

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

In the Matter of
The Establishment of Policies and Service
Rules for the Non-Geostationary
Satellite Orbit, Fixed Satellite Service
in the Ka-Band
IB Docket No. 02-19

NOTICE OF PROPOSED RULEMAKING

Adopted: January 31, 2002

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Comment Date: 30 days after publication in the Federal Register
Reply Comment Date: 45 days after publication in the Federal Register

By the Commission:

I. INTRODUCTION

1. With this Notice of Proposed Rulemaking, we initiate a proceeding to determine the means by which multiple satellite network systems will be licensed to operate in spectrum designated on a primary basis for the non-geostationary satellite orbit, fixed-satellite service ("NGSO FSS"), and to determine service rules deferred in previous orders that will apply to Ka-band NGSO FSS applicants.

2. We propose to license all five of the Second Round Ka-band applicants seeking access to the spectrum designated on a primary basis to NGSO FSS systems, specifically the 18.8-19.30 GHz and 28.60-29.10 GHz frequency bands.

1 The term "Ka-band" generally refers to the space-to-Earth (downlink) frequencies at 17.70-20.20 GHz and the corresponding Earth-to-space (uplink) frequencies at 27.50-30.00 GHz.

FSS services. We propose four possible options for spectrum sharing as a starting point for comment. These proposed options are based on features of the pending applications, a proposal received from one of the applicants, and upon sharing mechanisms we have previously employed with other satellite services.

3. We also request comment on additional service rules for NGSO FSS licensees. We start with our existing satellite service rules for Ka-band FSS systems adopted in the *Third Report and Order*.<sup>2</sup> While that order resolved service rules and licensing qualifications for First Round applicants, the Commission deferred consideration of certain requirements for future NGSO FSS systems to a later processing round. We address these additional issues in this proceeding.

## II. BACKGROUND

4. In October 1997, in conjunction with the first Ka-band processing round, the Commission issued the *Third Report and Order* adopting technical requirements, licensing qualifications, and service rules for geostationary (“GSO”) and NGSO FSS systems in the Ka-band.<sup>3</sup> Specifically, for NGSO systems the Commission permitted use of either orthogonal linear or orthogonal circular polarization,<sup>4</sup> and modified the frequency reuse rules to allow Ka-band systems to utilize beam antennas to reuse frequencies in spatially independent beams.<sup>5</sup> The Commission permitted the use of hybrid satellites, on the condition that the technical and service requirements for both bands were satisfied and that both bands be licensed for hybrid use.<sup>6</sup> It also required NGSO FSS systems operating in the Ka-band to satisfy the same coverage requirements applicable to NGSO MSS “Big LEO” systems operating in the 1610-1626.5 MHz and 2483.5-2500 MHz bands. Thus, the Commission required these systems to serve locations as far north as 70 degrees latitude and as far south as 55 degrees latitude for at least 75% of every 24-hour period.<sup>7</sup> In addition, all systems must provide FSS on a continuous basis throughout the fifty-states, Puerto Rico and the U.S. Virgin Islands.<sup>8</sup> These existing NGSO Ka-band service rules form the basis for the additional service rules proposed herein.

5. The *Third Report and Order* deferred the determination of several issues, including: (1) sharing principles or mitigation techniques for multiple NGSO systems; (2) whether the Commission’s financial requirements would be a license qualification for future processing rounds; (3) the imposition of milestones and the assignment of inter-satellite links (ISLs);<sup>9</sup> and (4) licensing of earth stations and

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<sup>2</sup> *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Services and for Fixed Satellite Services*, Third Report and Order, 12 FCC Rcd 22310 (1997) (“*Third Report and Order*”). In May 2001, the Commission issued a Memorandum Opinion and Order disposing of petitions for clarification or reconsideration of the *Third Report and Order* filed by Motorola Global Communications, Inc. and Hughes Communications Galaxy, Inc. In this order, the Commission noted that a petition for reconsideration or clarification of the *Third Report and Order* filed by Teledesic would be addressed in notice and comment proceedings pertaining to a second licensing round for Ka-band satellite systems. 16 FCC Rcd 11464 (2001) ¶ 18.

<sup>3</sup> *Third Report and Order*, 12 FCC Rcd 22310.

<sup>4</sup> *Third Report and Order*, 12 FCC Rcd at 22320, ¶ 25; 47 C.F.R. § 25.210(a).

<sup>5</sup> Our polarization rules for the C- and Ku-Bands require state-of-the art full frequency reuse. *Third Report and Order*, 12 FCC Rcd 22321-22, ¶¶ 28-29; 47 C.F.R. § 25.210.

<sup>6</sup> *Third Report and Order*, 12 FCC Rcd 22322, ¶ 31.

<sup>7</sup> *Third Report and Order*, 12 FCC Rcd 22323, ¶ 34; 47 C.F.R. § 25.145(c)(1).

<sup>8</sup> *Third Report and Order*, 12 FCC Rcd 22323, ¶ 34; 47 C.F.R. § 25.145(c)(2).

<sup>9</sup> ISLs are communication links between in-orbit satellites. ISLs operate in spectrum allocated to the inter-satellite service. ITU Radio Regulation S1.22.

corresponding power flux-density limits. At that time, the Commission decided not to adopt band sharing plans, preferring instead to “evaluate all applications for NGSO FSS on a case-by-case basis, revisiting the multiple entry issue, as necessary, as we gain more experience with NGSO FSS systems.”<sup>10</sup> The Commission did, however, state that it expected all NGSO FSS licensees to bear some portion of the burden sharing.<sup>11</sup> Moreover, while the Commission determined that financial qualification requirements would not apply to First Round applicants,<sup>12</sup> it noted that application of the financial requirements to any future Ka-band processing round would be addressed in the context of that proceeding.<sup>13</sup> On June 22, 2000, the Commission established power flux-density limits for NGSO FSS service downlinks<sup>14</sup> and approved blanket licensing of Ka-band NGSO FSS earth stations.<sup>15</sup> On January 31, 2001, the International Bureau assigned inter-satellite link (“ISL”) spectrum and imposed milestones on certain Ka-band licensees.<sup>16</sup>

6. In our first Ka-band processing round, Teledesic LLC (“Teledesic”) was authorized to construct, launch and operate a NGSO system to provide domestic and international fixed-satellite service in the Ka-band.<sup>17</sup> This was the first such license granted. Teledesic’s authorization requires it to “share the burden of coordination with other NGSO FSS systems and to coordinate in good faith.”<sup>18</sup>

7. Teledesic filed a petition for clarification and/or reconsideration of the *Third Report and Order*. Teledesic asked the Commission to clarify or reconsider certain statements addressing co-frequency sharing by multiple NGSO FSS systems.<sup>19</sup> The issues raised in Teledesic’s petition are

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<sup>10</sup> *Third Report and Order*, 12 FCC Rcd at 22325, ¶ 38.

<sup>11</sup> *Third Report and Order*, 12 FCC Rcd at 22325, ¶ 38.

<sup>12</sup> *Third Report and Order*, 12 FCC Rcd at 22316, ¶ 15 (waiving the financial qualification requirement because future Ka-band NGSO FSS entry was possible).

<sup>13</sup> *Third Report and Order*, 12 FCC Rcd, at 22318, ¶ 18.

<sup>14</sup> *Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, Report and Order, 15 FCC Rcd 13430, 13471, ¶ 86 (2000) (“*18 GHz Order*”); 47 C.F.R. 25.208(f).

<sup>15</sup> *18 GHz Order*, 15 FCC Rcd at 13475, ¶ 95.

<sup>16</sup> See International Bureau Orders and Authorizations, released Jan. 31, 2001 for Teledesic LLC, DA 01-229; GE American Communications Corp., DA 01-225; PanAmSat Corp., DA 01-228; EchoStar Satellite Corp., DA 01-224; WB Holdings1, LLC, DA 01-231; VisionStar, Inc. DA 01-230; Motorola Inc., DA 01-222; Loral Space & Communications Corp., DA 01-227; Hughes Communications Galaxy, Inc., DA 01-226; Cyberstar Licensee LLC, DA 01-223.

<sup>17</sup> See *Teledesic Corporation Application for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the Domestic and International Fixed Satellite Service*, 12 FCC Rcd 3154 (1997) (Order and Authorization) (“*Teledesic Order*”). We subsequently granted Teledesic’s application for minor modification of its license. See *Teledesic LLC for Minor Modification of License to Construct, Launch, and Operate a Non-Geostationary Fixed Satellite Service System*, 14 FCC Rcd 2261 (1999) (recon. pending) (“*Teledesic Minor Modification Order*”). Teledesic Corporation changed its name to Teledesic LLC, by pro forma assignment of its license, granted on January 26, 1998. See Letter from Thomas S. Tycz, Chief, Satellite and Radiocommunication Division, International Bureau, to Mark A. Grannis, Counsel to Teledesic LLC, dated January 26, 1998.

