

**FCC FACT SHEET**\*

**Grant of U.S. Market Access to LeoSat MA, Inc.**

Order and Declaratory Ruling – IBFS File No. SAT-PDR-20161115-00112

**Background:** LeoSat MA, Inc. seeks U.S. market access for a proposed non-geostationary-satellite orbit fixed-satellite service system consisting of 78 satellites, which will operate under the ITU filings of France and a planned authorization from the Netherlands. The proposed grant will facilitate the provision of new and innovative satellite broadband service in the United States, including high-speed connectivity for enterprises and underserved communities.

**What the Order Would Do:**

- Grant LeoSat’s request for U.S. market access in the 17.8-18.6 GHz, 18.8-19.4 GHz, 19.6-20.2 GHz, 27.5-29.1 GHz, and 29.5-30.0 GHz frequency bands.
- Specify conditions to protect or accommodate other operations including:
  - Geostationary-orbit (GSO) operations: LeoSat would protect GSO operations by meeting specific equivalent power-flux density limits.
  - Non-geostationary orbit (NGSO) operations: LeoSat would comply with the avoidance of potential interference situations sharing method specified in the Commission’s rules for any NGSO system licensed or granted U.S. market access pursuant to the processing rounds.
  - Terrestrial operations: LeoSat would be required to protect terrestrial operations in the requested frequency bands by meeting power flux-density limits. In particular, LeoSat would be required to protect Upper Microwave Flexible Service in certain frequency bands.
- Require modification of LeoSat’s operations to bring them into accordance with any future rules or policies adopted by the Commission.

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\* This document is being released as part of a “permit-but-disclose” proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in IBFS File No. SAT-PDR-20161115-00112, which may be accessed via the International Bureau Filing System (<http://licensing.fcc.gov/myibfs>). Before filing, participants should familiarize themselves with the Commission’s *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission meeting. See 47 CFR § 1.1200 *et seq.*

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

In the Matter of )
LeoSat MA, Inc. ) IBFS File No. SAT-PDR-20161115-00112
Petition for Declaratory Ruling Concerning U.S. ) Call Sign S2979
Market Access for the LeoSat Ka-band Low- )
Earth Orbit Satellite System )

ORDER AND DECLARATORY RULING\*

Adopted: [ ]

Released: [ ]

By the Commission:

I. INTRODUCTION

1. In this Order and Declaratory Ruling, we grant the request of LeoSat MA, Inc. (LeoSat) for a declaratory ruling concerning access to the U.S. market using its proposed non-geostationary orbit (NGSO) satellite system for the provision of fixed-satellite service (FSS).1 In granting LeoSat’s request, we address concerns expressed by commenters seeking various conditions on the grant and address two pleadings filed as Petitions to Deny.2 Grant of those parts of LeoSat’s petition that were accepted for filing will facilitate LeoSat’s provision of new and innovative satellite broadband services in the United States, including high-speed connectivity for enterprises and underserved communities.3

\* This document has been circulated for tentative consideration by the Commission at its November 2018 open meeting. The issues referenced in this document and the Commission’s ultimate resolutions of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public’s ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The Commission’s ex parte rules apply and presentations are subject to “permit-but-disclose” ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission’s ex parte rules, including the general prohibition on presentations (written and oral) on matters listed in the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR §§ 1.200(a), 1.1203.

1LeoSat MA, Inc., Petition for a Declaratory Ruling Granting Access to the U.S. Market, IBFS File No. SAT-PDR-20161115-00112 (filed Nov. 15, 2016) (LeoSat Petition or Petition).

2 See Telesat Petition to Deny (filed June 26, 2017); ViaSat Petition to Deny or Impose Conditions (filed June 26, 2017) (ViaSat Petition to Deny).

3 The International Bureau deferred a determination concerning the acceptability for filing of the 19.3-19.6 GHz band because NGSO operations in this frequency band were at the time limited to feeder links for Mobile-Satellite Service (MSS) space stations. See 47 CFR 2.106, footnote NG166; see also Applications Accepted for Filing; Cut-off Established for Additional NGSO-like Satellite Applications or Petitions for Operations in the 12.75-13.25 GHz, 13.85-14.0 GHz, 18.6-18.8 GHz, 19.3-20.2 GHz, and 29.1-29.5 GHz Bands, Public Notice, DA 17-524 (IB rel. May 26, 2017) (May 2017 PN). Subsequently, NG166 and the Ka-band Plan were modified to allow NGSO FSS operations at 19.3-19.4 GHz, but not at 19.4-19.6 GHz (where NGSO operations remain limited to MSS feeder links). See 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) (NGSO FSS Report and Order). As a result, the Bureau accepted for filing LeoSat’s request to operate at 19.3-19.4 GHz, but

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## II. BACKGROUND

2. *Petition.* On November 15, 2016, LeoSat filed a petition for declaratory ruling concerning access to the U.S. market for a proposed NGSO FSS satellite system.<sup>4</sup> The proposed LeoSat system consists of 78 high-throughput, low-Earth orbit satellites (plus six in-orbit spare satellites) in six orbital planes, inclined at 90 degrees, with an orbit having an approximate altitude of 1,400 kilometers.<sup>5</sup> LeoSat seeks to access the U.S. market in the 17.8-18.6 GHz, 18.8-20.2 GHz (space-to-Earth), 27.5-29.1 GHz and 29.5-30.0 GHz (Earth-to-space) frequency bands.<sup>6</sup> LeoSat states that it will operate its system under filings made by France with the International Telecommunication Union (ITU), and that LeoSat plans to obtain an authorization for its system from the Netherlands.<sup>7</sup> Due to its operation in polar orbits,

