

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

In the Matter of )
Karousel Satellite LLC ) IBFS File Nos. SAT-LOA-20161115-00113
Application for Authority to Launch and Operate a ) and SAT-AMD-20180801-00058
Non-Geostationary Earth Orbit Satellite System in ) Call Sign S2980
the Fixed Satellite Service )

MEMORANDUM OPINION, ORDER AND AUTHORIZATION

Adopted: August 15, 2018

Released: August 16, 2018

By the Commission:

I. INTRODUCTION

1. In this Memorandum Opinion, Order and Authorization, we authorize Karousel Satellite LLC (Karousel) to construct, deploy, and operate a proposed non-geostationary-satellite orbit (NGSO) satellite system comprising twelve satellites for the provision of fixed-satellite service (FSS) around the world.1 In granting those parts of Karousel’s Application that were accepted for filing, we address concerns expressed by commenters seeking various conditions on the grant and partially deny two Petitions to Deny. Grant of this Application will enable Karousel to deploy a novel video and data distribution service to rural consumers in the United States and around the world who lack access to adequate or affordable broadband connectivity.2

II. BACKGROUND

2. Application. On November 15, 2016, Karousel filed an application requesting authority for its proposed NGSO FSS satellite system, comprising twelve satellites operating in highly inclined, elliptical, geosynchronous orbits, with apogees around 40,002 kilometers and perigees around 31,569 kilometers.3 In its Application, Karousel proposes to operate in the 10.7-12.7 GHz (space-to-Earth), 14.0-

1 Karousel LLC, Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service, IBFS File No. SAT-LOA-20161115-00113 (filed Nov. 15, 2016) (Application). Karousel provided a supplemental filing with an additional technical showing prior to its application going on public notice. See Letter from Monish Kundra, Vice President, Karousel LLC, to Marlene H. Dortch, Secretary, FCC (filed Dec. 27, 2016) (Karousel Dec. 27 Letter). Karousel’s request for operations in the 29.1-29.5 GHz band is not before us because the International Bureau has not accepted that part of the application for filing. See Satellite Policy Branch Information: Space Station Applications Accepted for Filing, Public Notice, Report No. SAT-01277 (IB Oct. 20, 2017). Karousel filed an amendment to its application changing the applicant from “Karousel LLC” to “Karousel Satellite LLC,” a wholly owned subsidiary of Karousel LLC. See IBFS File No. SAT-AMD-20180801-00058 (filed Aug. 1, 2018). Because the change in applicant is the result of a corporate restructuring and involves no change in the ultimate ownership or control of the Karousel system, we find that the amendment is not a major amendment within the meaning of Section 25.116(b) of the Commission’s rules and therefore it is not necessary for the amendment to be placed on public notice. See 47 CFR § 25.116(b).

2 Application, Narrative at 4.

3 Application, Schedule S Tech Report. Karousel filed this Application in response to an International Bureau public notice that initiated a “processing round” for additional NGSO applications in the 10.7-12.7 GHz, 14.0-14.5

14.47 GHz (Earth-to-space)<sup>4</sup>, 17.8-19.3 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), and 27.5-30.0 GHz (Earth-to-space) frequency bands.<sup>5</sup> Karousel also requests waivers of certain Commission rules.<sup>6</sup>

3. *Comments.* On May 26, 2017, the Karousel Application was accepted for filing.<sup>7</sup> ViaSat, Inc. (ViaSat) filed a petition to deny the Karousel Application unless certain conditions are imposed on the grant.<sup>8</sup> Telesat Canada (Telesat) also filed a Petition to Deny the Karousel Application requesting that any grant to Karousel be subject to certain conditions.<sup>9</sup> SES S.A. and O3b Limited (SES and O3b) requested that any grant of the Karousel Application be subject to certain conditions, including the same conditions that were placed on other NGSO FSS authorizations.<sup>10</sup> Space Exploration Technologies Corp. (SpaceX) expressed concerns about certain technical characteristics of the Karousel system.<sup>11</sup> Hughes Network Systems, LLC (Hughes) requested conditions related to sharing with geostationary orbit (GSO) systems.<sup>12</sup> Hughes also partially supported the ViaSat Petition to Deny.<sup>13</sup> Karousel opposed the petitions to deny and responded to the comments.<sup>14</sup>

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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 frequency bands. *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 2016).