<sup>18</sup> *Teledesic Minor Modification Order*, 14 FCC Rcd 2261, ¶ 23.

<sup>19</sup> Teledesic Corporation, Petition for Clarification And/Or Reconsideration, filed Dec. 18, 1997 (“*Teledesic Petition*”).

addressed in detail in a companion order released today.<sup>20</sup> In sum, Teledesic asked the Commission to clarify certain statements concerning the feasibility of sharing using non-coordinated orbits.<sup>21</sup> In the companion order, we deny Teledesic's request to clarify that the Commission would not subdivide the 500 MHz of spectrum that was allocated to NGSO FSS systems on a primary basis.<sup>22</sup> In addition, Teledesic requested clarification that, as a first round licensee, it would be protected from interference from future licensees. In the companion order we state that licensees that have made progress in system implementation should not have to significantly alter or redesign their systems to accommodate later applicants.<sup>23</sup> Thus, to the extent Teledesic is proceeding with the construction of its licensed system, subsequently licensed systems would be obligated to coordinate their systems with Teledesic.<sup>24</sup> We also state that we expect Teledesic to coordinate in good faith and accommodate the subsequently licensed systems. Further, although the Commission only licensed one NGSO FSS system in the first round, we reiterate our expectation that there will be multiple NGSO FSS systems in the Ka-band. If the only way to accomplish this goal is to further subdivide the spectrum then we will do so. Finally, as set forth in the *Third Report and Order*, we state that all non-Federal Government NGSO FSS systems are responsible for some portion of the burden sharing.<sup>25</sup>

8. In October 1997, the International Bureau initiated a second processing round inviting interested parties to file applications for consideration in that round by December 27, 1997. Six applicants applied for licenses to operate NGSO FSS systems in the Second Round: (1) @contact, LLC; (2) Hughes Communications Inc.; (3) Lockheed Martin Corporation; (4) Motorola, Inc.; (5) SkyBridge II, LLC; and (6) TRW, Inc.<sup>26</sup> Since that time, Motorola Inc. amended its application to seek the use of only GSO FSS primary frequencies in the Ka-band.<sup>27</sup> Thus, at this time, there are five applicants requesting

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<sup>20</sup> Teledesic LLC, Petition for Clarification And/Or Reconsideration, *Memorandum Opinion and Order*, FCC No. 02-6 (rel. Feb. 6, 2002) ("*Teledesic Memorandum Opinion and Order*").

<sup>21</sup> *Teledesic Petition* at 7.

<sup>22</sup> *Teledesic Memorandum Opinion and Order*, at 4.

<sup>23</sup> *Id.*

<sup>24</sup> *Id.*

<sup>25</sup> *Id.*

<sup>26</sup> See @contact, LLC Application for Authority to Construct, Launch and Operate a Nongeostationary Orbit Fixed Satellite Service System in the Ka-band, File No. SAT-LOA-19971222-00222 (filed Dec. 22, 1997); Hughes Communications, Inc. Application for Authority to Launch and Operate Spaceway NGSO, File No. SAT-LOA-19971222-00210 (filed Dec. 22, 1997); Application of Lockheed Martin Corporation for Authority to Launch and Operate the LM-MEO Satellite Communications System in Non-Geostationary Orbit, File No. SAT-LOA-19971222-00203 (filed Dec. 22, 1997); Motorola Global Communications, Inc.'s Application for Authority to Construct, Launch and Operate The Celestri Multimedia LEO System, File No. SAT-LOA-19970613-00053 (filed June 13, 1997); Application of SkyBridge II, L.L.C. for Authority to Launch and Operate the SkyBridge II System, A Global Network of Low Earth Orbit Communications Satellites Providing Broadband Services In the Fixed Satellite Service, File No. SAT-LOA-19971222-00221 (filed Dec. 22, 1997); and TRW Inc., For Authority to Launch and Operate a Global Satellite System Employing Geostationary and Nongeostationary Satellites in the Fixed-Satellite Service, Petition for Waiver of Section 25.116(b), File Nos. SAT-AMD-19971222-00219, SAT-WAV-19971222-00220 (filed Dec. 22, 1997).

<sup>27</sup> See *Motorola, Inc. Amendment For Authority to Construct, Launch, and Operate the Celestri Multimedia LEO System, a Global Non-Geostationary Orbit Satellite System in the Fixed-Satellite Service*, File No. 79-SAT-P/LA-97(63) (filed July 29, 1998). Motorola has notified the Commission that it will no longer prosecute its Second Round NGSO FSS application. Letter from Philip L. Malet, Counsel for Motorola, Inc., to Magalie R. Salas, Secretary, FCC, File No. 79-SAT-P/LA-97(63), dated Jan. 8, 2001. Teledesic has filed a request for waiver of the Commission's "cut off" rule so that it may acquire Motorola's NGSO application. *Application of Motorola, Inc. and Teledesic LLC for Consent to Assignment of Authorization to Construct, Launch and Operate the Millennium Satellite System, a Geostationary Fixed Satellite System and Request of Teledesic LLC for Exemptions From Cut-Off* (continued....)

spectrum designated on a primary basis to NGSO FSS systems in the Ka-band: @contact LLC, Hughes Communications, Lockheed Martin Corporation, SkyBridge II, LLC, and TRW, Inc. The applications are mutually exclusive as filed because they all seek access to the same 500 megahertz of uplink and 500 megahertz of downlink spectrum designated for NGSO FSS use. The applicants have not reached a coordination agreement to accommodate all systems. Each of these applications is summarized in Appendix D.

### III. SPECTRUM ALLOCATION

9. In the Ka-band, the Commission allocated the 18.80-19.30 GHz band to NGSO FSS for service downlinks<sup>28</sup> on a primary basis, and designated the 28.60-29.10 GHz band for service uplinks on a primary basis.<sup>29</sup> These designations provide 500 megahertz of spectrum for service downlink operations and 500 megahertz of spectrum for service uplink operations.<sup>30</sup>

10. The Commission originally permitted NGSO FSS systems to operate service downlinks in the 17.70-18.80 GHz and 19.70-20.20 GHz bands on a secondary basis to GSO FSS systems and in the 28.35-28.60 GHz and 29.50-30.00 GHz bands for service uplinks on a secondary basis to GSO FSS systems. Based on the Commission's Ka-Band Plan, many Second Round applicants applied for spectrum in these bands on a secondary basis. Subsequently, in the *18 GHz Order*, the Commission eliminated the allocation of the 17.70-18.80 GHz and 19.70-20.20 GHz bands for NGSO FSS systems.<sup>31</sup> In that order, the Commission concluded that "secondary use of the 18 GHz band is not viable because it would unreasonably inhibit ubiquitous deployment of these services and limit the use of spectrum by primary users of the band."<sup>32</sup> This conclusion was subject to a petition for reconsideration and recently affirmed by the Commission.<sup>33</sup> In the order on reconsideration, the Commission stated that removing secondary operations from bands designed for primary use by other services lessens the potential for harmful interference to the primary service in each band and avoids disruptions that could occur to users of secondary services.<sup>34</sup> Consequently, authorizations for second round applicants will be limited to 18.8-19.3 GHz for downlink spectrum. Authorizations for NGSO FSS uplink operations will be in the 28.6-29.10 GHz band on a primary basis and 28.35-28.60 GHz on a secondary basis. The two tables in

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*Rule for Pending Applications to Construct, Launch, and Operate Geostationary and Non-Geostationary Fixed Satellite Systems*, File No. SAT-ASG-20010109-0005 at 3 (Jan. 9, 2001).

<sup>28</sup> *18 GHz Order*, 15 FCC Rcd at 13433, ¶¶ 4, 5. Terrestrial fixed service ("FS") operators already operating in this 18.80-19.30 GHz band may continue to do so for a period of 10 years.

<sup>29</sup> Primary operation means that no non-primary, or secondary service, can cause harmful interference to the primary service, nor can any secondary service claim interference protection. If harmful interference occurs, secondary users must immediately cease operations. *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Services and for Fixed Satellite Services*, 11 FCC Rcd 19005 (1996) (First Report and Order and Fourth Notice of Proposed Rulemaking) ("*Ka-Band Plan Order*").

<sup>30</sup> *18 GHz Order*, 15 FCC Rcd at 13459, ¶ 60.

<sup>31</sup> *18 GHz Order*, 15 FCC Rcd at 13456, ¶ 55. The secondary use of downlink spectrum in the 28 GHz band for NGSO FSS systems was not affected by the *18 GHz Order*.

<sup>32</sup> *18 GHz Order*, 15 FCC Rcd 13456, ¶ 55.

<sup>33</sup> Resignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and the 24.75-25.25 GHz Frequency Bands for Broadcast Satellite Service Use, *First Order on Reconsideration*, FCC 01-323 (rel. Nov. 1, 2001).