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kept in a deferred status that portion of LeoSat's petition that requested authority for NGSO FSS operations in the 19.4-19.6 GHz and a waiver of the rules' limitation on those frequencies to MSS feeder links. *See Satellite Policy Branch Information: Space Station Applications Accepted for Filing*, Public Notice, Report No. SAT-01325 (Sat. Div. rel. June 29, 2018) (*June 29, 2018 PN*). The International Bureau also deferred consideration of similar types of requests (and associated waivers) by several other NGSO applicants and petitioners in this processing round to use other bands for operations that the relevant band allocation did not cover. *See Space Exploration Holdings, LLC Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System Application For Approval For Orbital Deployment And Operating Authority for the SpaceX NGSO Satellite System Supplement*, Memorandum Opinion, Order and Authorization, FCC 18-38, para. 1 n.1 (rel. Mar. 29, 2018) (*SpaceX Order*); *O3b Limited, Request for Modification of U.S. Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service*, Order and Declaratory Ruling, FCC 18-70, para. 1 n.1 (rel. June 6, 2018) (*O3b 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, FCC 18-125, para. 3 n.7 (rel. Aug. 16, 2018) (*Karousel Order*). These pending requests and associated waivers will be addressed, if needed, in a future order. We note that SpaceX has withdrawn its request to operate in the deferred band, so no further action is needed. *See Letter from William M. Wiltshire, Counsel for SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-LOA-20170726-00110* (dated July 17, 2018).

<sup>4</sup> The Commission developed the market access procedure we follow here to facilitate the participation of non-U.S.-licensed satellite systems in the FCC licensing process, even though such systems do not seek a U.S. space station license. As such, favorable action on such a request is in the nature of a policy statement or declaratory ruling with respect to the availability of spectrum and other public interest considerations for future licensing of U.S. earth stations that would operate with the non-U.S.-licensed space station. *See Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites to Provide Domestic and International Service in the United States*, Report and Order, 12 FCC Rcd 24094, 24106, para. 29, 24173-74, paras. 184-88 (1997) (*1997 Report and Order*). In addition to the present petition, LeoSat must file, and the Commission must approve, corresponding earth station applications before LeoSat may provide its proposed services in the United States.

<sup>5</sup> LeoSat Petition at 2-6.

<sup>6</sup> The LeoSat Petition was filed as part of a processing round for additional NGSO-like applications and petitions in the Ku- and Ka-band frequencies requested by WorldVu Satellites Limited (OneWeb). *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 Sat. Div. Jul. 15, 2016). Eleven additional applications and petitions were filed for NGSO-like satellite systems, including the LeoSat Petition. Under the Commission's rules, the term "Ku-band" includes both the "conventional Ku-band" (11.7-12.2 GHz and 14.0-14.5 GHz) and the "extended Ku-band" (10.95-11.2 GHz, 11.45-11.7 GHz, and 13.75-14.0 GHz). 47 CFR § 25.103. The term "Ka-band" refers to the 18.3-18.8 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz, and 29.25-30.0 GHz frequency bands, also known as the "conventional Ka-band," which the Commission has designated as primary for GSO FSS operation. *See* 47 CFR § 25.103. LeoSat does not seek U.S. market access in any Ku-band frequencies. The LeoSat system will also have four optical inter-satellite links per satellite. LeoSat Petition at 4.

<sup>7</sup> The LeoSat satellite system is registered pursuant to ITU filings made by France under MCSAT-2 LEO-2. LeoSat Petition at 3, Attach A., Technical Annex to Supplement Schedule S, at 21-22; October 20 Letter at 2, n.5. ); *see also* Letter from Phillip R. Marchesiello and Lynne M. Montgomery, Counsel for LeoSat MA, Inc., to Jose P. Albuquerque, (continued....)

the LeoSat system will provide coverage of the underserved polar regions, as well as provide access to new broadband services for remote and underserved communities in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands.<sup>8</sup> As part of its petition for U.S. market access, LeoSat seeks waivers of certain Commission rules.<sup>9</sup>

3. *Comments.* Several parties filed pleadings in response to the public notice of LeoSat's Petition. Telesat Canada (Telesat) and ViaSat, Inc. (ViaSat) filed pleadings captioned as petitions to deny the LeoSat Petition.<sup>10</sup> Space Exploration Holdings, LLC (SpaceX) filed comments expressing concerns regarding sharing with LeoSat's operations.<sup>11</sup> Space Norway requests that the Commission require LeoSat, through a condition on its authorization, to implement mechanisms to avoid in-line interference with highly elliptical orbit systems such as Space Norway's system.<sup>12</sup> Other parties filed comments expressing concerns regarding all NGSO FSS applicants' compliance with single-entry and aggregate equivalent power-flux density (EPFD) limits in ITU Article 22 of the ITU Radio Regulations.<sup>13</sup> SES and O3b requested that any grant to LeoSat be subject to standard conditions, including those that were placed on O3b's initial grant of U.S. market access as well as other NGSO FSS systems.<sup>14</sup> Spire Global requested that LeoSat provide more information on its orbital debris mitigation plans including how it would avoid collisions with or operational impacts on Spire's NGSO system during deorbit of the LeoSat satellites.<sup>15</sup> LeoSat opposed the petitions to deny and responded to the comments.<sup>16</sup>

4. *NGSO FSS Report and Order.* In September 2017, following the close of the comment cycles in this proceeding, the Commission adopted the *NGSO FSS Report and Order* updating several

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Chief, Satellite Division, International Bureau, FCC at 2 (filed May 15, 2017) (May 15 Letter) (changing the country of authorization from France to the Netherlands). Letter from Phillip R. Marchesiello and Lynne M. Montgomery, Counsel for LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC at 2 (filed Oct. 20, 2017) (October 20 Letter).