<sup>4</sup> Although Karousel listed in its Schedule S that it would be operating from 14.0-14.5 GHz, it clarified in its application that it would not operate between 14.47-14.5 GHz. *Compare* Application, Schedule S *with* Application, Narrative at 69. The scope of this grant is limited accordingly.

<sup>5</sup> Application, Narrative at 37-39.

<sup>6</sup> Karousel requests waivers of Sections 2.106, footnotes NG52 and NG164; 25.103; 25.146(a); 25.156(d)(4)-(5); and 25.202(a)(1). Application, Narrative at 56-66.

<sup>7</sup> *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). As previously noted, the International Bureau did not accept Karousel's request to operate using the 29.1-29.5 GHz band because the International Telecommunications Union (ITU) Radio Regulations limit the use of the band 29.1-29.5 GHz by the FSS to geostationary satellite systems and feeder links to NGSO systems in the mobile-satellite service. *See* 5.535A of the ITU Radio Regulations. In the same public notice, the International Bureau initiated a processing round for additional frequency bands requested by applicants, including several bands requested by Karousel. *Id.*

<sup>8</sup> ViaSat, Inc. Petition to Deny (filed June 26, 2017) (ViaSat); ViaSat Reply (filed July 14, 2017).

<sup>9</sup> Telesat Canada Petition to Deny (filed June 26, 2017) (Telesat); Telesat Reply (filed July 14, 2017).

<sup>10</sup> SES S.A. and O3b Limited Comments at 8-10 (filed June 26, 2017) (SES and O3b); SES and O3b Reply (filed June 26, 2017).

<sup>11</sup> SpaceX Technologies Corp. Comments (filed June 26, 2017) (SpaceX); SpaceX Reply (filed July 14, 2017).

<sup>12</sup> Hughes Network Systems, LLC Comments (filed June 26, 2017) (Hughes); Hughes Reply (filed July 7, 2017).

<sup>13</sup> Specifically, Hughes supported ViaSat's request to condition grant on compliance with the outcome of the *NGSO FSS* proceeding and part of ViaSat's proposal related to aggregate interference.

<sup>14</sup> Karousel Response to Comments and Opposition to Petitions to Deny (filed July 7, 2017) (Karousel Response and Opposition). Although it did not file comments on the Karousel Application, the MVDDS 5G Coalition has expressed concern in other proceedings regarding protection of current and potential future MVDDS operations in the 12.2-12.7 GHz band. *See, e.g.*, Letter from MVDDS 5G Coalition to Marlene H. Dortch, Secretary, FCC (filed March 6, 2018) (on file in IBFS File No. SAT-LOA-20161115-00118). Such concerns are addressed by paragraphs 24(e) and 24(v) below, requiring Karousel to comply with established PFD limits in this band and subjecting the authorization to modification to conform it to any future rules or policies adopted by the Commission in pending

4. *NGSO FSS Order.* On September 26, 2017, following the close of the comment cycle in this proceeding, the Commission adopted a Report and Order updating several rules and policies governing NGSO FSS systems, including the proposed Karousel system.<sup>15</sup> Among other changes, the Commission adopted EPFD limits on NGSO FSS systems operating in portions of the 17.8-20.2 GHz and 27.5-30 GHz frequency bands in order to protect GSO FSS networks. The Commission also adopted a more flexible milestone schedule for NGSO constellations. As these changes are now in effect,<sup>16</sup> we consider below their pertinence to the public interest analysis required to act upon the Karousel Application.