<sup>34</sup> *Id.* at ¶ 29.

Appendix A summarize the NGSO FSS downlink and uplink bands. Table 1 of Appendix A also includes the Federal Government primary FSS allocations where Federal Government GSO and NGSO FSS systems are authorized in the 17.8-20.2 frequency band.

#### IV. DISCUSSION

11. Bearing in mind the allocated spectrum and the technical and licensing criteria established by the *Third Report and Order* and *18 GHz Order*, we must now determine sharing principles and certain licensing and service criteria for Second Round NGSO FSS licensees in the Ka-band. In this Notice of Proposed Rulemaking (“*Notice*”), we discuss four possible sharing options among the non-Federal Government NGSO systems, seeking comment on which option – or variation on a proposed option – can best accommodate the applicants. We then discuss our proposals to modify the service rules. We believe that these modifications are necessary to provide competitive and robust broadband communication services to the American consumer. We ask for comment on these service rules in light of our stated objectives set forth in this *Notice*.

##### A. Spectrum Sharing Options

12. We recognize that proposed NGSO FSS systems cannot share allocated Ka-band spectrum - without potential interference - if each system were to use the full amount of spectrum it has requested. We also recognize that all five Second Round proposals vary in their complexity, purpose, requirements, and systems designs. Nevertheless, we tentatively conclude, for purposes of comment and discussion, that the 18.8-19.3 and 28.6-29.1 GHz band contains sufficient spectrum to accommodate all five Second Round proposals and the First Round licensee under a comprehensive and coordinated spectrum sharing approach. Thus, in developing the proposed spectrum sharing options we are guided by the following three principal objectives.

13. First, we recognize that spectrum sharing among multiple NGSO FSS systems may have a considerable operational and technological impact on all systems. As stated in the *Third Report and Order*, the Commission expects all non-Federal Government NGSO FSS systems to be responsible for sharing some portion of the burden.<sup>35</sup> We are also convinced that to the extent possible the marketplace, and not the Commission, should decide the most effective implementation of the NGSO FSS systems. Thus, we structured the proposed spectrum sharing schemes to avoid promoting a particular technological solution by disproportionately allocating the sharing burden to some second round NGSO FSS systems at the expense of others. We seek to establish a regulatory framework that does not favor any particular technology or operational method. We ask for comment on whether the proposed options provide for equitable burden sharing. In particular, we ask system proponents to assess the impact of each spectrum sharing option on their system. To the extent that commenters assert that any of our proposed options do not provide sufficient spectrum capacity for a particular system, they should specify the minimum spectrum capacity required to support such a system, and substantiate this assertion with concrete technical and economic analyses.

14. We are also interested in how the proposed options affect second round licensees in light of the Commission’s order mandating that the second round licensees’ access to spectrum is subject to coordination with Teledesic. While Teledesic must also coordinate with second round NGSO systems in good faith, we recognize that the farther along a licensee is in the construction of its system, the less flexibility it has to redesign its system to accommodate new entrants. For example, if Teledesic, which was licensed in 1997, has already contracted for and constructed major components of its authorized system, it would not have the same degree of flexibility to redesign its system as would entities not yet licensed. Conversely, if Teledesic has not yet finalized its system parameters, as would be evidenced by a

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<sup>35</sup> *Third Report and Order*, 12 FCC Rcd at 22325, ¶ 38.

subsequent application for authority to modify its licensed system, we would view Teledesic in a much better position to make additional changes to facilitate coordination with additional systems.<sup>36</sup> We invite comments and recommendations on the spectrum sharing among the Second Round licensees and Teledesic.<sup>37</sup>

15. Second, although we hope that all authorized systems will be built, our experience with the implementation of NGSO MSS systems cautions us to recognize that it is possible, if not likely, that not all proposed systems will be implemented. We therefore seek to prevent spectrum warehousing by non-implemented NGSO FSS systems at the expense of operational systems. The options proposed in this *Notice* attempt to maximize spectrum availability to operational systems, while incorporating sufficient flexibility to accommodate all applicants once they commence operations. We seek comment on the disposition of spectrum capacity that is unused when systems are not timely implemented. We also seek comment on whether the NGSO FSS systems' designs are sufficiently flexible to make interim use of additional spectrum in the period before additional systems are implemented, and the effect that interim use may have on the operations of all other systems.

16. Third, recognizing the limited availability of NGSO FSS spectrum to accommodate these broadband operations, we are convinced that the public interest would be well served to the extent that the systems' proponents are able to share cooperatively their respective spectrum assignments. Thus, the options presented herein are structured to provide regulatory certainty to the NGSO FSS licensees but not to preclude, in any way, the NGSO FSS systems' coordinated use of their spectrum assignments. Given the obvious benefits of coordinated spectrum sharing, we expect that the NGSO FSS operators will attempt to negotiate such arrangements with each other. We ask commenters to address whether the proposed options incorporate sufficient flexibility to promote and accommodate spectrum coordination by the systems' proponents.

17. Furthermore, recognizing that all five NGSO FSS applicants and Teledesic seek to provide service outside of the United States, we are concerned about how the proposed spectrum sharing schemes comport with the spectrum planning and satellite system licensing processes in other countries. For example, the European Radiocommunications Committee ("ERC") has adopted decisions concerning FSS earth stations in the 17.7-19.7 GHz and 27.5-29.5 GHz bands.<sup>38</sup> These decisions primarily address the use of spectrum by uncoordinated FSS Earth stations in Europe, but in conjunction with spectrum sharing requirements elsewhere, they may have a significant impact on the commercial viability of the proposed NGSO FSS systems. We seek comments on all aspects of this complex issue. In particular, we ask commenters to focus on the feasibility of each spectrum sharing option in the context of varying spectrum regulatory regimes around the world. This rulemaking pertains to service rules for NGSO FSS systems, therefore, we are not seeking proposals for the removal or addition of any allocations in the existing International Table of Frequency Allocation, elimination of coordination requirements or the imposition of additional regulatory constraints in the International Telecommunication Union (ITU) Radio Regulations (*i.e.*, the current rights of GSO FSS and NGSO FSS systems would be maintained). All licensees would

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<sup>36</sup> Consistent with Commission actions in other satellite proceedings, modified systems that are significantly different from the system as authorized may be considered a new system and treated on equal footing with new or subsequent processing groups. *See, e.g.*, Geostar Positioning Corporation, *Memorandum Opinion and Order*, 6 FCC Rcd 2276 (CCB 1991).

<sup>37</sup> As a First Round licensee, Teledesic has over a four-year head start on the implementation of its Ka-band NGSO FSS system.

<sup>38</sup> *See* ERC Decision of October 19, 2000 on the shared use of the band 17.7-19.7 GHz by the fixed service and Earth stations of the fixed-satellite service (space-to-Earth), ERC/DEC/(00)07 and ERC Decision of October 19, 2000 on the use of the band 27.5-29.5 GHz by the fixed service and uncoordinated Earth stations of the fixed-satellite service (Earth-to-space), ERC/DEC/(00)09.

also be expected to satisfy applicable ITU coordination requirements. We note as well that all NGSO FSS licensees are required to coordinate with Federal Government GSO and NGSO FSS systems operating under footnote US334. The spectrum sharing options described here would not apply to Federal Government NGSO FSS systems.

18. We seek comment on the following spectrum assignment options: (1) Flexible Band Segmentation; (2) Dynamic Band Segmentation; (3) Avoidance of In-line Interference Events; and (4) Homogeneous Constellations. While we are prepared to move forward expeditiously with any of these spectrum assignment proposals, we reserve the option of adopting an alternative engineering solution or band sharing arrangement that might include a hybrid solution arising from the options described below, or an alternative solution negotiated by the applicants. Interested parties will have an opportunity to comment on alternative proposals significantly different from those set forth in this Notice.

### 1. Option I – Flexible Band Segmentation

19. The Flexible Band Segmentation option would segment the available spectrum to accommodate all Second Round proposals while providing flexibility for system implementation and expansion. Under this option, the NGSO FSS uplink and downlink spectrum would be divided into distinct spectrum segments of equal bandwidth (Selected Spectrum Assignments) based on the number of Second Round system proponents that we authorize. The segments will consist of adjacent spectrum blocks stretching from one end of the NGSO FSS bands to another.<sup>39</sup> Each NGSO FSS licensee will identify one selected spectrum segment in the uplink and downlink bands at the time that the first satellite in its system reaches its intended orbit and initiates transmission and reception, and will be required to notify the Commission, in writing, of its identified segments.<sup>40</sup> A combination of two segments (one uplink and one downlink) will represent the operator's Selected Spectrum Assignment. The Commission staff will then issue a Public Notice to provide notification of the licensee's selected segments.