<sup>8</sup> LeoSat Petition at 5.

<sup>9</sup> LeoSat requests a waiver of the Commission's Ka-band Plan and Section 2.106 of the Commission's rules to allow for non-conforming use of the 17.8-18.6 GHz and 19.3-20.2 GHz bands, as well as a waiver of the NGSO band segmentation rule in Section 25.157(e) of the Commission's rules. LeoSat Petition at 13-15.

<sup>10</sup> See generally, Telesat Petition to Deny; ViaSat Petition to Deny.

<sup>11</sup> SpaceX Comments at 2-6 (filed June 26, 2017); see also, SES S.A. and O3b Limited Comments at 6-7 (filed June 26, 2017) (stating that, in the NGSO NPRM proceeding, it "... urged the Commission to reject arguments that ITU priority should determine sharing status among NGSO systems authorized to serve the U.S. market").

<sup>12</sup> See generally, Space Norway Comments (filed June 26, 2017).

<sup>13</sup> Hughes Comments at 2-3 (filed June 26, 2017); SES and O3b Comments at 3-6; SES and O3b Reply at 1-4 (filed July 14, 2017); see generally, ViaSat Petition to Deny; ViaSat Reply. See also Letter from Brennan T. Price, Senior Principal Engineer, Regulatory Affairs, EchoStar Corporation, to Marlene H. Dortch, Secretary, FCC (dated Aug. 2, 2017) (supporting the Commission's proposal to adopt aggregate EPFD limits for NGSO systems in the Ka-band and arguing that the Commission should condition the NGSO FSS operations on compliance with those limits); Letter from Brian D. Weimer, Counsel for WorldVu Satellites Limited (OneWeb), to Marlene H. Dortch, Secretary, FCC (dated Sept. 10, 2017) (discussing the importance of complying with the EPFD limits adopted by the ITU for NGSO FSS constellations and raising concerns about LeoSat's EPFD demonstrations) (OneWeb Sept. 10 Letter); Letter from Phillip R. Marchesiello and Lynne M. Montgomery, Counsel for LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC (dated Sept. 19, 2017) (responding to OneWeb's ex parte letter regarding LeoSat's EPFD demonstrations).

<sup>14</sup> SES and O3b Comments at 8-10; SES and O3b Reply at 9-10. (filed July 14, 2017).

<sup>15</sup> See generally, Spire Global Comments (filed June 26, 2017).

<sup>16</sup> See generally, LeoSat Opposition and Response (filed July 7, 2017).

rules and policies governing NGSO FSS systems.<sup>17</sup> Among other changes, the Commission adopted equivalent power-flux density (EPFD) limits on NGSO FSS systems operating in portions of the 17.8-20.2 GHz and 27.5-30.0 GHz frequency bands in order to protect GSO FSS networks.<sup>18</sup> The *NGSO FSS Report and Order* also adopted changes to the Ka-band Plan, the U.S. non-federal Table of Frequency Allocations and the spectrum sharing rules, among other things. The Commission also adopted a more flexible milestone schedule for NGSO constellations and eliminated the international geographic coverage requirement. These changes are now in effect.<sup>19</sup>

### III. DISCUSSION

5. After review of the record, we conclude that grant of the LeoSat Petition will serve the public interest, subject to the requirements and conditions specified herein. Below, we address the various outstanding issues raised by commenters on the LeoSat Petition.<sup>20</sup> We also address LeoSat's waiver requests. Where appropriate, we defer matters of general applicability to ongoing or potential future rulemakings.

6. *ITU Coordination.* In its Petition to Deny, Telesat observes that international coordination will be required between the LeoSat system and its own NGSO FSS system.<sup>21</sup> Telesat argues that, at a minimum, any grant to LeoSat should be conditioned upon compliance with this international obligation. In response, LeoSat supports a condition, similar to the condition in the *OneWeb Order*, to comply with international coordination obligations.<sup>22</sup> The Commission recently declined to adopt Telesat's proposal to tie coordination obligations and licensing conditions directly to ITU filing dates by awarding priority according to those dates,<sup>23</sup> and accordingly we deny Telesat's petition insofar as it reiterates Telesat's ITU filing date priority proposal. We include a condition requiring LeoSat, like all other NGSO FSS operators, to comply with the spectrum sharing requirements specified in Section 25.261 of the Commission's rules with respect to any other NGSO system licensed or granted U.S. market access pursuant to the processing rounds in which LeoSat participated.<sup>24</sup> Since LeoSat filed its Petition, the Commission adopted changes to Section 25.261 that replaced the avoidance of in-line interference methodology for triggering spectrum division (absent coordination) with a default spectrum splitting sharing mechanism that is triggered when the change in system noise temperature caused by

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<sup>17</sup> See generally *NGSO FSS Report and Order*, *supra*, note 3.

<sup>18</sup> *Id.* at 7820-21, paras. 35-36.

<sup>19</sup> See 82 FR 59972 (Dec. 18, 2017); 83 FR 22391 (May 15, 2018) (announcing effective date of May 31, 2018, for all remaining rules that were subject to OMB approval).

<sup>20</sup> SES and O3b requested that the Commission include in any LeoSat grant, standard operating conditions, and specifically several of the same grant conditions included in O3b's initial grant of market access. See SES and O3b Comments at 8-10. To the extent that the LeoSat Petition raises the same concerns as other authorized NGSO FSS systems, we impose substantially identical conditions on LeoSat as we did in those orders, including O3b's recent grant. In addition, since O3b's initial market access grant, the Commission has adopted revisions to its rules and policies governing NGSO FSS systems. The conditions herein are consistent with these rule changes.