### III. DISCUSSION

5. After review of the record, we conclude that grant of the Karousel Application as set forth herein will serve the public interest, subject to the requirements and conditions specified herein.<sup>17</sup> Below we address the various outstanding issues raised by commenters on Karousel's Application. We also address Karousel'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 expressed concerns that the proposed Karousel system had the potential to cause interference to its system because the two systems would operate in overlapping geographic areas on overlapping Ka-band frequencies, and observed that international coordination will be required between the Karousel system and its own NGSO FSS system.<sup>18</sup> Telesat argued that, at a minimum, any grant to Karousel should be conditioned upon compliance with this international obligation, as was provided in the Commission's grant of OneWeb's NGSO authorization, and on compliance with the outcome of the NGSO FSS rulemaking proceeding. Finally, Telesat argues that Karousel fails to recognize that Telesat's NGSO filings with the ITU have date priority over those filings associated with the proposed Karousel system. In response, Karousel argued that the Commission should reject Telesat's assertions that its Application should be denied on the basis of hypothetical interference and that the Commission should reject Telesat's assertion that that ITU filing date priority overrides the Commission's processing round procedures.<sup>19</sup> We recently declined to adopt Telesat's proposal to tie coordination obligations and licensing conditions directly to ITU filing dates by

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rulemaking proceedings. *See, e.g.,* Petition of MVDDS 5G Coalition for Rulemaking, RM-11768 (filed Apr. 26, 2016).

<sup>15</sup> *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 R&O)*.

<sup>16</sup> *See* 82 FR 59972 (Dec. 18, 2017); 83 FR 22391 (May 15, 2018).

<sup>17</sup> SES and O3b requested that the Commission include in any Karousel authorization standard operating conditions, and specifically several of the same grant conditions included on O3b's initial grant of market access. *See* SES and O3b Comments at 8-10. To the extent that the Karousel application raises the same concerns as other authorized NGSO FSS systems, we impose substantially identical conditions on Karousel as we did in those orders, including O3b's recent grant. In addition, since O3b's initial market access grant, the Commission has adopted significant revisions to its rules and policies governing NGSO FSS systems. The conditions herein are consistent with these rule changes.

<sup>18</sup> Telesat Petition to Deny; Telesat Reply at 9-13; *see also* ITU Radio Regulations, No. 9.12 (requiring coordination of certain NGSO systems), No. 9.53 (requiring 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>19</sup> Karousel Response and Opposition at 7-9.

awarding priority according to those dates,<sup>20</sup> and accordingly deny Telesat's petition insofar as it reiterates Telesat's ITU filing date priority proposal. We include a condition requiring Karousel, as with 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 FSS system licensed or granted U.S. market access pursuant to the processing rounds in which Karousel participated.<sup>21</sup> We recently 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 mechanism that is triggered when the change in system noise temperature caused by interference, or  $\Delta T/T$ , exceeds a threshold of 6 percent.<sup>22</sup> We note, however, that outside the United States (i.e., when communications to or from the U.S. territory are not involved) the coexistence between Karousel's operations and operations of a system that received a grant for access to the U.S. market are governed only by the ITU Radio Regulations as well as the regulations of the country where the earth station is located and are not subject to Section 25.261. We include a condition, which was also included in the OneWeb Order, that provides that when Section 25.261 is not applicable, Karousel, when coordinating with other systems, is required to comply with the ITU Radio Regulations.<sup>23</sup>

7. *EPFD Analysis.* Karousel provided an EPFD analysis as part of its Application showing compliance with the Commission's rules and with the limits established by Article 22 of the Radio Regulations, including an analysis using ITU approved software.<sup>24</sup> We find that these demonstrations are sufficient to justify grant of Karousel's Application. To ensure that Karousel will satisfy its EPFD obligations going forward, we condition this grant on Karousel receiving a favorable or "qualified favorable" finding of its EPFD demonstration by the ITU prior to the initiation of service. Review by the ITU of Karousel's compliance with ITU EPFD limits, using methods now approved by the ITU,<sup>25</sup> will provide sufficient assurances, beyond the other technical demonstration that Karousel has already provided, that it will comply with the EPFD limits specified in Article 22 of the Radio Regulations.

8. As we did in other recent approvals for NGSO FSS operations,<sup>26</sup> we are permitting Karousel 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 Karousel's satisfaction of the ITU's EPFD assessment, and the condition that Karousel cooperate with other NGSO operators to meet limits for aggregate EPFD. We therefore reject ViaSat's arguments that Karousel should be limited to the levels used in the EPFD demonstration in its Application and deny this portion of

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<sup>20</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7825-26, para. 50.

<sup>21</sup> 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, 5377, para. 23(k) (2017) (*OneWeb Order*).