20. Under this option, each Second Round licensee would be authorized to operate throughout the entire spectrum allocated on a primary basis to Ka-band NGSO FSS but may claim priority use with respect to other Second Round licensees only in its own Selected Spectrum Assignment. In addition to operating in its own Selected Spectrum Assignment, each licensee may provide service anywhere else within unoccupied spectrum allocated to the NGSO FSS.<sup>41</sup> The NGSO FSS licensees will be required to coordinate the use of spectrum outside of their respective Selected Spectrum Assignments. If licensees cannot coordinate use in a desired additional portion of spectrum (*i.e.*, outside of the Selected Spectrum Assignment), those frequencies can be subdivided equally with the right of selection determined by the date each system commences service, as determined by its transmission and reception of service, as noted above.

21. We expect the NGSO FSS licensees to have spectrum requirements that initially will be modest, but will increase following the commencement of commercial operations. Flexible Band Segmentation would create sufficient certainty to proceed with system implementation. We recognize that under this option the amount of spectrum available to each system will decrease as more NGSO FSS operators implement their systems. If we adopt a sharing option in which specific spectrum segments are assigned to particular systems, we cannot assume that the same bands will be assigned to the same systems in other countries. We therefore ask commenters to address the possible effects of Flexible Band

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<sup>39</sup> For instance, if there were five qualified Second Round applicants, we would identify five equal spectrum segments within the 18.8-19.3 GHz and 28.6-29.1 GHz. If we determine that the same spectrum sharing provisions should apply to the First Round licensee as well, then we will identify a total of six spectrum segments.

<sup>40</sup> A satellite's intended orbit is the orbit it will occupy to provide commercial service.

<sup>41</sup> This additional spectrum is "unoccupied" because an operational NGSO FSS licensee has not yet identified it as selected spectrum.

Segmentation on U.S.-licensed systems' operations outside the United States. We seek comment on all aspects of Flexible Band Segmentation.

22. We note that one of the Second Round applicants, @contact, proposed a similar spectrum sharing option entitled "Band Segmentation Plus Coordination."<sup>42</sup> @contact proposes that coordination issues between the second round applicants and Teledesic should be deferred until the issuance of the second round licenses. We request comment on @contact's spectrum sharing proposal as well as the associated implementation requirements.

## 2. Option II – Dynamic Band Segmentation

23. Dynamic Band Segmentation is similar to Flexible Band Segmentation. Under this approach, we propose to subdivide the NGSO FSS spectrum equally by the number of operational systems. Each time a new system becomes operational, other operational systems would be required to surrender spectrum to accommodate the new entrant. The system would be considered operational or brought into use when the first satellite in its system reaches its intended orbit and initiates transmission and reception. Recognizing the public interest benefit of hastening the provision of NGSO FSS to the public, we propose that priority in selecting spectrum segments be based on the date a licensed system becomes operational. Under this option, the first operational system would have access to all spectrum allocated on primary basis to Ka-band NGSO FSS. When there are two operational systems, then uplink and downlink bands would be split in two equal parts, with the first operational system having the right to select its uplink and downlink spectrum halves. When there are three systems, then the spectrum would be split into three equal parts, and again the first system would select its uplink and downlink spectrum segments, followed by the second system and the remaining spectrum segments would go to the third system, and so on. Nothing would prevent systems that find ways to share from pooling their spectrum segments. Each system will notify the Commission of its specific frequency assignments.

24. We seek comment on Dynamic Band Segmentation, and whether it is preferable to a more structured band sharing arrangement. We seek comment on how Dynamic Band Segmentation might give system proponents the flexibility to initiate service to the public based on business needs and market forces, and to implement or update their systems to include new technologies. We note that service providers will be required to readjust and reduce the spectrum they occupy, as additional systems become operational. We seek comment on any impact that such adjustments might have on the system's customers and how that impact might be mitigated. As noted with regard to Flexible Band Segmentation above, we cannot assume that this band arrangement can be preserved outside of the United States. Thus, commenters should address the possible effects of Dynamic Band Segmentation on U.S.-licensed systems' operations worldwide. We seek comment on all aspects of the Dynamic Band Segmentation, including variations or alternatives that commenters propose.

## 3. Option III – Avoidance of In-Line Interference Events

25. One distinctive characteristic of all of the proposed NGSO FSS systems is the directivity of the satellite and earth station antennas they must employ.<sup>43</sup> Operating on Ka-band frequencies requires the use of directive-tracking antennas for both earth and space station portions of the NGSO FSS network. A third spectrum sharing option is premised on the fact that separate NGSO satellite systems could share

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<sup>42</sup> Letter from Todd Stansbury, Counsel for @contact LLC, to Magalie Roman Salas, Secretary, FCC, dated June 11, 2001.

<sup>43</sup> Directivity of an antenna is a performance characteristic defined by a ratio of signal energy received (or transmitted) between desired and unwanted directions. Directivity indicates the antenna's ability to receive (or transmit) signals arriving from desired directions and reject (suppress) signals coming from unwanted directions. Generally, the more highly directive an antenna, the better it can reject signals from the sides and rear.

the same spectrum frequency and coverage so long as they avoid near in-line interference events.

26. An in-line interference event occurs whenever there is an unintentional transmission in either direction between an earth station of one system and a satellite of another caused by physical alignment. In other words, an in-line event is an event during which one NGSO FSS system's in-line transmission path between its satellite and one of its earth stations is intersected by an in-line transmission path of another NGSO FSS system's satellite or its earth station, all of which are aligned in nearly a straight line. During an in-line event, an NGSO FSS earth station would receive the highest interference level from the other NGSO FSS system's transmitting satellite when the satellite mainbeam transmission path is aligned with the earth station antenna. Conversely, the other NGSO FSS system's satellite would receive the highest interference level by the in-line transmission path of the earth station's mainbeam transmission.

27. There are essentially two possible techniques for coping with in-line interference events: satellite diversity and frequency isolation.<sup>44</sup> With satellite diversity, NGSO FSS systems avoid in-line interference by selecting another visible satellite within its system constellation whenever the current satellite approaches the in-line event with a satellite operating in another NGSO FSS system's constellation. Satellite diversity implies performing a hand-over (switching) process, selecting an alternative satellite in one system in order to avoid interfering with the in-line transmission path between an earth station and a space station in another system. Alternatively, the two NGSO FSS licensees could agree to split the spectrum between their two systems, solely for the duration of that potential in-line interference event, thereby avoiding interference through frequency isolation.<sup>45</sup> In either case, operations of both NGSO FSS systems in accordance with the in-line event spectrum sharing procedure will require close cooperation of the involved operators. At a minimum, it will require periodic exchanges of ephemeris data for each affected NGSO FSS system between the respective authorized system operators.<sup>46</sup> Hence, under this option, the NGSO FSS operators would be required to disclose periodically their satellites' orbital elements in the North American Aerospace Defense Command ("NORAD") 2-line element format. We seek comment on how frequently these orbital elements need to be updated to provide for effective spectrum sharing among proposed NGSO FSS systems. We note that Teledesic and the second round applicants plan NGSO systems in low or medium earth orbit. If future applicants employed highly elliptical orbits, in-line interference events could be avoided using mechanisms that do not rely on ephemeris data.

28. Under this option, whenever in-line interference events are not a threat, NGSO FSS systems would have access to the entire spectrum allocated or designated for NGSO FSS use, since inter-system interference is minimal. Prior to the launch of its first satellite, each NGSO FSS operator would be required to complete coordination with all other operational NGSO FSS systems.<sup>47</sup> The coordination may be accomplished by employing satellite diversity or a combination of other interference mitigation techniques.<sup>48</sup> If operators cannot reach a coordination agreement with a new entrant, they would be required to establish an in-line event spectrum sharing procedure based on the frequency isolation

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<sup>44</sup> ITU-R Recommendation S.1431, Methods to Enhance Sharing Between Non-GSO FSS Systems (Except MSS Feeder Links) In the Frequency Bands Between 10-30 GHz.

<sup>45</sup> Polarization isolation can also be used as a variation of frequency isolation. However, the use of polarization isolation is only useful for sharing between two systems. A third system could not maintain opposite polarization to the other two systems.

<sup>46</sup> Ephemeris data are technical parameters for a particular satellite that allow one to compute the location of that satellite in its orbit at any given time.

<sup>47</sup> A system is deemed operational when at least one of its satellites reaches its intended orbit and initiates transmission and reception of radio signals.

<sup>48</sup> See ITU-R S.1431 (e.g., satellite diversity, alternate polarization, etc.).

technique, that is, segmenting the spectrum among the operating systems involved in the predicted specific in-line interference event. For the duration of the in-line event, the satellite system operators would be required to divide the spectrum equally in the uplink and downlink bands. Recognizing the public interest benefit of hastening the provision of NGSO FSS to the public, we propose that priority in selecting spectrum segments would be based on the date the first satellite of each system successfully reaches its intended orbit and initiates transmission and reception.