<sup>21</sup> See generally, Telesat Petition to Deny; Telesat Reply (filed July 14, 2017); see also International Telecommunication Union (ITU) Radio Regulations, No. 9.12 (requiring coordination of certain NGSO systems), No. 9.53 (requiring both parties in coordination to "make every possible mutual effort to overcome [coordination] difficulties, in a manner acceptable to the parties concerned"), No. 11.42 (requiring the immediate cessation of harmful interference actually caused to a recorded assignment with which coordination is required but has not been effected).

<sup>22</sup> LeoSat Opposition and Response (dated July 17, 2017) at 10-11.

<sup>23</sup> *NGSO FSS Order*, 32 FCC Rcd at 7825-26, para. 50.

<sup>24</sup> See *OneWeb Order*, 32 FCC Rcd at 5377, para. 23(k); see also *infra*, para. 22.

interference, or  $\Delta T/T$ , exceeds a threshold of 6 percent.<sup>25</sup> However, we note that outside the United States (*i.e.*, when communications to or from U.S. territory are not involved) the coexistence between LeoSat's operations and operations of a system that received a grant for access to the U.S. market is governed only by the ITU Radio Regulations as well as the regulations of the country where the earth stations are located and is not subject to Section 25.261. Additionally, we include a condition, which was also included in the *OneWeb Order*, that provides that when Section 25.261 is not applicable, LeoSat, when coordinating with other systems, is required to comply with the ITU Radio Regulations.<sup>26</sup>

7. *EPFD Analysis.* Some commenters suggest that the EPFD analysis provided by LeoSat is insufficient and that the Commission should request a supplemental EPFD analysis.<sup>27</sup> We disagree. We find that LeoSat's demonstrations in its Petition and associated filings are sufficient to justify grant of its request for U.S. market access. Furthermore, LeoSat has provided a revised EPFD analysis using ITU-approved software.<sup>28</sup> To ensure that LeoSat will satisfy its EPFD obligations going forward, we condition this grant on LeoSat receiving a favorable or "qualified favorable" rating of its EPFD demonstration by the ITU prior to initiation of service. Review by the ITU of LeoSat's compliance with ITU EPFD limits, using methods now approved by the ITU,<sup>29</sup> will provide sufficient assurances, beyond the other technical demonstrations that LeoSat has already provided, that LeoSat will comply with the EPFD limits specified in Article 22 of the Radio Regulations.

8. In addition, as a condition to this grant of U.S. market access, LeoSat must communicate the ITU finding to the Commission and submit the files containing the data used as input to the ITU validation software. We find such a requirement satisfies the concerns of GSO FSS operators who request verification, either by the Commission or third parties, of the complete set of input information used for the EPFD showing to the ITU. Submission of the data input files used for the ITU validation of Article 22 limits will allow such verification, either by the Commission or third parties.

9. As we did in other recent grants for NGSO FSS,<sup>30</sup> we are permitting LeoSat to operate up to the PFD and EPFD levels specified in applicable regulations, rather than the levels associated with specific demonstrations in its application. We find this flexibility is warranted given the preliminary nature of the system design, the fact that this grant is conditioned on LeoSat's satisfaction of the ITU's EPFD assessment and the condition that LeoSat cooperate with other NGSO operators to meet limits for aggregate EPFD. We therefore reject ViaSat's arguments that LeoSat should be limited to the levels used in the EPFD demonstration in its application and deny this portion of ViaSat's Petition to Deny.<sup>31</sup>

10. *Orbital Debris Mitigation.* An applicant for a space station authorization must submit a description of the design and operational strategies that it will use to mitigate orbital debris, including a

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<sup>25</sup> *NGSO FSS Order*, 32 FCC Rcd at 7825, para. 49.

<sup>26</sup> *OneWeb Order*, 32 FCC Rcd at 5376, para. 23(a). Compliance with ITU coordination procedures is a requirement of the ITU Radio Regulations, which hold the force of treaty to which the United States is a party. Compliance with the ITU Radio Regulations is a typical condition of both U.S. space station licenses and grants of U.S. market access. See 47 CFR § 25.111(b); see also, *e.g.*, *Inmarsat Mobile Networks, Inc., Application to Operate a Fixed-Satellite Service Gateway Earth Station Facility in Lino Lakes, Minnesota with the Inmarsat-5 F2 Space Station*, Order and Authorization and Declaratory Ruling, 30 FCC Rcd. 2770, 2784, para. 41c (IB 2015).

<sup>27</sup> See Hughes Comments at 2-3; see generally, *OneWeb Sept. 10 Letter*.

<sup>28</sup> See May 15 Letter, Attach. A, Results of ITU Software EPFD Analysis.

<sup>29</sup> See Letter from Francois Rancy, Director, ITU Radiocommunication Bureau, to Administrations of ITU Member States, "Examinations under Resolution 85 (WRC-03)" (Dec. 6, 2016), <https://www.itu.int/md/R00-CR-CIR-0414/en>.

<sup>30</sup> See generally, *OneWeb Order*, *Space Norway Order*, *Telesat Canada Order*, *SpaceX Order*.