<sup>22</sup> 47 CFR § 25.261; *NGSO FSS R&O*, 32 FCC Rcd at 7825, para. 49.

<sup>23</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>24</sup> Karousel Dec. 27 Letter.

<sup>25</sup> Letter from Francois Rancy, Director, ITU Radiocommunication Bureau, to Administrations of ITU Member States, "Examinations under Resolution 85 (WRC-03)" (Dec. 6, 2016), <http://www.itu.int/md/R00-CR-CIR-0414/en>.

<sup>26</sup> See, e.g., *Telesat Canada, Order and Declaratory Ruling*, 32 FCC Rcd 9663, 9666, para. 11 (2017) (*Telesat Canada Order*).

ViaSat's Petition to Deny.<sup>27</sup>

9. *Orbital Debris.* 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 statement detailing post-mission disposal plans for space stations at the end of their operating life.<sup>28</sup> Karousel provided a preliminary orbital debris mitigation analysis as part of its Application<sup>29</sup> and provided additional details about its plans,<sup>30</sup> but indicates throughout its Application that the debris mitigation plan is a preliminary assessment and that neither the plan nor the spacecraft design has been finalized. Accordingly, we condition this grant on Karousel presenting and the Commission granting a modification of this authorization to include a final orbital debris mitigation plan.<sup>31</sup> The modification should include, among other things, details of the planned disposal orbit and fuel reserves to be maintained for final orbital maneuvers.

10. Additionally, Karousel will be subject to the same conditions as other NGSO operators, including the requirement that it coordinate its physical operations with space stations of NGSO systems operating with similar orbital parameters.<sup>32</sup> To the extent that Karousel and other NGSO operators fail to come to an agreement regarding physical coordination, the Commission may intervene as appropriate.

11. *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>33</sup> SpaceX suggests that the Commission should consider conditions of grant that would promote efficient spectrum sharing among operators, including uplink power limits for earth stations communicating with the Karousel system and conditions designed to promote sharing among LEO and HEO systems.<sup>34</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>35</sup>

12. All of these comments relate to issues of general applicability that are more appropriately addressed in the context of a rulemaking. Several of these issues were already raised in the rulemaking concerning NGSO FSS matters<sup>36</sup> and addressed in the *NGSO FSS R&O* adopted September 26, 2017.<sup>37</sup> For example, Hughes and ViaSat express concerns about international EPFD limits and aggregate EPFD

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<sup>27</sup> ViaSat Petition to Deny at 3-8.

<sup>28</sup> *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11619 (2004); 47 CFR § 25.114(d)(14).

<sup>29</sup> Application, Narrative at 39-42.

<sup>30</sup> Letter from Monish Kundra, Vice President, Karousel LLC, to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC (filed April 11, 2017).

<sup>31</sup> The International Bureau has previously required applicants to file a modification application including updated orbital debris mitigation in some instances. See *Telesat Canada, Order and Declaratory Ruling*, 32 FCC Rcd 9663, 9668-69, 9675-76 (2017) (*Telesat Canada Order*); *Northrop Grumman Space & Mission Systems Corp.*, Order and Authorization, 24 FCC Rcd 2330, 2363-64, para. 102 (IB 2009); *ContactMEO Communications, LLC*, Order and Authorization, 21 FCC Rcd 4035, 4052-53, para. 47 (IB 2006).

<sup>32</sup> See, e.g., *Telesat Canada Order*, 32 FCC Rcd at 9673, para 29(c).

<sup>33</sup> Hughes Comments at 2-4.

<sup>34</sup> SpaceX Comments at 2-9.

<sup>35</sup> ViaSat Petition to Deny at 8-9.

<sup>36</sup> *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Notice of Proposed Rulemaking, 31 FCC Rcd 13651, 13656-58 (2016).

<sup>37</sup> See generally *NGSO FSS R&O*.

enforcement mechanisms, but these issues were previously addressed in the *NGSO FSS R&O*.<sup>38</sup> Earth station power limits as suggested by SpaceX were also considered in the *NGSO FSS R&O* and the Commission declined in that order to adopt any such limits.<sup>39</sup> To the extent that commenters raise 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 Karousel Application on the outcome of such rulemaking proceedings, based on the record in those proceedings.<sup>40</sup>

13. We note that as with our other recent authorizations of NGSO FSS systems, grant of the Karousel Application will not prejudice any decision, including a contrary action, in any future rulemaking proceedings.<sup>41</sup> Rather, decisions of general applicability in such proceedings will be based on the totality of comments and proposals in those proceedings, including Karousel's. Accordingly, in addition to being subject to any future proceedings, Karousel would have to comply with any new orbital debris requirements.