29. Although we have so far described in-line events in lay terms, we would need to establish an unambiguous technical definition of in-line interference event parameters if we are to adopt this option. In this regard, we note that for GSO FSS, it has long been established that a requirement to coordinate, for co-frequency operation, should be based on maximum allowable inter-network interference. For example, coordination is triggered between GSO FSS systems only when the inter-network interference caused by the earth or space station emissions of any one other network operating in the same frequency band or bands is greater than six percent (6%) of the total system noise power under clear-sky conditions.<sup>49</sup> It is important to note that this coordination threshold is based on clear sky conditions, which are long-term in nature. In-line interference events between NGSO systems, however, are short-term, transient phenomena.<sup>50</sup> We are concerned that a long-term interference criterion may not be appropriate for the definition of an NGSO in-line event and seek comments in this regard.

30. In comments filed in response to the Commission's *Ku-band NPRM*, Teledesic proposes that a 10% aggregate allowance applicable to the interference from NGSO FSS systems be adopted as the in-line event coordination threshold.<sup>51</sup> Given the similarities between Ku- and Ka-band NGSO FSS system characteristics, we believe that it is advantageous to consider Teledesic's proposal in this proceeding as well. We further note that the proposed definition is based on ITU-R Recommendation S.1323-1<sup>52</sup> that provides the interference criteria for fixed-satellite networks for time-varying interference sources and is consistent with a recent revision of this recommendation by the ITU-R Working Party 4A.<sup>53</sup> Thus, we propose that the in-line interference event between two NGSO FSS networks be defined as the period of time during which 10% of the time allowance for the BER<sup>54</sup> specified in the short-term performance objectives of either network is exceeded. We seek comment on the adequacy of this definition. We further request comment on whether there is a need for additional provisions to address NGSO FSS systems using adaptive coding and what those provisions should be.<sup>55</sup>

31. The potential for in-line interference events -- and therefore the need to employ satellite diversity or frequency isolation to remediate them -- increases with the number of NGSO FSS systems placed into operation. The preceding discussion involved the most likely in-line interference event,

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<sup>49</sup> See ITU-R, Recommendation S.735-1.

<sup>50</sup> The duration of the transient period depends upon the altitude of the NGSO constellations affected, the earth station antenna size, and the number of satellites involved in the in-line interference event.

<sup>51</sup> Teledesic LLC, Comments filed July 5, 2001 at 5, in response to *The Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ku-Band*, Notice of Proposed Rulemaking, IB Docket No. 01-96 (rel. May 3, 2001).

<sup>52</sup> Recommendation ITU-R S.1323-1, Maximum Permissible Levels of Interference In a Satellite Network (GSO/FSS, Non-GSO/FSS; Non-GSO/MSS Feeder Links) in the Fixed-Satellite Service Caused by Other Codirectional Networks Below 30 GHz.

<sup>53</sup> *Chairman's Report From The Meeting of Working Party 4A*, Seattle, 23 April-2 May 2001, Document 4A/217 (Rev.1)-E, 22 June 2001 at 42.

<sup>54</sup> Bit Error Rate (BER) is a ratio of erred bits to the total transmitted bits in some measured time interval.

<sup>55</sup> Adaptive coding systems improve BER performance by implementing error correction coding to compensate for varying link degradation.

involving two satellites from two operating systems, which can be called a two-satellite in-line interference event. In the case of three operating NGSO FSS systems, there are two possible combinations of two satellites aligning with an earth station for an interference event (one of the two being an unintended point of communication), as well as the more remote possibility that three satellites could align their transmission paths with the earth station mainbeam of one of the three systems (with two satellites being unintended points of communication). In the case of four operating NGSO FSS systems, there are three possible combinations leading to a two-satellite in-line interference event and two possible combinations leading to a three-satellite in-line interference event. Recognizing that the frequency and duration of in-line events that involve multiple (three or more) NGSO FSS systems are relatively low, we, nonetheless, are concerned about interference aggregation. Specifically, we seek comments on whether there is a need to scale the aggregate interference allowance (10%) in the proposed definition of the in-line interference event to account for multiple interference sources and if so, how this should be accomplished.

32. The Avoidance of In-Line Interference Events option requires sub-dividing the NGSO FSS spectrum only during the time intervals involved in potential in-line interference events and only if coordination and satellite diversity cannot be implemented. During all other times, the affected NGSO FSS systems can operate using the entire allocated spectrum. We request comment on all aspects of the Avoidance of In-Line Interference Events option, including variations or alternatives that commenters propose. In particular, we seek comment on whether the complexity of managing multi-constellation in-line interference events through satellite switching protocols or frequency selection algorithms would negate the inherent benefits of this spectrum sharing option. We also recognize that requiring satellite diversity would increase the technical complexity of NGSO FSS systems.<sup>56</sup> We seek comment on the impact this complexity may have on system designs and commercial feasibility, and we ask commenters to quantify this impact. Commenters should provide support for all assertions and quantify, with supporting documentation, any alleged impact that adopting this option would have on their system and its operations. We seek comment on the feasibility of this proposal as well as any variations or alternatives that commenters propose.

#### 4. Option IV – Homogeneous Constellations

33. The ITU has determined that several NGSO FSS systems can share the same frequency band without interference when these systems employ nearly identical orbital parameters.<sup>57</sup> To minimize intersystem interference, the systems' transmission characteristics must also remain at a relatively uniform level. Consequently, requiring a homogeneous constellation standard represents another option for licensing Ka-band NGSO FSS systems.<sup>58</sup> We ask commenters to address whether we should adopt one or more unifying constellation standards that could accommodate all Ka-band NGSO FSS systems.

34. The pending NGSO FSS applications include a wide range of constellation designs. To foster heterogeneity of service offerings and flexibility of systems' designs, under this option, we could adopt more than one homogeneous constellation standard. We could then designate a proportional

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<sup>56</sup> The increased technical complexity takes at least two forms. First, satellite diversity, by its nature, requires the earth station to select another satellite within its constellation in order to provide continuous uninterrupted service. Consequently, for the duration of the in-line interference event, the in-line satellite's capacity cannot be used, and overall system capacity is not fully utilized. This requires, in turn, that NGSO FSS systems build additional capacity to compensate for the capacity lost during the in-line interference events. A second technical complexity is that earth stations must detect the onset of in-line interference events, predict the duration of the event, and determine to which other satellite in its constellation to which to switch. These reactions require complex software and switching hardware to provide seamless communications during an in-line interference event.

<sup>57</sup> See ITU-R S.1431.

<sup>58</sup> A homogeneous constellation standard is defined by a set of orbital parameters and transmission characteristics.

amount of Ka-band spectrum to each standard. Each NGSO FSS licensee would then be required to deploy its system within a defined envelope of orbital and transmission parameters comprising an identified constellation standard, and to share its spectrum assignment with systems of like design. For example, if we determine that two homogeneous constellation standards can accommodate all proposals, then under this option, we would subdivide the NGSO FSS spectrum sub-bands into two segments. Each licensee would select between the two designs, implement its system in accordance with that constellation standard's specifications, and share the spectrum designated for that standard with the other NGSO FSS systems that also selected that standard.

35. As a variation on this option, we propose to mandate only one homogenous constellation standard in a portion of the available NGSO FSS spectrum, and to allow NGSO FSS licensees who choose not to conform to that standard to share the remaining portion of the NGSO FSS spectrum using another of the spectrum sharing options proposed in this *Notice*. We seek comment on whether, if certain licensees elect not to conform to a homogenous standard, the spectrum should be divided evenly among the licensees or proportionately among the types of systems to be implemented. We ask commenters to address what other option would be most compatible under this alternative.

36. We seek proposals for specific constellation designs that we might adopt. Comments should address both the benefits and disadvantages of a homogeneous constellation approach, especially with regard to a specific constellation standard. We request that comments recommend values for a complete set of orbital parameters<sup>59</sup> and corresponding limits on a system's transmission characteristics that would ensure homogeneity of NGSO FSS systems. In addition, proponents of a specific design should demonstrate how the design serves the public interest. Likewise, opponents of a specific design should specifically address particular orbital parameters that are troublesome, discuss how a specific parameter or its value could be modified to mitigate those concerns, and propose modifications to the proposal. We also ask for comment on whether a particular design can support international operations, given that constellation parameters of NGSO FSS systems that are not serving the United States may not be compatible with a design we adopt. We seek comment on all aspects of the Homogenous Constellation option, as well as any variations or alternatives that commenters propose.

## B. Service Rules

37. Because our *Third Report and Order* focused on First Round GSO and NGSO systems, we deferred consideration of several NGSO FSS rules to a later processing round. We now seek comment on the following licensing and service rules in light of the decisions made in prior orders, our goal of ensuring expedited licensing, and considering the NGSO FSS spectrum sharing proposals presented in this *Notice*.