<sup>31</sup> *ViaSat Petition to Deny* at 3-8.

statement detailing post-mission disposal plans for space stations at the end of their operating life.<sup>32</sup> LeoSat included a preliminary orbital debris mitigation plan in its application, which contains a post-mission disposal plan to place the satellites into a higher orbit above 2000 km or a lower orbit in which atmospheric reentry would occur in less than 25 years.<sup>33</sup> Thereafter, LeoSat made supplemental filings in response to the Satellite Division's request for additional information regarding its orbital debris mitigation plan.<sup>34</sup>

11. In their comments, Spire Global (Spire) and SpaceX raise concerns about LeoSat's post-mission disposal plans. Specifically, Spire asserts that more information is needed regarding those NGSO applications, including LeoSat's, with post-mission disposal plans through atmospheric re-entry so that existing operators can assess the risk from those disposals.<sup>35</sup> SpaceX questions whether LeoSat's proposal to dispose the satellites at a higher altitude that results in an orbital lifetime in excess of 100 years would hinder space safety and the public interest.<sup>36</sup> With regard to Spire, LeoSat argues that the requested information would not be useful because Spire's space stations would be unable to implement any collision avoidance maneuvers.<sup>37</sup> LeoSat also disagrees with SpaceX, arguing that LeoSat's satellite disposal plans are consistent with the *Orbital Debris Mitigation Order* and the Space Debris Mitigation Guidelines of the Committee on Peaceful Uses of Outer Space (UNCOPUOS Guidelines) and the Inter-Agency Debris Coordination Space Debris Mitigation Guidelines (IADC Guidelines).<sup>38</sup>

12. LeoSat indicates that its orbital debris mitigation plan is a preliminary assessment pending the final constellation design.<sup>39</sup> Accordingly, we conditionally<sup>40</sup> grant of the LeoSat Petition on LeoSat presenting, and the Commission granting, a modification of this market access grant to include a final orbital debris mitigation plan.<sup>41</sup> With respect to the disposal operations LeoSat is considering using an orbit above its operational orbit, we provide some additional information that LeoSat should consider in finalizing its plans. First, as SpaceX correctly observes, satellites left at higher altitudes will remain in orbit indefinitely. Removal from orbit is preferable. While the U.S. Government Orbital Debris

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<sup>32</sup> *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11619 (2004) (*Orbital Debris Mitigation Order*); 47 CFR § 25.114(d)(14).

<sup>33</sup> See LeoSat Petition, Attach. A, Technical Annex to Supplement Schedule S, at 22-24.

<sup>34</sup> See Letter from Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, to Joseph C. Anders, LeoSat MA, Inc. (filed Mar. 15, 2017) (March 15 Letter); May 15 Letter at 3-5; Letter from Phillip R. Marchesiello and Lynne M. Montgomery, Counsel for LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC at 1-2 (May 22 Letter), Attach. A at 1; October 20 Letter at 3-4.

<sup>35</sup> Spire Global Comments at 2-5 (filed June 26, 2017).

<sup>36</sup> SpaceX Comments at 7-8.

<sup>37</sup> LeoSat Opposition and Response at 17 n.53.

<sup>38</sup> LeoSat Petition at 18 (citing *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11601-02, para. 84; IADC Guidelines at 6, 9-10, § 3.3.2, § 5.3.2).

<sup>39</sup> See May 15 Letter at 4-11.

<sup>40</sup> In light of limited information provided concerning debris mitigation plans and the status of review by the Netherlands, we do not reach a conclusion at this time as to whether LeoSat has demonstrated that it is subject to direct and effective oversight by the Netherlands concerning orbital debris mitigation. See May 15 Letter; May 22 Letter. LeoSat may renew this request in connection with the modification application required in paragraph 21(o), by providing additional information concerning its debris mitigation plans and the scope and status of review by the Netherlands.

<sup>41</sup> The International Bureau has previously required applicants to file a modification application including updated orbital debris mitigation information in some instances. See *Northrop Grumman Space & Mission Systems Corp.*, Order and Authorization, 24 FCC Rcd 2230, 2263-64, para. 102 (IB 2009) (Northrop Grumman Order); *ContactMEO Communications, LLC*, Order and Authorization, 21 FCC Rcd 4035, 4052-53, para. 47 (IB 2006).

Mitigation Standard Practices,<sup>42</sup> developed during the 1990s, recognize disposal to a region above LEO as an option, the IADC Guidelines do not recognize this option.<sup>43</sup> As a general matter, it would be prudent to consider disposal of LEO spacecraft to a higher orbit as a disfavored option. In any event, the plan submitted for consideration should include the following information regarding post-mission disposal: (1) if the generally disfavored option of disposing of the satellites to a higher orbit is selected, specify the disposal orbit altitude or range of altitudes and discuss the long-term stability of the disposal orbits selected; and (2) if disposing of the satellites through atmospheric reentry, provide a human casualty risk assessment. In either case, additional discussion of measures to avoid collisions during disposal operations should be included. In addition, the updated plan should address whether, at LeoSat's operational orbit, physical coordination with any other system will be necessary, and in particular with respect to the Globalstar system, which operates at an altitude of 1414 km. LeoSat should also provide information concerning the method or methods it will use to avoid self-collision during polar crossings.

13. *Matters Broadly Applicable to NGSO FSS Applications.* Hughes urges the Commission to adopt mechanisms for ensuring that aggregate EPFD limits are met by all NGSO systems authorized in the United States.<sup>44</sup> ViaSat questions the sufficiency of the EPFD limits proposed by the Commission to protect GSO systems from harmful interference and requests that each NGSO operator be held jointly and severally liable for harmful interference caused to GSO systems until the Commission adopts adequate aggregate EPFD limits and enforcement mechanisms.<sup>45</sup> Space Norway requests that grant of LeoSat's application be conditioned on LeoSat's implementation of mechanisms to avoid in-line interference with highly elliptical orbit NGSO systems, such as that proposed by Space Norway.<sup>46</sup> SpaceX argues that LeoSat lacks a substantive showing that its system will be able to share spectrum efficiently and equitably with other Ka-band NGSO systems.<sup>47</sup> Spire states that the Commission should condition grant of these applications on the outcome of future rulemakings, specifically if the Commission adopts any new orbital debris requirements.<sup>48</sup>

14. All of these comments relate to issues of general applicability and several of these issues were addressed in the *NGSO FSS Report and Order* adopted in September 2017.<sup>49</sup> ViaSat has sought reconsideration of the Commission's decision to adopt EPFD limits in the 27.5-28.6 GHz and 29.5-30

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<sup>42</sup> The U.S. Government Standard Practices were adopted in response to an interagency U.S. Government report published in November 1995. *See generally*, White House Office of Science and Technology Policy, Interagency Report on Orbital Debris (1995).