14. *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, Karousel 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.

15. *Waiver Standard.* Karousel seeks waivers of certain Commission rules.<sup>42</sup> Generally, the Commission may waive any rule for good cause shown.<sup>43</sup> Waiver is appropriate where the particular facts make strict compliance inconsistent with the public interest.<sup>44</sup> In making this determination, we may take into account considerations of hardship, equity, or more effective implementation of overall policy

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<sup>38</sup> We considered ViaSat's concerns regarding the sufficiency of existing international EPFD limits and found that as ViaSat has not proposed any new EPFD limits it would be inadvisable to remain without Ka-band EPFD limits in our rules pending such deliberations. Thus, we adopted the ITU EPFD limits in the 17.8-30 GHz frequency range and require authorized NGSO FSS systems to comply with existing aggregate EPFD limits. *NGSO FSS R&O*, 32 FCC Rcd at 7821-21, para. 35. ViaSat has sought reconsideration of the Commission's decisions to adopt EPFD limits in the 27.5-28.6 GHz band, and that argument will be addressed in the context of that petition for reconsideration. *Petition for Reconsideration of ViaSat, Inc.*, IB Docket No. 16-408 (filed Jan. 17, 2018) (also seeking reconsideration of EPFD limits in the 29.5-30 GHz band).

<sup>39</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7827, para. 55.

<sup>40</sup> We note that this condition addresses several comments that requested that grant of the Karousel Application be conditioned on compliance with certain pending and future rulemakings. See ViaSat Petition to Deny at 9; Hughes Reply at 2; SpaceX Comments 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>41</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>42</sup> See *supra*, note 6.

<sup>43</sup> 47 CFR § 1.3.

<sup>44</sup> *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

on an individual basis.<sup>45</sup> Waiver is therefore appropriate if special circumstances warrant a deviation from the general rule and such deviation will serve the public interest.<sup>46</sup> We address the specific requests for waivers below.

16. *Waivers for Frequency Use.* Karousel requests several waivers in connection with operations in certain frequency bands, including the list of frequencies available for FSS in Section 25.202(a)(1), the U.S. Table of Frequency Allocations, and the Commission's Ka-band Plan to permit operations in the 10.7-11.7 GHz, 17.8-18.6 GHz, and 19.7-20.2 GHz frequency bands.<sup>47</sup> In the *NGSO FSS R&O*, the Commission eliminated the informational list of available FSS frequency bands in Section 25.202(a)(1)<sup>48</sup> making Karousel's request for a waiver of this Section moot. The Commission also adopted changes to the U.S. Table of Frequency Allocations and the Commission's rules to permit NGSO FSS operations in the 17.8-18.6 GHz and 19.7-20.2 GHz frequency bands.<sup>49</sup> Karousel's proposed operations in the 17.8-18.6 GHz and 19.7-20.2 GHz bands are consistent with the Commission's rules as modified and consequently Karousel's related waiver requests are moot. Karousel must comport its operations in these bands with the Commission's rules as modified by the *NGSO FSS R&O*, any applicable PFD and EPFD limits and requirements specified in Article 21 and Article 22 of the ITU Radio Regulations, and aggregate EPFD limits specified in Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations. We also note that in accordance with U.S. Table of Frequency Allocations, Karousel's operations in the 17.8-18.3 GHz band will be on a secondary basis with respect to the fixed service.<sup>50</sup>

17. Concerning operations in the 10.7-11.7 GHz frequency band, Karousel requested waivers of footnote NG52 to the U.S. Table of Frequency Allocations and Section 25.202(a)(1), n.6 in order to permit Karousel to operate its user terminal earth stations in the 10.7-11.7 GHz band on a non-conforming, non-interference, unprotected basis.<sup>51</sup> Section 25.202(a)(1), n.6 was recently eliminated from our rules, and accordingly we dismiss the waiver request as moot.<sup>52</sup> Footnote NG52 applies to the operation of GSO space stations.<sup>53</sup> As the system proposed by Karousel is an NGSO system, NG52 does not apply and we dismiss the waiver request as moot.

