over these 22 MVDDS licenses will best serve the public interest by promoting fuller participation in the record to be developed in response to the Further Notice of Proposed Rulemaking as well as by providing additional certainty regarding the status of these MVDDS licenses.

II. Ordering Clauses

43. *It is ordered* that, pursuant to sections 1, 2, 4, 5, 301, 302, 303, 304, 307, 309, 310, and 316 of the Communications Act of 1934, 47 U.S.C. 151, 152, 154, 155, 301, 302a, 303, 304, 307, 309, 310, 316, and § 1.411 of the Commission's rules, 47 CFR 1.411, the Report and Order and Further Notice of Proposed Rulemaking and Notice of Proposed Rulemaking and Order in the captioned dockets *is adopted*.

44. The inquiry in *Expanding Flexible Use in Mid-Band Spectrum Between 3.7–24 GHz,* GN Docket No. 17–183, is *terminated* as to the mid-band spectrum between 12.2 GHz and 13.25 GHz.

45. *It is further ordered* that, pursuant to applicable procedures set forth in §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415, 1.419, interested parties may file comment on the *Further Notice of Proposed Rulemaking* in WT Docket No. 20–443 and the *Notice of Proposed Rulemaking* in GN Docket No. 22–352 on or before the number of days shown on the first page of this document after publication in the **Federal Register**, and reply comment on or before the number of days shown on the first page of this document after publication in the **Federal Register**.

[165] The remaining 23 licenses automatically terminated for failure to meet the buildout requirement. *See Requests of Three Licensees of 22 Licenses in the Multichannel Video and Data Distribution Service for Extension of Time to Meet the Final Buildout Requirement for Providing Substantial Service under Section 101.1413 of the Commission's Rules, Applications of Three Licensees for Renewal of 22 Licenses in the Multichannel Video and Data Distribution Service,* Order, 33 FCC Rcd 10757 (WTB BD 2018), *recons. pending. See also* Blumenthal DTV LLC, Call Sign WQAR709 (Terminated July 26, 2014).

[166] 47 CFR 101.1413.

[167] The licensee uses one station that transmits towards the relatively distant urban market and surrounding suburbs from a unique site, geographically and topographically, that allowed the Commission to waive certain technical rules without increasing harmful interference to DBS or significantly increasing the area in which future NGSO FSS receivers would be precluded by this MVDDS transmitter. *See MDS Operations Inc., Request for Waiver of Certain Multichannel Video Distribution and Data Service Technical Rules for One Station in Sandia Part, New Mexico,* Order, 25 FCC Rcd 7963, 7968–69, paras. 13–14 (WTB 2010). From 2011 to 2013, a former MVDDS licensee offered fixed wireless broadband and voice service in Florida's Broward and Palm Beach counties. *See, e.g., http://www.multichannel.com/news/finance/cablevision-completes-omgfast-shutdown/271409.*

[168] *See, e.g., Requests of Ten Licensees of 191 Licenses in the Multichannel Video and Data Distribution Service for Waiver of the Five-Year Deadline for Providing Substantial Service,* Order, 25 FCC Rcd 10097 (WTB 2010).

[169] *See https://wireless2.fcc.gov/UlsApp/ApplicationSearch/searchAppl.jsp.* Click on ''Advanced Application Search'' and select the following: Radio Service Code: ''DV,'' Status: ''2-Pending,'' Purpose: ''NT.'' Scroll to bottom of page, Customize Your Results, and click on ''Search.'' Ninety-five of the 191 filings were amended in 2020.

[170] *See id. See also MVDDS Second Report and Order,* 17 FCC Rcd at 9684, para. 177.

[171] *See Requests of Three Licensees of 22 Licenses in the Multichannel Video and Data Distribution Service for Extension of Time to Meet the Final Buildout Requirement for Providing Substantial Service under Section 101.1413 of the Commission's Rules, Applications of Three Licensees for Renewal of 22 Licenses in the Multichannel Video and Data Distribution Service,* Order, 33 FCC Rcd 10757 (WTB BD 2018), *recons. pending.*

[172] *See* 47 CFR 1.925(b)(3)(ii).

46. *It is further ordered* that the Commission's Office of the Secretary, Reference Information Center, *shall send* a copy of the Report and Order and *Further Notice of Proposed Rulemaking* and *Notice of Proposed Rulemaking* and *Order,* including the associated Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

Federal Communications Commission.

Marlene Dortch,

Secretary, Office of the Secretary.

[FR Doc. 2023–13503 Filed 7–7–23; 8:45 am]

BILLING CODE 6712–01–P