38. ***Financial qualifications.*** As noted above, the Commission waived the financial qualification requirement for the First Round Ka-band applicants, but deferred consideration of the applicability of this rule to Second Round applicants to a later processing round. Historically, the Commission has fashioned financial requirements for satellite services on the basis of entry opportunities in the particular service being licensed.<sup>60</sup> In cases where it can accommodate all pending applications and future entry is possible, the Commission has not looked to current financial ability as a prerequisite to a license grant. But in situations where potential applicants appear to have requirements that exceed the available spectrum or orbital resources, the Commission has invoked a strict financial qualifications standard. This policy is designed to make efficient use of spectrum by preventing underfinanced applicants from depriving another fully capitalized applicant of the opportunity to provide service to the

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<sup>59</sup> Orbital parameters are typically comprised of Epoch, Orbital Inclination, Right Ascension of Ascending Node (RAAN), Argument of Perigee, Eccentricity, Mean Motion, and Mean Anomaly.

<sup>60</sup> 47 C.F.R. §§ 25.140(c), 25.142(a)(4), and 25.143(b)(3).

public. Since this *Notice* proceeds from the assumption that a spectrum sharing plan can be devised to accommodate all the pending applicants' proposed systems and future entry, we are not proposing a strict financial qualification standard for this service with respect to the Second Round NGSO FSS applicants. If, however, the record developed in this proceeding indicates that the allocated spectrum cannot accommodate all applicants, we may impose a strict financial qualifications standard.

39. Should we determine the need to impose strict financial qualifications, we seek comment on whether to modify our existing financial qualifications requirement. Presently, NGSO FSS applicants are required to demonstrate internal assets or committed financing sufficient to cover construction, launch, and first-year operating costs of its entire system. We propose to require the commitment of funds not previously committed for any other purpose. If strict financial qualifications are invoked, applicants for NGSO FSS licenses will be required to demonstrate that they have assets or committed financing for their NGSO FSS systems that are separate and apart from any funding necessary to construct and operate any other licensed satellite systems. We request comment on this proposal, and ask whether there are alternative means of oversight we can employ to ensure that licensees will be able to commence timely service to the public.

40. **Implementation milestones.** As with all other satellite services, we propose that all NGSO FSS Ka-band licensees adhere to a strict timetable for system implementation. Milestones are intended to ensure that licensees are building their systems in a timely manner and that the spectrum resources are not being held by licensees unable or unwilling to proceed with their plans to the detriment of other operators who might benefit the public interest by implementing satellite systems. We propose implementation milestones that track schedules recently imposed on other NGSO systems.<sup>61</sup> Specifically, we propose that NGSO FSS Ka-band licensees must enter into a non-contingent satellite manufacturing contract for the system within one year of authorization, complete critical design review within two years of authorization, begin physical construction of all satellites in the system within two and half years of authorization, and complete construction and launch of the first two satellites within three and a half years of grant. The entire system will have to be launched and operational within six years of authorization. As is consistent with our practice in other services, we propose to require operators to submit certifications of milestone compliance, or file a disclosure of non-compliance, within 10 days following a milestone specified in the system authorization.

41. Alternatively, we propose to modify the implementation milestones for NGSO FSS licensees by tying the milestones to the ITU bring into use date.<sup>62</sup> For example, we could require applicants to demonstrate that they are on a launch manifest at a designated point some months before the ITU bringing into use date. In addition, we could require licensees to also meet the intermediate milestones noted above, that is, enter into a non-contingent contract, complete critical design review and begin physical construction of all satellites within a specified time frame prior to the ITU bringing into use date. We seek comment on what time frames would be appropriate. We seek comment on these or other possible approaches to implementation milestones.<sup>63</sup>

42. **Reporting requirements.** We propose a slight modification to section 25.145 of our rules, which governs reporting requirements for FSS systems. FSS licensees are required to file an annual report with the Commission describing: the status of satellite construction and anticipated launch dates,

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<sup>61</sup> The Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band, *Report and Order*, 15 FCC Rcd 16127 (2000) (“2 GHz Report and Order”).

<sup>62</sup> The ITU deadline for putting these U.S. systems into use is May 18, 2003. A two-year extension may be granted under certain circumstances, thus the latest date to bring into use at least one satellite by each of the second round applicants is May 18, 2005.

<sup>63</sup> We plan to undertake an investigation of milestones issues in a separate, broader proceeding, not limited to NGSO FSS service.

including any major delays or problems encountered; and a detailed description of the use made of each satellite in orbit.<sup>64</sup> Licensees should request an extension of time if they anticipate delays in these schedules. We propose to apply these requirements to NGSO FSS systems. We do not, however, propose to apply a requirement to report unscheduled satellite outages.<sup>65</sup> The outage reporting requirement was a means of spectrum management instituted to ensure that satellite spectrum resources were not warehoused in orbit. We believe that the operational characteristics of NGSO systems obviate the need for this reporting requirement. One of the second round applicants, @contact, suggests that applicants be required to file quarterly reporting requirements to enable the Commission to monitor more closely milestone compliance. We request comment on these proposals. We also seek comment on a proposal to require NGSO FSS operators to file affidavits certifying whether milestone requirements are met following the appropriate milestone deadlines.<sup>66</sup> The Commission would retain the right to request additional information (e.g., copies of construction contracts), as required to ensure compliance with milestones. Failure to file a timely certification or disclosure of non-compliance would result in automatic cancellation of an operator's system authorization, with no further action required on the Commission's part.<sup>67</sup> We seek comment on this proposal.

43. ***Orbital Debris Mitigation.*** Currently, the FCC addresses concerns regarding orbital debris of satellite systems on a case-by-case basis. The Commission analyzes such concerns under the general "public interest, convenience, and necessity," standard in the Communications Act. In our *2 GHz Report and Order*,<sup>68</sup> we adopted a requirement that applicants for 2 GHz MSS authorizations disclose their orbital debris mitigation plans. Like the Ku-band Notice of Proposed Rulemaking<sup>69</sup> we propose to apply that requirement to NGSO FSS applicants as well, and seek comment on its application to this service. We also intend to commence a separate rulemaking proceeding to consider whether to adopt filing requirements for all FCC-licensed satellite services, including orbital debris mitigation issues, the selection of safe flight profiles and operational configurations, as well as post-mission disposal practices.

44. ***System License and License Terms.*** NGSO systems historically consist of constellations of technically identical satellites that may be launched and retired at different times. Consequently, existing NGSO satellites in other bands and services have been authorized under blanket licenses.<sup>70</sup> Under this approach, licensees are issued a single blanket authorization for the construction, launch and operation of a specified number of technically identical space stations that constitute the satellite network constellation. The authorization covers all construction and launches necessary to implement the complete constellation and to maintain it until the end of the license term, including any replacement satellites necessitated by launch or operational failure, or by retirement of satellites prior to the end of the license period. All replacement satellites, however, must be technically identical to those in service, including the same orbital parameters, and may not cause a net increase in the number of operating satellites. The license term runs from the date on which the first space station in the system begins transmitting and receiving radio signals, and is valid for 10 years from that point in time. There is a filing window for system replacement applications prior to the expiration of the license that allows sufficient time for the Commission to act upon replacement system applications. We believe it is appropriate to

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<sup>64</sup> 47 C.F.R. § 25.210(1)(1) and (3).

<sup>65</sup> 47 C.F.R. § 25.210(1)(2).

<sup>66</sup> This requirement currently applies to Big LEO and 2 GHz operators.

<sup>67</sup> See 47 C.F.R. 25.161.

<sup>68</sup> *2 GHz Report and Order*, 15 FCC Rcd at 16187-88, ¶¶ 135-138.

<sup>69</sup> *Ku-Band NPRM*, ¶¶ 66-67.

<sup>70</sup> See, e.g., Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to Mobile Satellite Service in the 1610-1626/2483.5-2500 MHz Frequency Bands, *Report and Order*, 9 FCC Rcd 536 (1994).

continue using this model of licensing for the NGSO FSS. We propose to require that replacement applications be filed no earlier than three months prior to, and no later than one month after, the end of the eighth year of the existing system license. We request comment on this proposal.