18. Concerning operations in the 18.6-18.8 GHz frequency band, Karousel requests a waiver of footnote NG164 to the U.S. Table of Frequency Allocations to permit NGSO FSS operations on a non-conforming, non-interference basis.<sup>54</sup> Karousel states that its operations will comply with the Commission's PFD limits for the 18.6-18.8 GHz band, and the PFD limits described in Article 21 of the

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<sup>45</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.

<sup>46</sup> *Northeast Cellular*, 897 F.2d at 1166.

<sup>47</sup> Application, Narrative at 56-64. Karousel also requested a waiver of Section 25.103 of the Commission's rules, which provides a list of definitions applicable to Part 25. 47 CFR § 25.103. Although this rule Section includes a definition for the "Conventional Ka-band" that specifies 19.7-20.2 GHz as designated for primary GSO FSS, this does not conflict with the Commission's recent decision to adopt a secondary NGSO FSS allocation in that frequency band and consequently no waiver is necessary.

<sup>48</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7817-18, para. 27.

<sup>49</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7812-13, para. 7-10.

<sup>50</sup> 47 CFR § 2.106.

<sup>51</sup> Application, Narrative at 57-59.

<sup>52</sup> We recently modified our rules concerning the use of the 10.7-11.7 GHz frequency band to permit blanket licensing of receive earth stations on an unprotected basis. See *NGSO FSS R&O*, 32 FCC Rcd at 7817, paras. 24-25; 47 CFR § 25.115(f).

<sup>53</sup> 47 CFR § 2.106, footnote NG52.

<sup>54</sup> Application, Narrative at 61-62.

ITU Radio Regulations, and with the PFD limit specified in Footnote US255.<sup>55</sup> Footnote NG164 specifies that the FSS operations in the 18.6-18.8 GHz frequency band are limited to GSO networks.<sup>56</sup> This frequency band is also allocated to both Federal and non-Federal passive services in the U.S. Table of Frequency Allocations.<sup>57</sup> The Commission recently considered and adopted modifications to its rules and the U.S. Table of Frequency Allocations to permit NGSO FSS operations in several bands previously designated exclusively for GSO FSS, although the 18.6-18.8 GHz frequency band was not among those considered in that proceeding.<sup>58</sup> However, in light of the technical information provided in Karousel's Application and Schedule S, the characteristics of its highly elliptical orbit NGSO system and small number of satellites, and its willingness to operate on a non-interference basis, we find good cause to grant the requested waiver of footnote NG164. Accordingly, we grant this waiver and condition operations in the 18.6-18.8 GHz band on Karousel operating on a non-interference basis to Federal and non-Federal systems and satisfying the applicable power flux-density limits in Section 25.208(d) of the Commission's rules and Article 21 of the ITU Radio Regulations.

19. *Section 25.146(a) Waiver.* Karousel requests a temporary waiver of Section 25.146(a) of the Commission's rules, which requires a comprehensive technical showing that a proposed NGSO FSS system will not exceed certain EPPD limits.<sup>59</sup> Before its Application was placed on public notice Karousel submitted a supplemental technical demonstration including the information required by Section 25.146(a).<sup>60</sup> Based on this submission, Karousel provided the necessary information to review its Application and consequently Karousel's request for a waiver of this requirement is moot.

20. *Section 25.156(d)(4) Waiver.* Karousel requests a waiver of Section 25.156(d)(4) of the Commission's rules.<sup>61</sup> This rule section requires that applications for feeder-link authority be treated as an application separate from associated service bands.<sup>62</sup> As an FSS system, Karousel by definition does not have feeder-links.<sup>63</sup> Consequently, Karousel's request for a waiver of this requirement is moot.