<sup>43</sup> IADC Guidelines at 6, 9-10, § 3.3.2, § 5.3.2.

<sup>44</sup> Hughes Comments at 3.

<sup>45</sup> ViaSat Petition to Deny.

<sup>46</sup> Space Norway Comments at 3-5.

<sup>47</sup> SpaceX Comments at 1-6.

<sup>48</sup> Spire Global Comments at 2-5.

<sup>49</sup> *See generally NGSO FSS Order*, 32 FCC Rcd at 7820, para. 35 (addressing concerns of compliance with aggregate EPFD limits by affirming that the Commission will require NGSO FSS licensees to comply with aggregate EPFD limits, and may intervene if operators cannot agree among themselves how to ensure the aggregate limits are met), 7820, para. 35 (acknowledging ViaSat's concern that EPFD limits in the 17.8-30 GHz range were not developed with the most advanced modern GSO networks in mind, but concluding that it would not be advisable to remain without such EPFD limits in our rules pending the proposal and development of new EPFD limits), 7824-25, paras. 47-48 & n.111 (noting Space Norway concern for protection of highly elliptical systems and concluding that the required good faith coordination among NGSO FSS systems "also offers the best means to mitigate potentially unequal burdens for . . . those in highly elliptical orbits"), *id.* (noting SpaceX proposal to encourage efficient spectrum use among NGSO FSS systems, but finding the record insufficient to adopt a requirement at the time).



GHz uplink bands.<sup>50</sup> Those arguments will be addressed in the context of that petition for reconsideration. To the extent that commenters here have raised any other issues of general applicability that are pending in any ongoing Commission rulemaking proceedings, we defer consideration of such issues to those proceedings, and condition grant of the LeoSat Petition on their outcome, based on the record in those proceedings.<sup>51</sup>

15. We note that as with our other recent authorizations of NGSO FSS systems, grant of the LeoSat Application will not prejudice any decision, including a contrary action, in any future rulemaking proceedings.<sup>52</sup> Rather, decisions of general applicability in such proceedings will be based on the totality of comments and proposals in those proceedings, including LeoSat's. Accordingly, in addition to being subject to any future proceedings, LeoSat would have to comply with any new orbital debris requirements.

16. *Radio Astronomy.* The transmission of out-of-band signals into allocated radio astronomy bands can cause interference to radio astronomy observations. We also note that radio astronomy as a service frequently makes use of observations (passive) in bands not allocated to the radio astronomy service. This practice is a result of scientifically valuable signals being subject to the Doppler Effect and shifted in frequency outside radio astronomy-allocated bands. Although not a condition to this authorization, LeoSat should be aware of these facts and contact the National Science Foundation Spectrum Management Unit ([esm@nsf.gov](mailto:esm@nsf.gov)) to assist with coordination and information on radio astronomy sites. In the bands in question, the relevant sites are the Green Bank Telescope, the Very Long Baseline Array, and the Very Large Array.<sup>53</sup>

17. *Earth-Exploration Satellite Service/Space Research Service.* The band 18.6 – 18.8 GHz includes a primary allocation to the Earth-exploration Satellite Service and Space Research Service for passive sensing, and excessive unwanted energy into this band from the proposed adjacent bands could cause interference to these services. All emissions into this band within the United States from adjacent bands should comply with the relevant limits found in the Commission's rules. Emissions in 18.6-18.8 GHz outside the United States should comply with the power flux-density limits in No. 21.16.2 of Article 21 of the ITU Radio Regulations.

18. *Waiver Standard.* LeoSat seeks waivers of certain Commission rules.<sup>54</sup> Generally, the Commission may waive any rule for good cause shown.<sup>55</sup> Waiver is appropriate where the particular facts make strict compliance inconsistent with the public interest.<sup>56</sup> In making this determination, we may take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.<sup>57</sup> Waiver is therefore appropriate if special circumstances warrant a deviation

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<sup>50</sup> *Petition for Reconsideration of ViaSat, Inc.*, IB Docket No. 16-408 (filed Jan. 17, 2018).

<sup>51</sup> We note that this condition addresses several comments that requested that grant of the LeoSat Petition be conditioned on compliance with certain pending and future rulemakings. See SpaceX Comments at 6; Spire Global Comments at 5; ViaSat Petition to Deny at 9. To the extent that commenters believe that their concerns are not already addressed by ongoing rulemakings, we remind commenters that they have the option to file petitions for rulemaking with the Commission.

<sup>52</sup> See, e.g., *NGSO FSS R&O; Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016); *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373, 6377, n.14 (2017).

<sup>53</sup> See 47 CFR § 2.106, footnote US131, for locations of these radio astronomy observatories.

<sup>54</sup> See *supra*, note 9.

<sup>55</sup> 47 CFR § 1.3.

<sup>56</sup> *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

<sup>57</sup> *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972); *Northeast Cellular*, 897 F.2d at 1166.

from the general rule and such deviation will serve the public interest.<sup>58</sup> We address the specific requests for waivers below.