### C. Coordination with Federal Government Systems

45. Further, we note that NGSO FSS licensed systems must coordinate with Federal Government systems in accordance with footnote US334 to the Table of Frequency Allocations.<sup>71</sup> This footnote requires coordination of commercial systems with Federal Government GSO and NGSO FSS systems that are presently operating throughout the 17.8-20.2 GHz frequency band. These Federal Government systems operate in accordance with the power flux-density limits contained in the current ITU Radio Regulations.<sup>72</sup> None of the spectrum sharing options in Section IV of this NPRM apply to Federal Government NGSO FSS systems; however, in all cases a NGSO FSS licensee will be required to complete coordination with Federal Government systems prior to the launch of the first satellite. Licensees will also be required to comply with footnote US255 to the Table of Frequency Allocations which contains power flux-density limits to protect the Earth exploration satellite (passive) and space research (passive) services in the 18.6-18.8 GHz band.<sup>73</sup>

## V. CONCLUSION

46. In adopting this Notice of Proposed Rulemaking, we intend to allow expeditious deployment of NGSO FSS in the United States for the benefit of consumers by establishing a spectrum sharing plan and service rules so that systems can be implemented in compliance with International Telecommunication Union (ITU) deadlines, and by allowing market forces to play a role in the implementation of these systems. We believe it is in the public interest to provide opportunities for multiple systems to compete, providing more service choices and competitive prices in the marketplace. Our expectation is that NGSO FSS providers will provide a vigorous, additional source of broadband service for consumers, in competition with existing satellite and terrestrial services. This *Notice* puts forth several options for assigning shared NGSO FSS spectrum resources, including incentives for rapid implementation of service. We believe that the proposals in this *Notice* are sufficiently flexible to accommodate the NGSO FSS systems set forth by the pending applicants. We seek comment on these and other possible sharing proposals. Finally, we request any other suggestions commenters might set forth with respect to sharing or service rules for NGSO FSS systems.

## VI. PROCEDURAL INFORMATION

47. *Initial Regulatory Flexibility Certification.* The certification, pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. Section 603, is contained in Appendix C.

48. *Ex Parte Presentation.* This is a permit-but-disclose rule making proceeding. Ex parte presentations are permitted, provided they are disclosed as provided in Commission Rules. *See generally*

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<sup>71</sup> 47 C.F.R. § 2.106 US334.

<sup>72</sup> *18 GHz Order*, 15 FCC Rcd at 13473. The power flux-density limits in the 18.3-18.6 GHz band are  $-115$  dB ( $W/m^2$ ) in any one megahertz band, depending upon the angle of arrival. There are currently no power flux-density limits in the 19.7-20.2 GHz band. *See* Letter from William T. Hatch, National Telecommunications and Information Administration, to Dale Hatfield, Chief, Office of Engineering and Technology, Federal Communications Commission (March 29, 2000).

<sup>73</sup> 47 C.F.R. § 2.106 US255 (as revised in the *18 GHz Order*, 15 FCC Rcd at 13489) states: In addition to any other applicable limits, the power flux-density across the 200 MHz band 18.6-18.8 GHz produced at the surface of the Earth by emissions from a space station under assumed free-space propagation conditions shall not exceed  $-95$ db ( $W/m^2$ ) for all angles of arrival. This limit may be exceeded by up to 3 db for no more than 5% of the time.

47 C.F.R. Sections 1.1202, 1.1203, and 1.1206(a).

49. *Authority.* This action is taken pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the *Communications Act of 1934*, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r).

50. *Comment.* Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on or before 30 days after this Notice is published in the Federal Register and reply comments no later than 45 days after this Notice is published in the Federal Register. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by paper copies. See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24,121 (1998).

51. Comments filed through the ECFS can be sent as an electronic file via the Internet to <<http://www.fcc.gov/e-file/ecfs.html>>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to [ecfs@fcc.gov](mailto:ecfs@fcc.gov), and should include the following words in the body of the message, "get form <your e-mail address.>" A sample form and directions will be sent in reply.

52. Parties who choose to file by paper must file an original and four copies of each filing. All filings must be sent to the Commission's Acting Secretary, William F. Caton, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, SW, Room TW-A325, Washington, D.C. 20554.

53. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: William F. Caton, Acting Secretary, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, SW, Room TW-A325, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible format using *Microsoft Word* for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, IB Docket No. 02-19, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleading, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, Qualex International, 445 12<sup>th</sup> Street, SW, Room CY-B402, Washington, D.C. 20554.

54. Alternative formats (computer diskette, large print, audio recording, and Braille) are available to persons with disabilities by contacting Brian Millin at (202) 418-7426 voice, (202) 418-7365 TTY, or <[bmillin@fcc.gov](mailto:bmillin@fcc.gov)>. This NPRM can also be downloaded in Microsoft Word and ASCII formats at <<http://www.fcc.gov/ib>>.

55. IT IS ORDERED, that pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the *Communications Act of 1934*, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r), this Notice of Proposed Rulemaking is hereby ADOPTED.

56. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of this Notice of Proposed Rulemaking, including the Initial Regulatory Flexibility Certification to the Chief Counsel for Advocacy of the Small Business Administration.

57. *Additional Information.* For further information concerning this rulemaking proceeding contact: Alyssa Roberts at (202) 418-7276, internet: aroberts@fcc.gov, or Robert Nelson at (202) 418-2341, internet: rnelson@fcc.gov, International Bureau, Federal Communications Commission, Washington, DC 20554.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton  
Acting Secretary

## APPENDIX A

Table 1 summarizes the U.S. domestic allocation table in the downlink Ka-band.

Frequency Band (GHz)	17.70-18.30	18.30-18.58	18.58-18.80	18.80-19.30	19.30-19.70	19.70-20.20
<b>Government</b>	GSO&NGSO/ FSS	GSO&NGSO/ FSS	GSO&NGSO/ FSS EESS & SRS (passive)	GSO&NGSO/ FSS	GSO&NGSO/ FSS	GSO&NGSO/ FSS
<b>Non-Government</b>	FS	GSO/FSS  FS	GSO/FSS  EESS & SRS (passive)	NGSO/FSS	MSS/FL  FS	GSO/FSS  MSS
<b>Total MHz Bandwidth</b>	600 MHz	280 MHz	220 MHz	500 MHz	400 MHz	500 MHz

Table 2 summarizes the FCC band plan designations in the uplink Ka-band.

Frequency Band (GHz)	27.50-28.35	28.35-28.60	28.60-29.10	29.10-29.25	29.25-29.50	29.50-30.00
	FS  gso/fss  ngso/fss	GSO/FSS  ngso/fss	NGSO/FSS  gso/fss	MSS/FL  FS	MSS/FL  GSO/FSS	GSO/FSS  ngso/fss
<b>Total MHz Bandwidth</b>	850 MHz	250 MHz	500 MHz	150 MHz	250 MHz	500 MHz

**APPENDIX B: Proposed Rules**

For the reasons set forth in the preamble, part 25 of title 47 of the Code of Federal Regulations is proposed to be amended as follows:

**PART 25-SATELLITE COMMUNICATIONS**

The authority citation for Part 25 continues to read as follows:

**AUTHORITY:** 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303; 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309 and 332, unless otherwise noted.

1. Section 25.145 is amended by adding or modifying the following paragraphs (c)(3), (f), (g), (j), (k), and (l):

**§ 25.145 Licensing conditions for the Fixed-Satellite Service in the 20/30 GHz bands.**

(c) \* \* \* \* \*

(3) A description of the design and operational strategies that it will use, if any, to mitigate orbital debris. Each applicant must submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft.

(f) Implementation Milestone Schedule. Each NGSO FSS licensee in the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands will be required to enter into a non-contingent satellite manufacturing contract for the system within one year of authorization, to complete critical design review within two years of authorization, to begin physical construction of the satellites in the system within two and a half years of grant, and to launch and operate its entire authorized system within six years of authorization.

(g) Reporting Requirements:

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(iv) All operators of NGSO FSS systems in the 18.8-19.3 GHz and 28.6-29.1 GHz bands shall, within 10 days after a required implementation milestone as specified in the system authorization, certify to the Commission by affidavit that the milestone has been met or notify the Commission by letter that it has not been met. At its discretion, the Commission may require the submission of additional information (supported by affidavit of a person or persons with knowledge thereof) to demonstrate that the milestone has been met. Failure to file a timely certification of milestones, or filing disclosure of non-compliance, will result in automatic cancellation of the authorization with no further action required on the Commission's part.

(j) Financial Requirements. Each NGSO FSS applicant must demonstrate, on the basis of the documentation contained in its application, that it is financially qualified to meet the estimated costs of the construction and/or launch and any other initial expenses of all proposed space stations in its system and the estimated operating expenses for one year after the launch of the proposed space station(s). Financial qualifications must be demonstrated in the form specified in § 25.140(c) and (d). In addition, applicants relying on current assets or operating income must submit evidence that those assets are

separate and apart from any funding necessary to construct or operate any other licensed satellite system. Failure to make such a showing will result in the dismissal of the application.