21. *Section 25.156(d)(5) Waiver.* Karousel requests a waiver of Section 25.156(d)(5) of the Commission's rules.<sup>64</sup> At the time Karousel filed its Application, Section 25.156(d)(5) stated that in frequency bands where the Commission has not adopted band specific service rules it will not consider applications for NGSO-like operation after it has granted an application for GSO-like operation, and vice-versa, unless the Commission establishes NGSO/GSO sharing criteria for that frequency band, but the Commission recently eliminated Section 25.156(d)(5) in the *NGSO FSS R&O*.<sup>65</sup> As the modified rules adopted in that proceeding are now in effect, Karousel's request for a waiver of this requirement is moot.

22. *Other.* In the 14.0-14.2 GHz band, the National Aeronautics and Space Administration (NASA) operates Tracking and Data Relay Satellite System earth station facilities at three locations: Guam (latitude 13°36'55" N, longitude 144°51'22" E); White Sands, New Mexico (latitude 32°20'59" N,

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<sup>55</sup> Application, Narrative at 68.

<sup>56</sup> 47 CFR § 2.106, footnote NG164.

<sup>57</sup> 47 CFR § 2.106.

<sup>58</sup> See, e.g., *NGSO FSS R&O*, 32 FCC Rcd at 7813, para. 10 (permitting NGSO FSS operations in the 18.3-18.6 GHz and 19.7-20.2 GHz frequency bands).

<sup>59</sup> We note that since the filing of the Karousel Application Section 25.146 was modified in the *NGSO FSS R&O*. See *NGSO FSS R&O*, 32 FCC Rcd at 7822-23, paras. 41-42.

<sup>60</sup> Karousel Dec. 27 Letter.

<sup>61</sup> Application, Narrative at 65.

<sup>62</sup> 47 CFR § 25.156(d)(4).

<sup>63</sup> 47 CFR § 25.103.

<sup>64</sup> Application, Narrative at 66.

<sup>65</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7821-22, para. 39.



longitude 106°36'31" W and latitude 32°32'40" N, longitude 106°36'48" W); and Blossom Point, Maryland (latitude 38° 25' 53" N, longitude 77° 05' 06" W). For transmissions in the 14.0-14.2 GHz band from NGSO FSS earth stations located within 125 kilometers of these three sites, earth station operators should take account of these NASA facilities.

#### IV. CONCLUSION

23. We conclude that grant of the Karousel Application, as conditioned and set forth herein, will serve the public interest by enabling Karousel to pursue its goal of providing access to on-demand content to unserved and underserved consumers in the United States and around the world.

#### V. ORDERING CLAUSES

24. Accordingly, IT IS ORDERED, that the Application filed by Karousel Satellite LLC as accepted for filing IS GRANTED IN PART AND DISMISSED IN PART, as set forth in this Memorandum Opinion, Order and Authorization, for operations in the 10.7-12.7 GHz (space-to-Earth), 14.0-14.47 GHz (Earth-to-space), 17.8-19.3 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-29.1 GHz (Earth-to-space), and 29.5-30.0 GHz (Earth-to-space), pursuant to Section 309(a) of the Communications Act of 1934, as amended, 47 U.S.C. § 309(a).

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

- a. Karousel must timely provide the Commission with the information required for Advance Publication, Coordination, and Notification of the frequency assignment(s) for this constellation, including due diligence information, pursuant to Articles 9 and 11 of the ITU Radio Regulations. This authorization may be modified, without prior notice, consistent with the coordination of the frequency assignment(s) with other Administrations. *See* 47 CFR § 25.111(b). Karousel is responsible for all cost-recovery fees associated with the ITU filings. 47 CFR § 25.111(d).
- b. Operations in the 10.7-11.7 GHz (space-to-Earth) frequency band are authorized up to the applicable power flux-density limits in 47 CFR § 25.208(b), 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.
- c. Operations in the 10.7-11.7 GHz band must be coordinated with the radio astronomy observatories listed in 47 CFR § 2.106, footnote US131, to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities operating in the 10.6-10.7 GHz band. For the purposes of coordination with these listed facilities or the National Radio Quiet Zone, correspondence should be directed to the National Science Foundation Spectrum Management Unit (Email: [esm@nsf.gov](mailto:esm@nsf.gov)).
- d. Operations in the 11.7-12.2 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 12.2-12.7 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in 47 CFR § 25.208(o) and 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.
- f. Operations in the 14.0-14.47 GHz (Earth-to-space) frequency band are authorized up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations.
- g. Operations in the 17.8-19.3 GHz and 19.7-20.2 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 17.8-19.3 GHz, and 19.7-20.2 GHz bands must be in accordance with any

signed coordination agreement between Karousel and U.S. Federal operators. Two weeks prior to the start of any operations in the 17.8-19.3 GHz and 19.7-20.2 GHz bands, Karousel 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).