19. *Waivers for Frequency Use.* LeoSat requests waivers of the U.S. Table of Frequency Allocations (Table) and the Ka-band plan to perform NGSO FSS operations in the 17.8-18.6 GHz and 19.3-20.2 GHz bands.<sup>59</sup> LeoSat's proposed operations in the 17.8-18.6 GHz, 19.3-19.4 GHz and 19.6-20.2 GHz bands are now in conformance with the Table and the Ka-band plan as revised in the *NGSO FSS Report and Order*.<sup>60</sup> NGSO FSS operations are allowed in the 17.8-18.6 GHz, 19.3-19.4 GHz and 19.6-20.2 GHz bands on a secondary basis, subject to certain power limits.<sup>61</sup> Thus, LeoSat's requests for waivers concerning NGSO FSS operations in the 17.8-18.6 GHz, 19.3-19.4 GHz and 19.6-20.2 GHz bands are dismissed as moot.<sup>62</sup>

20. *Waiver of Band-Splitting Procedure.* LeoSat requests a waiver of Section 25.157(e) to permit it to share the 17.8-18.6 GHz, 19.7-20.2 GHz, 27.5-28.6 GHz, and 29.5-30 GHz bands with other NGSO FSS operators through avoidance of interference events, rather than by assignment of only a portion of these bands.<sup>63</sup> At the time of filing of the LeoSat Petition, Section 25.157(e) provided for "available spectrum" to be "divided equally" among the applications granted as the result of a processing round.<sup>64</sup> This rule presumed that NGSO operators could not use the same frequencies without causing harmful interference to each other, and therefore must be assigned discrete segments of the requested band. After the filing of the LeoSat Petition, the Commission adopted changes that apply a spectrum sharing mechanism to all NGSO FSS systems that have sharing capabilities (e.g., directional earth station antennas), regardless of the frequency bands used.<sup>65</sup> Accordingly, LeoSat's request for waiver of Section 25.157(e) is no longer needed and is dismissed as moot.

#### IV. ORDERING CLAUSES

21. Accordingly, IT IS ORDERED that the Petition for Declaratory Ruling filed by LeoSat MA, Inc. and accepted for filing IS GRANTED IN PART and DISMISSED as MOOT IN PART, as set forth in this Order and Declaratory Ruling, pursuant to Section 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. § 303(r) and Section 25.137(c) of the Federal Communications Commission's rules, 47 CFR § 25.137(c).

22. IT IS FURTHER ORDERED that this grant of U.S. market access is subject to the following requirements and conditions:

a. Prior to initiation of service, LeoSat must obtain from the Radiocommunication Agency Netherlands an authorization for deployment and space operations. LeoSat must file evidence in IBFS File No. SAT-PDR-20161115-00112 demonstrating grant of any such authorizations within five business days of action by the Radiocommunication Agency Netherlands. Thereafter, this grant will remain

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<sup>58</sup> *Northeast Cellular*, 897 F.2d at 1166.

<sup>59</sup> LeoSat Petition at 13. *See also* 47 CFR §§ 2.102(a), 2.106. Non-Federal operations in this band are subject to coordination with Federal systems. 47 CFR § 2.106, n.US334.

<sup>60</sup> *NGSO FSS Order*, 32 FCC Rcd at 7840, 7850.

<sup>61</sup> *NGSO FSS Order*, 32 FCC Rcd at 7812, 7813, 7815-16, paras. 7, 9-10, 19, 21. We note that any blanket-licensed earth stations in the bands 17.8-18.3 GHz, 19.3-19.4 GHz and 19.6-19.7 GHz will operate on a secondary basis to fixed services. 47 CFR § 25.115(f)(2).

<sup>62</sup> We do not address LeoSat's request for a waiver to operate in the 19.4-19.6 GHz band. *See supra*, note 3.

<sup>63</sup> *See* LeoSat Petition at 14-15 and Attach A., Technical Appendix to Supplement Schedule S at 18.

<sup>64</sup> 47 CFR § 25.157(e).

<sup>65</sup> *NGSO FSS Order*, 32 FCC Rcd at 7826, para. 52 (applying the newly adopted Section 25.261 to NGSO FSS systems in any frequency band).

effective only to the extent that launch and space operations continue to be authorized by the Radiocommunication Agency Netherlands under the Netherlands Space Activities Law.

b. Communications between U.S.-licensed earth stations and LeoSat space stations must comport with all existing and future space station coordination agreements reached by the Netherlands and/or France, with other administrations. In the absence of a coordination agreement, such communications must comport with applicable provisions of the ITU Radio Regulations.

c. Space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.4 GHz, and 19.6-20.2 GHz frequency bands must complete coordination with U.S. Federal systems, in accordance with footnote US334 to the United States Table of Frequency Allocations, 47 CFR § 2.106, prior to being used. The use of space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.4 GHz, and 19.6-20.2 GHz bands must be in accordance with any signed coordination agreement between LeoSat and U.S. Federal operators. Two weeks prior to the start of any operations in the 17.8-18.6 GHz, 18.8-19.4 GHz, and 19.6-20.2 GHz bands, LeoSat must provide contact information for a 24/7 point of contact for the resolution of any harmful interference to Jimmy Nguyen, Email: [Jimmy.Nguyen@us.af.mil](mailto:Jimmy.Nguyen@us.af.mil).

d. Operations in the 17.8-18.6 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations, and up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

e. Operations in the 17.8-18.3 GHz (space-to-Earth) frequency band are on a secondary basis with respect to the fixed service.

f. Operations in the 18.8-19.3 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations.

g. The power flux-density at the Earth's surface from out of band emissions into the frequency band 18.6-18.8 GHz must comply with the power flux-density limit in No. 21.16.2 of Article 21 of the ITU Radio Regulations.