(k) Replacement of Space Stations within the System License Term. Licensees of NGSO FSS systems in the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands authorized through a blanket license pursuant to paragraph (b) of this section need not file separate applications to launch and operate technically identical replacement satellites within the term of the system authorization. However, the licensee shall certify to the Commission, at least thirty days prior to launch of such replacement(s) that:

- (1) The licensee intends to launch a space station into the previously-authorized orbit that is technically identical to those authorized in its system authorization and
- (2) Launch of this space station will not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(l) In-Orbit Spares. Licensees need not file separate applications to operate technically identical in-orbit spares authorized as part of the blanket license pursuant to paragraph (b) of this section. However, the licensee shall certify to the Commission, within 10 days of bringing the in-orbit spare into operation, that operation of this space station did not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

**APPENDIX C: INITIAL REGULATORY FLEXIBILITY CERTIFICATION and  
INITIAL PAPERWORK REDUCTION ACT OF 1995 ANALYSIS****INITIAL REGULATORY FLEXIBILITY CERTIFICATION**

The Regulatory Flexibility Act (RFA),<sup>1</sup> requires that a regulatory flexibility analysis be prepared for notice and comment rulemaking proceedings unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.”<sup>2</sup> The RFA generally defines “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”<sup>3</sup> In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.<sup>4</sup> A small business concern is one which: (a) is independently owned and operated; (b) is not dominant in its field of operation; and (c) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>5</sup>

This Notice of Proposed Rulemaking (*Notice*) seeks comment on proposed options for spectrum sharing among the second round Ka-Band non-geostationary satellite orbit fixed-satellite service (NGSO FSS) applicants. The Commission proposes to license all five of the applicants and seeks comment on which option may best accommodate the applicants. Implementation of these NGSO FSS systems will introduce additional means of providing broadband services to consumers as quickly as possible. This *Notice* also seeks comment on our proposals for service rules to apply to NGSO FSS systems.<sup>6</sup> These actions are necessary for the Commission to evaluate these proposals and seek comment from the public on any other alternatives. The objective of this proceeding is to assign the NGSO FSS spectrum in an efficient manner and create rules to ensure systems implement their proposals in a manner that serves the public interest and enables the U.S. to preserve its ITU international coordination priority. We believe that adoption of the proposed rules will reduce regulatory burdens and, with minimal disruption to existing FCC permittees and licensees, result in the continued development of NGSO FSS and other satellite services to the public. If commenters believe that the proposed rules discussed in the *Notice* require additional RFA analysis, they should include a discussion of this in their comments.

The Commission has not developed a definition of small entities applicable to geostationary or non-geostationary satellite orbit fixed-satellite or mobile satellite service operators. Therefore, the applicable definition of small entity is the definition under the SBA rules applicable to Communications Services “Not Elsewhere Classified.” This definition provides that a small entity is one with \$11.0 million or less in annual receipts.<sup>7</sup> This Census Bureau category is very broad, and commercial satellite services constitute only a subset of the total number of entities included in the category.

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<sup>1</sup> The RFA, 5 U.S.C. § 601 *et. seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

<sup>2</sup> 5 U.S.C § 605(b).

<sup>3</sup> *Id.* at § 601(6).

<sup>4</sup> *Id.* at § 601(3) (incorporating by reference the definition of “small business concern” in Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

<sup>5</sup> Small Business Act, 15 U.S.C. § 632.

<sup>6</sup> See paragraphs 37-44, *supra*.

<sup>7</sup> 13 C.F.R. § 121.201, North American Industry Classification System (NAICS) Code 51334.

The rules proposed in this *Notice* apply only to entities providing NGSO FSS. Small businesses will not likely have the financial ability to become NGSO FSS system operators because of the high implementation costs associated with satellite systems and services. Since there is limited spectrum and orbital resources available for assignment, we estimate that only five applicant entities, whose applications are pending, will be authorized by the Commission to provide these services. We expect that none of these would be considered small businesses under the SBA definition. Thus, the rules proposed in this Notice of Proposed Rulemaking, if adopted, would not have a significant economic impact on a substantial number of small entities.

The Commission will send a copy of this Notice of Proposed Rulemaking, including this initial certification, to the Chief Counsel for Advocacy of the Small Business Administration. A copy will also be published in the Federal Register. *See* 5 U.S.C. § 605(b).

#### **INITIAL PAPERWORK REDUCTION ACT OF 1995 ANALYSIS**

This Notice of Proposed Rulemaking contains either a proposed or a modified information collection. As part of our continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to comment on the information collections contained in this Notice, as required by the Paperwork Reduction Act of 1995, Pub. L. No. 104-13. Public and agency comments are due on or before 30 days after the date of publication of this Notice in the Federal Register. Comments should address: (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimates; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology.

**APPENDIX D: NGSO FSS SYSTEM APPLICATIONS**

The following applications, and amendments to pending applications, for spectrum allocated on a primary basis to NGSO FSS are currently on file in the second Ka-band processing round, which was initiated by Public Notice, Report No. SPB-105 (released October 15, 1997) (*Satellite Applications Accepted for Filing in the 18.8-19.3/28.6-29.1 and 19.7-20.2/29.5-30.0 GHz Bands; Cut-off Established for Additional Applications in the 18.8-19.3 and 28.6-29.1 GHz Bands*), and Public Notice, Report No. SPB-106 (*Satellite Applications Accepted for Filing in the Ka-band; Cut-off Established for Additional Applications in the 28.35-28.6 GHz, 29.1-30.0 GHz, 17.7-18.8 GHz, and 19.3-30.0 GHz Frequency Bands*) (*Ka-Band Cut-off Notices*).

**Hughes** **File No.:** **SAT-LOA-19971222-00210**

Hughes filed an application to launch and operate SPACEWAY NGSO, a global broadband NGSO satellite system. Hughes requested authority to operate 20 medium earth orbit (MEO) satellites in 4 planes, inclined at 55 degrees with respect to the equator and in circular orbits at an altitude of 10,352 km. SPACEWAY NGSO proposes to operate at 18.80-19.30 GHz for space-to-Earth (downlink) transmissions and 28.60-29.10 GHz for Earth-to-space (uplink) transmissions. Hughes also requested inter-satellite links (ISLs) in the 1.55 micron range, and telemetry, tracking, and control (TT&C) links for its SPACEWAY NGSO system.

**@contact** **File No.:** **SAT-LOA-19971222-00222**

@contact filed an application for authority to launch and operate a global constellation of NGSO FSS satellites. The proposed @contact system consists of sixteen operational satellites, plus four orbital spares in 10,400 kilometer circular MEO's inclined at 45 degrees. @contact requests authority to operate within the 18.80-19.30 GHz and 19.70-20.20 GHz bands for uplinks and within 28.60-29.10 GHz and 29.50-30.00 GHz for downlinks. @contact requests spectrum communications among satellites of MEO constellation operating on a primary basis in the ISL band 59.00-64.00 GHz, or, alternatively, 54.25-58.20 GHz. @contact also requests TT&C functions in the NGSO Ka-band. Finally, @contact requested a waiver of the Commission's financial qualifications rule Section 25.140(d).

**SkyBridge II** **File No.:** **SAT-LOA-19971222-00221**

SkyBridge II filed an application to launch and operate a global broadband network of NGSO satellites. SkyBridge requested authority to operate 96 operational low earth orbit ("LEO") satellites, plus six in-orbit spares, in circular orbit at an altitude of 1468 km. SkyBridge proposes to distribute its 96 satellites in 2 identical sub-constellations of 48 satellites each. Each of these sub-constellations proposes to have eight planes, inclined at 55 degrees with respect to the equator. SkyBridge requests authority to operate its system in the 28.60-29.10 GHz, 28.35-28.6 GHz and 29.50-30.00 GHz bands for uplink spectrum and 18.80-19.30 GHz, 17.80-18.60 GHz and 19.70-20.20 GHz bands for downlink spectrum. SkyBridge proposed to use TT&C links in the Ku-band.

**Lockheed Martin Corporation** **File No.:** **SAT-LOA-19971222-00203**

Lockheed Martin filed an application to launch and operate a global broadband NGSO system known as the LM-MEO System. The requested LM-MEO constellation will consist of 32 MEO satellites in four planes, inclined at 70 degrees, at an altitude of 10,352 km. Lockheed Martin requests 1.25 GHz of uplink spectrum in the 28.35-29.10 GHz and 29.50-30.0 GHz bands, and 1.25 GHz of downlink spectrum in the 18.05-18.3 GHz, 18.8-19.30 GHz and 19.70-20.20 GHz bands. For communications among its MEO satellites, Lockheed Martin requests optical ISLs providing 2.48 Gbps interconnection in the 1.55 micron

region. Finally, Lockheed requests authority to perform TT&C communications in the Ka-band service channel.

**TRW**

**File Nos.: SAT-AMD-19971222-00219  
SAT-WAV-19971222-00220**

TRW filed an application for authority to launch and operate a global constellation of NGSO FSS satellites. TRW requests authority to launch and operate fifteen MEO satellites at a distance 5591 n.m. and inclined at 55 degrees. The spectrum TRW requests is 17.70-20.20 for uplinks and within 28.60-29.10 GHz and 29.50-30.00 GHz for downlinks.