- h. Operations in the 17.8-18.3 GHz (space-to-Earth) frequency band are on a secondary basis with respect to the fixed service.
- i. 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.
- j. Operations in the 18.6-18.8 GHz (space-to-Earth) frequency band are authorized on a non-conforming basis. Such operations are on an unprotected basis and must immediately terminate upon notification of harmful interference. In addition, such operations must comport with the applicable power flux-density limits in 47 CFR § 25.208(d) and Article 21 of the ITU Radio Regulations.
- k. 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.
- l. 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.
- m. 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.
- n. 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 14-177).<sup>66</sup>
- o. 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.
- p. Prior to initiation of service, Karousel 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.
- q. Karousel 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 (EPFD<sub>down</sub>) contained in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (WRC-03) of the ITU Radio Regulations.
- r. 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 Karousel’s operations and operations of NGSO systems granted U.S. market access, where such operations do not include communications to or from the U.S. territory, are governed only by the ITU Radio Regulations and are not subject to Section 25.261.

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<sup>66</sup> See generally *Spectrum Frontiers R&O and FNPRM*.

s. Karousel must comply with the sharing of ephemeris data procedures described in 47 CFR § 25.146(e).

t. Upon finalization of its space station design and prior to initiation of service, Karousel 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 9 above.

u. Karousel 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.

v. This authorization is subject to modification to bring it into conformance with any rules or policies adopted by the Commission in the future. Accordingly, any investments made toward operations in the bands authorized in this order by Karousel 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.

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

a. Karousel must post a surety bond in satisfaction of 47 CFR §§ 25.165(a)(1) & (b) no later than September 17, 2018, 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. Karousel 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 August 16, 2024, and Karousel must launch the remaining space stations necessary to complete its authorized service constellation, place them in their assigned orbits, and operate each of them in accordance with the authorization no later than August 16, 2027. 47 CFR § 25.164(b).<sup>67</sup>

27. 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 Karousel'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 Karousel's surety bond. By September 2, 2024, Karousel 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).

28. IT IS FURTHER ORDERED that the request for waivers of the United States Table of Frequency Allocations, 47 CFR § 2.106, footnote NG164, and the Commission's Ka-band plan, with regard to NGSO FSS operations in the 17.8-18.6 GHz and 19.7-20.2 GHz frequency bands IS DISMISSED as MOOT for the reasons set forth herein.

29. IT IS FURTHER ORDERED that the request for a waiver of the United States Table of Frequency Allocations, 47 CFR § 2.106, footnote NG164, with regard to NGSO FSS operations in the 18.6-18.8 GHz frequency band IS GRANTED for the reasons set forth herein.

30. IT IS FURTHER ORDERED that the request for waivers of the United States Table of Frequency Allocations, 47 CFR § 2.106, footnote NG52 IS DISMISSED as MOOT for the reasons set forth herein.

31. IT IS FURTHER ORDERED that the request for waiver of 47 CFR § 25.146(a) IS

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<sup>67</sup> We note that the *NGSO FSS R&O* modified Section 25.164(b) to offer additional flexibility and requires launch and operation of 50 percent of an authorized system within six years of grant and the remaining satellites within nine years of grant.

DISMISSED as MOOT for the reasons set forth herein.

32. IT IS FURTHER ORDERED that the request for waiver of 47 CFR § 25.156(d)(4) IS DISMISSED as MOOT for the reasons set forth herein.

33. IT IS FURTHER ORDERED that the request for waiver of 47 CFR § 25.156(d)(5) IS DISMISSED as MOOT for the reasons set forth herein.

34. IT IS FURTHER ORDERED that the requests for waiver of 47 CFR §§ 25.202(a)(1) and 25.103 ARE DISMISSED as MOOT for the reasons set forth herein.

35. 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