h. Operations in the 19.3-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) frequency bands are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations that govern NGSO FSS systems in the 17.7-19.3 GHz (space-to-Earth) frequency band. Operations in the band 19.3-19.4 GHz and 19.6-19.7 GHz are on a secondary basis with respect to the GSO FSS. Blanket authorized earth stations in the 19.3-19.4 GHz and 19.6-19.7 GHz operate on a secondary basis with respect to the fixed service.

i. Operations in the 19.7-20.2 GHz (space-to-Earth) frequency band are authorized up to the equivalent power-flux density limits in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

j. In the 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) frequency bands reception is permitted at levels up to the applicable equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations.

k. Operations in the 27.5-28.35 GHz (Earth-to-space) frequency band are secondary with respect to Upper Microwave Flexible Use Service (UMFUS) operations, except for FSS operations associated with earth stations authorized pursuant to 47 CFR § 25.136 and will comply with any determinations set forth in the *Spectrum Frontiers Proceeding* (GN Docket No. 14-177).<sup>66</sup>

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<sup>66</sup> See generally, *Spectrum Frontiers R&O and FNPRM; Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration and Memorandum Opinion and Order, 32 FCC Rcd 10988 (2017).

l. Operations in the 28.35-28.6 GHz and 29.5-30 GHz (Earth-to-space) frequency bands are on a secondary basis with respect to GSO FSS operations.

m. Prior to initiation of service, LeoSat must receive a favorable or “qualified favorable” finding in accordance with Resolution 85 (WRC-03) with respect to its compliance with applicable equivalent power flux-density limits in Article 22 of the ITU Radio Regulations. LeoSat must communicate the ITU finding to the Commission and submit the files containing the data used as input to the ITU validation software, unless they have been submitted before and do not need any update. *See also* 47 CFR § 25.146(c).

n. LeoSat must cooperate with other NGSO FSS operators in order to ensure that all authorized operations jointly comport with the applicable limits for aggregate equivalent power flux-density in the space-to-Earth direction (EPFDdown) contained in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (WRC-03) of the ITU Radio Regulations.

o. LeoSat must coordinate physical operations of spacecraft with any operator using similar orbits, for the purpose of eliminating collision risk and minimizing operational impacts. The orbital parameters specified in this grant are subject to change based on such coordination.

p. Upon finalization of its space station design and prior to initiation of service to and from the United States, LeoSat must seek and obtain the Commission’s approval of a modification containing an updated description of the orbital debris mitigation plans for its system, as discussed in paragraph 11 above.

q. 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.

r. IT IS FURTHER ORDERED that LeoSat must comply with the sharing of ephemeris data procedures described in Section 25.146(e) of the Commission’s rules, 47 CFR § 25.146(e).

23. IT IS FURTHER ORDERED that operations must comply with spectrum sharing procedures among NGSO FSS space stations specified in 47 CFR § 25.261 with respect to any NGSO system licensed or granted U.S. market access pursuant to the processing rounds initiated in Public Notice, DA 16-804 and Public Notice, DA 17-524. Spectrum sharing between LeoSat’s operations and operations of U.S. licensed NGSO systems, or NGSO systems granted U.S. market access, where such operations do not include communications to or from U.S. territory, are governed only by the ITU Radio Regulations and are not subject to Section 25.261.

24. IT IS FURTHER ORDERED that this authorization does not address the provision of any Direct-to-Home (DTH) service, Direct Broadcast Satellite Service (DBS)<sup>67</sup> or Digital Audio Radio Service (DARS) to, from, or within the United States.

25. IT IS FURTHER ORDERED that this authorization is also subject to the following requirements:

a. LeoSat must post a surety bond in satisfaction of 47 CFR §§ 25.165(a)(1) & (b) no later than [30 days from grant], and thereafter maintain on file a surety bond requiring payment in the event of a default in an amount, at minimum, determined according to the formula set forth in 47 CFR § 25.165(a)(1); and

b. LeoSat must launch 50 percent of the maximum number of proposed space stations, place them in the assigned orbits, and operate them in accordance with the station authorization no later than [6 years from grant], and LeoSat must launch the remaining space stations necessary to complete its

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<sup>67</sup> With respect to DBS and DTH, this paragraph excludes from the scope of the grant those services specified in 47 CFR § 25.701(a)(1)-(5).

authorized service constellation, place them in their assigned orbits, and operate each of them in accordance with the authorization no later than [9 years from grant]. 47 CFR § 25.164(b).

26. Failure to post and maintain a surety bond will render this grant null and void automatically, without further Commission action. Failure to meet the milestone requirements of 47 CFR § 25.164(b) may result in LeoSat's authorization being reduced to the number of satellites in use on the milestone date. Failure to comply with the milestone requirement of 47 CFR § 25.164(b) will also result in forfeiture of LeoSat's surety bond. By [6 years + 15 days], LeoSat must either demonstrate compliance with its milestone requirement or notify the Commission in writing that the requirement was not met. 47 CFR § 25.164(f).

27. IT IS FURTHER ORDERED that the request for waivers of the United States Table of Frequency Allocations, 47 CFR § 2.106 and the Commission's Ka-band plan, with regard to NGSO FSS operations in the 17.8-18.6 GHz, 19.3-19.4 GHz and 19.6-20.2 GHz frequency bands IS DISMISSED as MOOT for the reasons set forth herein.

28. IT IS FURTHER ORDERED that the request for waiver of the band segmentation provision in 47 CFR § 25.157(e) IS DISMISSED as MOOT.

29. IT IS FURTHER ORDERED that the Petitions to Deny of Telesat Canada and ViaSat, Inc. ARE GRANTED to the extent that certain conditions requested by Telesat Canada and ViaSat are imposed, as indicated herein, and are otherwise DENIED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary