

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

In the Matter of	)	
the Application of	)	
	)	
<b>SkyBridge L.L.C.</b>	)	IBFS No. SAT-LOA -19970228-00021
	)	IBFS No. SAT-AMD-19970703-00058
For Authority to Launch and Operate	)	IBFS No. SAT-AMD-19980630-00056
a Global Network of Low-Earth Orbit	)	IBFS No. SAT-AMD-19990108-00004
Communications Satellites Providing	)	IBFS No. SAT-AMD-20020917-00167
Broadband Services in the Fixed-Satellite Service	)	IBFS No. SAT-AMD-20040719-00135
	)	Call Sign S2241

**ORDER AND AUTHORIZATION**

Adopted: July 18, 2005

Released: July 18, 2005

By the Chief, International Bureau:

**I. INTRODUCTION**

1. With this Order, we authorize SkyBridge L.L.C. (SkyBridge) to launch and operate a system of non-geostationary satellite orbit (NGSO) fixed-satellite service (FSS) satellites in the Ku-band frequencies. Specifically, we authorize SkyBridge to operate service links, infrastructure and relay links, and telemetry, tracking, and command links in the 12.75-13.25 GHz and 13.75-14.5 GHz bands for its uplinks (Earth-to-space) and in the 10.7-12.7 GHz band for its downlinks (space-to-Earth). We also authorize SkyBridge to use the 12.7-12.75 GHz (space-to-Earth) band outside the Western Hemisphere, and the 17.3-17.8 GHz (Earth-to-space) and 17.8-18.1 GHz (Earth-to-space) bands outside the United States on a non-harmful interference basis. This authorization will allow SkyBridge to initiate a range of data, voice, and video broadband fixed satellite services to businesses and consumers around the globe. This license, the first in a new Ku-band NGSO satellite service, can promote competition and investment in broadband services through an innovative new satellite service platform.

**II. BACKGROUND**

2. SkyBridge seeks authority to operate a constellation of 80 low-Earth orbit (LEO) satellites arrayed in 20 orbital planes, with 4 equally-spaced satellites per plane. SkyBridge's planes will be inclined at 53 degrees from the equator, and will be equally spaced around the equator, 18 degrees apart. Each satellite will use a circular orbit at an altitude of 1,469.3 kilometers. All service links, infrastructure and relay links, and telemetry, tracking, and command (TT&C) links will be operated in the requested Ku-band frequencies.

3. SkyBridge filed its application on February 28, 1997.<sup>1</sup> The Satellite Policy Branch placed SkyBridge's application on Public Notice as accepted for filing on August 28, 1997.<sup>2</sup> In a later Public

<sup>1</sup> SkyBridge L.L.C., Application IBFS No. SAT-LOA-19970228-00021 (SkyBridge Application). The SkyBridge Application has subsequently been amended several times: IBFS No. SAT-AMD-19970703-00058; IBFS No. SAT-AMD-19980630-00056; IBFS No. SAT-AMD-19990108-00004; IBFS No. SAT-AMD-20020917-00167 and IBFS No. SAT-AMD-20040719-00135.

Notice, the Satellite Policy Branch established a cut-off date for filing competing NGSO FSS system applications.<sup>3</sup> Six entities filed applications to launch and operate seven NGSO FSS systems.<sup>4</sup> Boeing, Hughes (both applications), and Teledesic have since withdrawn their applications. Further, the Commission dismissed Denali's application as defective.<sup>5</sup>

4. In addition to its application, SkyBridge filed a petition for rulemaking to allow NGSO FSS systems in the requested Ku-band frequencies. Contemporaneous with its review of the specific applications filed, the Commission opened a rulemaking proceeding to consider co-frequency operation of NGSO FSS systems with geostationary satellite orbit (GSO) systems and terrestrial systems already operating in those frequencies.<sup>6</sup> In late 2000, the Commission determined the rules for inter-service sharing between satellite and terrestrial services in shared Ku-band frequencies.<sup>7</sup> The Commission decided the means for intra-service sharing among the Ku-band NGSO FSS applicants and issued service rules in 2002.<sup>8</sup> The Commission later refined the rules for sharing between GSO systems and the proposed NGSO FSS systems in Ku-band frequencies.<sup>9</sup> Consequently, we are now in a position to act on the pending Ku-band NGSO FSS applications.

5. SkyBridge is wholly owned and controlled by SkyBridge Limited Partnership.<sup>10</sup> The general partner of SkyBridge Limited Partnership is SkyBridge G.P., Inc., a Delaware corporation, which holds a .583% ownership interest. SkyBridge G.P., Inc. is in turn wholly owned by Alcatel Space, a French company. In addition to the general partner, two limited partners hold a greater than 10% equity ownership in SkyBridge Limited Partnership: Alcatel Multimedia Satellite, another French company (46.968% interest) and Loral Broadband Holdings, L.P., a Delaware limited partnership wholly owned by Loral Space & Communications, Ltd., a Bermuda company (14.296% interest). In addition, 16 other

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<sup>2</sup> *Public Notice*, Satellite Policy Branch Information: Application Accepted for Filing, Report No. SPB-98 (released August 28, 1997).

<sup>3</sup> Report No. SPB-141, released November 2, 1998 (*Ku-band Cut-Off Notice*).

<sup>4</sup> *Public Notice*, Satellite Policy Branch Information: Applications Accepted for Filing in the 12.75-13.25 GHz, 13.75-14.5 GHz, 17.3-17.8 GHz and 10.7-12.7 GHz Frequency Bands, Report No. SAT-00013 (released March 23, 1999). In addition to the SkyBridge Application, applications were filed by: Denali Telecom, LLC; Hughes Communications Inc. (an application for 22 medium-Earth orbit satellites); Hughes Communications Inc. (a separate application for 70 low-Earth orbit satellites); Teledesic, L.L.C.; The Boeing Company; and Virtual Geosatellite, L.L.C.

<sup>5</sup> Denali Telecom, L.L.C. See *Public Notice*, Satellite Policy Branch Information: Actions Taken, Report No. SAT-00231, DA No. 04-2436 (released July 30, 2004).

<sup>6</sup> *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-band Frequency Range*, ET Docket No. 98-206. (the *Ku-band Sharing Proceeding*).

<sup>7</sup> *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-band Frequency Range*, First Report and Order and Further Notice of Proposed Rulemaking, FCC 00-418, 16 FCC Rcd. 4096 (2000) (*First Report and Order*).

<sup>8</sup> *In The Matter Of The Establishment Of Policies And Service Rules For The Non-Geostationary Satellite Orbit, Fixed Satellite Service In The Ku-band*, Report and Order and Further Notice of Proposed Rulemaking, 17 FCC Rcd. 7841 (2002) (*Ku-band NGSO FSS Service Rules Order*).

<sup>9</sup> *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-band Frequency Range*, Third Memorandum Opinion and Order, 18 FCC Rcd. 2307 (2003) (*Third MO&O*).

<sup>10</sup> SkyBridge L.L.C. Amendment, IBFS No. SAT-AMD-20020917-00167 (2002 Conforming Amendment) at Exhibit A.



limited partners -- each holding less than 10% equity ownership -- collectively own 38.153% of SkyBridge Limited Partnership.<sup>11</sup>

6. A number of parties filed comments on or petitions to deny the SkyBridge Application. Virtually all the comments and petitions to deny focused on sharing issues between incumbent GSO services and terrestrial fixed services in the Ku-band frequencies and SkyBridge's proposed Ku-band NGSO FSS system. The majority of these sharing issues were subsequently resolved through an international agreement and changes to the International Radio Regulations at the 2000 World Radiocommunication Conference (WRC-2000). The Commission implemented these changes domestically in its *First Report and Order in the Ku-band Sharing Proceeding*.<sup>12</sup>

7. SkyBridge first amended its application on June 30, 1997.<sup>13</sup> The 1997 Amendment removed certain frequency bands used in the United States for government operations, changed the antenna pattern for residential user terminals, elaborated on frequency sharing with fixed terrestrial operators, and demonstrated the proposed system's ability to operate co-frequency with GSO and terrestrial systems in the Ku-band frequencies. SkyBridge further amended its application on June 30, 1998 to increase the number of satellites from 64 to 80, and to change the orbital configuration of the satellites.<sup>14</sup> On January 8, 1999, SkyBridge again amended its application to revise frequency usage requirements, to update radio transmission parameters and satellite antenna patterns, to propose a new "relay link" between gateway earth stations, and to update system routing and switching procedures.<sup>15</sup>

8. After the release of the Commission's service rules for the NGSO FSS in Ku-band frequencies, SkyBridge filed its Conforming Amendment in September 2002.<sup>16</sup> Also in September 2002, SkyBridge filed supplementary information with the International Telecommunication Union (ITU) in response to an ITU request for information to be used in developing software to prove compliance with certain power limits.<sup>17</sup> Subsequently, in a 2004 Public Notice, the International Bureau's Satellite Division clarified the minimum information that must be included in a casualty risk assessment if an applicant's planned post-mission disposal of NGSO satellites involves atmospheric re-entry of spacecraft.<sup>18</sup> SkyBridge filed a casualty risk assessment on July 19, 2004.<sup>19</sup> The Division subsequently

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<sup>11</sup> *Id.*

<sup>12</sup> First Report and Order and Further Notice of Proposed Rulemaking, 16 FCC Rcd. 4096 (2000).

<sup>13</sup> SkyBridge L.L.C. Amendment, File No. 89-SAT-AMEND-97, IBFS No. SAT-AMD-19970703-00058 (1997 Amendment); see *Public Notice*, Satellite Policy Branch Information: Application Accepted for Filing, Report No. SPB-98 (released August 28, 1997).

<sup>14</sup> SkyBridge L.L.C. Amendment, File No. 130-SAT-AMEND-98, IBFS No. SAT-AMD-19980630-00056 (1998 Amendment); see *Public Notice*, Satellite Policy Branch Information: Application Accepted for Filing, Report No. SPB-133 (released July 20, 1998).

<sup>15</sup> SkyBridge L.L.C. Amendment, IBFS No. SAT-AMD-19990108-00004 (1999 Amendment); see *Public Notice*, Satellite Policy Branch Information: Applications Accepted for Filing in the 12.75-13.25 GHz, 13.75-14.5 GHz, 17.3-17.8 GHz and 10.7-12.7 GHz Frequency Bands, Report No. SAT-00013 (released March 23, 1999).

<sup>16</sup> 2002 Conforming Amendment at Exhibit A.

<sup>17</sup> September 25, 2002 letter from Kathryn O'Brien, Chief, Strategic Analysis and Negotiations Division, International Bureau, FCC, to The Director, Radiocommunication Bureau, International Telecommunication Union (cover submission on behalf of SkyBridge) (SkyBridge 2002 CR/176 Filing); March 26, 2002 ITU-BR Circular letter CR/176.

<sup>18</sup> *Public Notice*, Report No. SPB-208, DA 04-1724 (released June 16, 2004).

<sup>19</sup> File No. SAT-AMD-20040719-00135.

wrote a letter to SkyBridge requesting additional details on its orbital debris mitigation plan.<sup>20</sup> SkyBridge filed a responsive letter detailing its plan.<sup>21</sup>

9. On April 12, 2005, the Policy Division of the International Bureau forwarded the SkyBridge application for Executive Branch review, to determine whether the application raised any national security, law enforcement, foreign policy or trade concerns.<sup>22</sup> Upon review, no Executive Branch agency filed an objection to the application.

10. SkyBridge states that the SkyBridge System will be divided into three business segments: (1) the space segment owned and operated on a global basis by SkyBridge; (2) gateway earth station operations; and (3) the user service provider segment.<sup>23</sup> The latter two segments will be owned and operated by independent third parties on a regional or local basis. This license does not authorize user terminals or gateway earth stations. We will license these stations when applications are filed, in accordance with the appropriate technical requirements for their respective frequency bands.

### III. DISCUSSION

11. All applicants requesting authority to launch and operate satellite space stations must present information sufficient to establish their legal, technical, and financial qualifications to hold a Commission license.<sup>24</sup> The regulations set forth in Part 25 of the Commission's rules govern FSS applicants and licensees, including this application for NGSO FSS in the Ku-band frequencies. We have reviewed SkyBridge's satellite application and associated amendments, petitions, comments, and replies. Nothing in the record suggests that SkyBridge is not legally qualified to provide its proposed service. We find that SkyBridge is qualified, and that the proposed facilities and operations comply with all applicable rules, regulations, and policies. Thus, we conclude that grant of this application will serve the public interest, convenience and necessity.

#### A. Technical Qualifications

12. This is the first authorization granted in the new Ku-band NGSO FSS service. When SkyBridge and other licensees in the service are operational, they will share their Ku-band spectrum under the "avoidance of in-line interference events" technique adopted by the Commission in the *Ku-band NGSO FSS Service Rules Order*. At the same time, SkyBridge and other Ku-band NGSO FSS licensees will share already heavily-used Ku-band spectrum with other space station operators and with terrestrial users pursuant to the sharing mechanisms adopted in the *First Report and Order*.<sup>25</sup> We reiterate, below, the necessary sharing constraints in the bands in which SkyBridge's NGSO FSS system will operate.

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<sup>20</sup> October 1, 2004 Letter from Thomas S. Tycz, Chief, Satellite Division, to Jeffrey Olson, Attorney for SkyBridge, L.L.C.

<sup>21</sup> November 10, 2004 Letter from Jeffrey H. Olson and Diane C. Gaylor, Attorneys for SkyBridge, L.L.C., to Marlene H. Dortch, Secretary, FCC (SkyBridge Orbital Debris Letter).

<sup>22</sup> April 12, 2005 Letter from George Li, Deputy Chief, Policy Division, International Bureau, FCC to Hillary Morgan, Damon Wells, Eric Werner, Edward T. Hand, Josephine Scarlett, Helen Domenici, Dominic Pastore, Laura Parsky, Monique Roth, Regina Hart, Louis Brenner, James Casey, Richard Lamb, Tina Gabbrelli, Kenneth Schagrin, and Myla S. Trotter.

<sup>23</sup> SkyBridge Application at 17.

<sup>24</sup> See 47 U.S.C. § 301.

<sup>25</sup> *First Report and Order*, 16 FCC Rcd. 4096 (2000).



## 1. System Design

13. As amended, the SkyBridge system is comprised of a constellation of 80 operational LEO satellites, additional in-orbit spares, a satellite control center, TT&C earth stations, a mission control center, gateway earth stations, and user terminals. Gateways interconnect the system with local servers and the terrestrial broadband and narrowband network. The system is designed primarily to provide communication links between gateways and user terminals. The communications traffic generated by user terminals will be transmitted by SkyBridge satellites to gateway earth stations without any processing other than amplification and frequency translation, a system architecture often described as a "bent pipe" system. In essence, SkyBridge satellites provide a radio repeater service between the gateways and user terminals.<sup>26</sup>

14. Each SkyBridge satellite will illuminate an area on the surface of the Earth with a radius of 3,000 kilometers. The satellite's downlink transmissions will be divided into a maximum of 24 steerable spot-beams, each illuminating a 350-kilometer radius cell on Earth. Gateway earth stations will be located within the 350-kilometer-radius cells illuminated by spot-beams and will connect to and continuously manage the traffic of user terminals within their respective cells.<sup>27</sup> Because the SkyBridge satellites' orbit is non-geostationary, gateway traffic must be periodically handed over between orbiting satellites. The system's mission control center will plan in advance the resources available to each gateway. The hand-over operation will be controlled in real time by the gateway stations. SkyBridge expects that approximately 200 gateways will be deployed worldwide, 30-40 of which will serve the United States.<sup>28</sup>

15. User terminals will be composed of an outdoor unit, including the antenna, radiofrequency components, modems and a control unit for establishing the link via satellite with the gateway station, and an indoor unit for delivering and collecting the user traffic via interfaces with terminals such as personal computers or set top boxes.<sup>29</sup> The type of user terminal will differ depending upon whether it is being used for a residential or professional application. SkyBridge anticipates that user terminals will be distributed to end users either directly through consumer electronics retailers or via the third-party service providers.<sup>30</sup>

## 2. Sharing with Other NGSO FSS Systems

16. In the *Ku-band NGSO FSS Service Rules Order*, the Commission adopted an "avoidance of in-line interference events" spectrum sharing method as the basis of spectrum sharing between and among NGSO FSS service operators.<sup>31</sup> SkyBridge must incorporate into its system design the capacity to implement avoidance of in-line interference events with all future NGSO FSS licensees. This authorization is conditioned on SkyBridge's ability to avoid in-line interference events with other NGSO FSS licensees in the Ku-band.

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<sup>26</sup> 1999 Amendment at A-4.

<sup>27</sup> 1999 Amendment at A-7.

<sup>28</sup> 1999 Amendment at A-49.

<sup>29</sup> 1999 Amendment at A-50.

<sup>30</sup> SkyBridge Application at 18.

<sup>31</sup> *Ku-band NGSO FSS Service Rules Order*, 17 FCC Rcd. at 7850 ¶ 27.

### 3. Sharing with Other Users

17. Incumbent GSO FSS operators and terrestrial fixed service operators raised concerns about SkyBridge's potential to adversely affect their co-frequency services in the Ku-band. Section 25.146(e) of the Commission's rules, 47 C.F.R. § 25.146(e), provides that NGSO FSS systems shall not claim protection from GSO FSS and Broadcast Satellite Service (BSS) networks operating in accordance with Commission rules.<sup>32</sup> In this section, we address these concerns in each of the uplink and downlink frequency bands in which SkyBridge proposes to operate its system.<sup>33</sup>

#### a. Downlink Bands

##### (i) 10.7 - 11.7 GHz

18. Prior to SkyBridge's application and petition for rulemaking, the 10.7-11.7 GHz band was allocated on a co-primary basis to terrestrial fixed service (FS), and to FSS downlinks for international systems only.<sup>34</sup> The Commission permitted NGSO FSS gateway earth stations to provide space-to-Earth transmissions (downlinks) in this band in the *First Report and Order*.<sup>35</sup> The Commission adopted technical sharing criteria to allow co-frequency NGSO FSS and FS operations in this band, consisting of power flux density (PFD) limits, consistent with decisions taken at WRC-2000.<sup>36</sup> The Commission also adopted technical sharing criteria to allow NGSO FSS and GSO FSS co-frequency operations, consisting of equivalent power flux density (EPFD) downlink limits, likewise consistent with WRC-2000 decisions.<sup>37</sup>

19. Further protection of incumbent GSO FSS operations in the Ku-band is afforded by operational EPFD limits, and additional operational EPFD limits.<sup>38</sup> SkyBridge must demonstrate that it meets these operational and additional operational limits after licensing, but prior to its system being placed into service.<sup>39</sup> And, finally, the Commission also adopted a limit to the aggregate EPFD, which is

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<sup>32</sup> 47 C.F.R. § 25.146(e) (2004).

<sup>33</sup> In its application, SkyBridge asserted that its system will require at least 1.05 gigahertz of contiguous uplink and 1.05 gigahertz of contiguous downlink spectrum in the Ku-band. SkyBridge Application at 75. In its 1997 Amendment, SkyBridge removed two frequency band segments from its request for authorization because those segments were used for United States government operations. 1997 Amendment at 3 (the 14.5-14.8 GHz band and the 17.8-18.1 GHz band). Recognizing that with those segments unavailable, it could not request 1.05 GHz of contiguous spectrum in the Ku-band, SkyBridge removed the request for contiguous spectrum from its Application. 1997 Amendment at 5.

<sup>34</sup> See 47 C.F.R. § 2.106 of the Commission's Rules, footnote 792 A.

<sup>35</sup> *First Report and Order*, 16 FCC Rcd. at 4099 ¶ 2.

<sup>36</sup> *First Report and Order*, 16 FCC Rcd. at 4116 ¶ 39. Power flux-density (PFD) is a measure of the amount of energy emitted by a transmitter that is present over a unit area at the Earth's surface or at the satellite, and is a critical factor in determining whether satellite systems can successfully share spectrum with other services or satellite systems. *Id.* at 4140 ¶ 106. The Commission adopted revised terminology used by international working groups, referring to "EPFD<sub>down</sub>" for power limits applicable to NGSO FSS space stations within an NGSO FSS system and EPFD<sub>up</sub> for power limits applicable to NGSO FSS Earth stations within an NGSO FSS system or GSO BSS and FSS systems. *Id.*

<sup>37</sup> *First Report and Order*, 16 FCC Rcd. at 4128 ¶ 72.

<sup>38</sup> *First Report and Order*, 16 FCC Rcd. at 4136 ¶ 96 (incorporating EPFD limits codified at 47 C.F.R. §§ 25.208(i) and 25.208(j)).

<sup>39</sup> *First Report and Order*, 16 FCC Rcd. at 4136 ¶ 96.

the cumulative level of interference into GSO FSS systems from all co-frequency NGSO FSS systems, although the method for verifying compliance with this limit has not yet been determined.<sup>40</sup>

20. In addition, the Commission required coordination between NGSO FSS operators and radio astronomy service receivers in the 10.6-10.7 GHz band,<sup>41</sup> and coordination to protect GSO FSS networks in this band using sensitive receiving earth stations with very large antennas.<sup>42</sup> The *First Report and Order* revised footnotes to the Table of Frequency Allocations to state that NGSO FSS systems shall not claim protection from GSO systems operating in accordance with the ITU Radio Regulations and that NGSO FSS systems shall operate in such a way that any unacceptable interference that may occur during their operations shall be rapidly eliminated.<sup>43</sup>

21. Because the Commission found that deployment of NGSO FSS service links in some Ku-frequency bands could hinder future co-frequency terrestrial service deployment in those bands, including the 10.7-11.7 GHz band, NGSO FSS use of them was limited to gateway earth stations. The Commission defined gateway earth stations in the *First Report and Order* as those earth stations that do not originate or terminate traffic, but interconnect multiple non-located user earth stations operating in frequency bands other than designated gateway bands, through a satellite to other primary networks, such as the public switched telephone network and the Internet.<sup>44</sup> On reconsideration, the Commission clarified that its definition of NGSO FSS earth station gateways limits their use to NGSO FSS backbone support, but does not prohibit connection to all private networks.<sup>45</sup> The clarified definition does, however, prohibit connection to a gateway earth station for the exclusive use of any single customer. The Commission also decided, on reconsideration, that the PFD limits it adopted are sufficient to protect incumbent services in the 10.7-11.7 GHz band without the need for individual coordination of gateway earth stations.<sup>46</sup>

22. In the *First Report and Order*, the Commission concluded that the record in the *Ku-band Sharing Proceeding* supported certain restrictions on NGSO FSS gateway earth station deployment in specified geographic areas that would protect incumbent services' use of the bands.<sup>47</sup> The Commission found that a growth zone concept -- focusing on coordination procedures to protect incumbent services within specified geographic areas -- would provide an efficient and flexible approach to band sharing.<sup>48</sup> But the Commission deferred evaluation of growth zones to a future proceeding because the concept needed further analysis. In a Notice of Proposed Rulemaking adopted in December 2003, the Commission proposed to apply the principles of a growth zone proposal developed by SkyBridge and the

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<sup>40</sup> *First Report and Order*, 16 FCC Rcd. at 4140 ¶ 106.

<sup>41</sup> *First Report and Order*, 16 FCC Rcd at 4191 ¶ 256; see also, 47 C.F.R. §2.106 Footnote US355.

<sup>42</sup> *First Report and Order*, 16 FCC Rcd at 4142 ¶ 112; see also 47 C.F.R. §25.146(f).

<sup>43</sup> *First Report and Order*, 16 FCC Rcd. at 4128 ¶ 73; see also 47 C.F.R. §2.106 Footnotes 5.441 and 5.484A.

<sup>44</sup> *First Report and Order*, 16 FCC Rcd. at 4111 ¶ 29.

<sup>45</sup> *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-band*, Second Memorandum Opinion and Order, 18 FCC Rcd 2324, 2335 ¶ 25 (2003) (*Second MO&O*).

<sup>46</sup> *Second MO&O*, 18 FCC Rcd at 2332 ¶ 20.

<sup>47</sup> *First Report and Order*, 16 FCC Rcd. at 4126 ¶ 66.

<sup>48</sup> *First Report and Order*, 16 FCC Rcd. at 4126 ¶ 67.



Fixed Wireless Communications Coalition.<sup>49</sup> We will require SkyBridge and any other NGSO FSS licensees in the Ku-band to meet any rules adopted in this proceeding.

23. SkyBridge proposes to use the 10.7-11.7 GHz frequency band (space-to-Earth) for its NGSO FSS service downlinks to gateway stations.<sup>50</sup> This use comports with the restrictions on the band.

(ii) 11.7 - 12.2 GHz

24. The 11.7-12.2 GHz band was previously allocated on a primary basis for FSS downlinks. In the *First Report and Order*, the Commission allowed the NGSO FSS to share the band with the GSO FSS on a co-primary basis by adopting the same EPFD<sub>down</sub> limits for NGSO FSS service downlinks in the band that it adopted for NGSO FSS gateway downlinks in the 10.7-11.7 GHz. As discussed above, NGSO operations in this band cannot claim protection from GSO operations.<sup>51</sup> In addition, each NGSO FSS licensee must demonstrate, prior to being placed into service, that it meets the operational and additional operational limits adopted in the *First Report and Order*,<sup>52</sup> and must coordinate with GSO FSS networks using sensitive receiving earth stations with very large antennas.<sup>53</sup>

25. Since the same EPFD limits apply to downlinks to gateway earth stations and to user terminal earth stations, either type of earth station may be operated in this band. SkyBridge proposes to operate either user terminals or gateways in the 11.7-12.2 GHz (space-to-Earth) frequency band,<sup>54</sup> and is authorized to do so, subject to the controlling EPFD limits.

(iii) 12.2 - 12.7 GHz

26. The 12.2-12.7 GHz band is allocated on a primary basis to the BSS for use by direct broadcast service systems. The band also has a primary allocation for the terrestrial fixed service, although systems licensed in the band after September 9, 1983 must operate on a non-harmful interference basis to the BSS. In the *First Report and Order*, the Commission further allocated the 12.2-12.7 GHz band to NGSO FSS service downlinks, sharing with BSS operations on a co-primary basis under technical operating parameters, consisting of EPFD limits. In order to allow NGSO FSS sharing with BSS, the Commission adopted single entry and aggregate EPFD<sub>down</sub> limits for NGSO FSS operations.<sup>55</sup> The Commission also permitted multichannel video distribution and data service (MVDDS) operations in this band on a co-primary basis to NGSO FSS and on a non-harmful interference basis to incumbent BSS.<sup>56</sup> In the *Third Memorandum Opinion and Order*, the Commission amended portions of the rules under which NGSO FSS providers demonstrate that they meet the EPFD<sub>down</sub> limits.<sup>57</sup> In

<sup>49</sup> *Amendment of Parts 25, 74, 78 and 101 of the Rules regarding Coordination between the Non-Geostationary and Geostationary Satellite Orbit Fixed-Satellite Service and Fixed, Broadcast Auxiliary and Cable Television Relay Services in the 7 GHz, 10 GHz and 13 GHz Frequency Bands*, Notice of Proposed Rulemaking, FCC 03-318, ET Docket No. 03-254 (released Dec. 23, 2003) (*NGSO FSS, BAS and CARS Coordination NPRM*).

<sup>50</sup> 1999 Amendment at A-20.

<sup>51</sup> See also 47 C.F.R. §2.106 Footnotes 5.484A and 5.487A.

<sup>52</sup> *First Report and Order*, 16 FCC Rcd. at 4136 ¶ 96 (incorporating EPFD limits codified at 47 C.F.R. §§ 25.208(i) and 25.208(j)).

<sup>53</sup> See also 47 C.F.R. §25.146(f).

<sup>54</sup> 1999 Amendment at A-20.

<sup>55</sup> *First Report and Order*, 16 FCC Rcd. at 4162 ¶ 170.

<sup>56</sup> *First Report and Order*, 16 FCC Rcd. at 4182 ¶ 224. See also, 47 C.F.R. § 25.139 (NGSO FSS information sharing with MVDDS licensees).

<sup>57</sup> *Third MO&O*, 18 FCC Rcd. 2307, 2310 ¶72.



addition, each NGSO FSS licensee must demonstrate, prior to being placed into service, that it meets the operational and additional operational limits adopted in the *First Report and Order*,<sup>58</sup> and must coordinate with GSO FSS networks using sensitive receiving earth stations with very large antennas.<sup>59</sup>

27. SkyBridge proposes to use the 12.2-12.7 GHz frequency band for service downlinks to either gateway or end user terminal earth stations.<sup>60</sup> We authorize SkyBridge to do so, subject to the controlling EPFD limits.

**b. Uplink Bands:**

**(i) 12.75 - 13.25 GHz**

28. In the *First Report and Order*, the Commission permitted NGSO FSS gateway uplink earth stations to operate in most of the 12.75-13.25 GHz band on a co-primary basis with incumbent operators.<sup>61</sup> The incumbent broadcast auxiliary service (BAS) and cable television relay service (CARS) operators are entitled to interference protection from NGSO FSS gateway uplinks. The Commission found in the *First Report and Order* that NGSO FSS coordination with BAS and CARS under existing Part 101 and Part 25 procedures is possible, but difficult, and therefore concluded that new coordination procedures need to be developed. In addition, some form of geographic protection area must be developed for locating NGSO FSS gateway earth stations. In the *NGSO FSS, BAS and CARS Coordination NPRM*, the Commission proposed to adopt a modified version of a growth zone proposal put forth by SkyBridge and the Fixed Wireless Communications Coalition, and to proposed to develop new coordination procedures. SkyBridge's operations in this band will be subject to the coordination procedures developed in that proceeding.

29. In addition to sharing this band with BAS and CARS, NGSO FSS licensees must coordinate with GSO FSS using the band.<sup>62</sup> The Commission adopted EPFD<sub>up</sub> limits at the geostationary satellite orbit, regardless of whether the NGSO FSS system transmission emanates from a gateway or from a user earth station facility.<sup>63</sup> These limits are single-entry EPFD<sub>up</sub> limits adopted at WRC-2000 and adopted in the Ku-band NGSO FSS service rules.<sup>64</sup>

**(a) 13.15 - 13.2125 GHz Exception**

30. Although the Commission permitted NGSO FSS gateway earth stations in most of the 12.75-13.25 GHz in the *First Report and Order*, the Commission carved out a portion of the band in which NGSO FSS operations were not permitted in order to continue remote backup operations throughout the United States for incumbent BAS and CARS.<sup>65</sup> On reconsideration, however, the Commission modified

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<sup>58</sup> *First Report and Order*, 16 FCC Rcd. at 4136 ¶ 96 (incorporating EPFD limits codified at 47 C.F.R. §§ 25.208(i) and 25.208(j)).

<sup>59</sup> See also 47 C.F.R. §25.146(f).

<sup>60</sup> 1999 Amendment at A-20.

<sup>61</sup> *First Report and Order*, 16 FCC Rcd. at 4146 ¶ 122.

<sup>62</sup> See 47 C.F.R. §2.106 Footnote 5.441.

<sup>63</sup> *First Report and Order*, 16 FCC Rcd. at 4149 ¶ 131.

<sup>64</sup> See 47 C.F.R. § 25.146(h).

<sup>65</sup> *First Report and Order*, 16 FCC Rcd. at 4147 ¶ 126.

its rules to permit NGSO FSS uplink operations in the 13.15-13.2125 GHz band, but only in areas of the country outside a 50 km radius of the top 100 television markets.<sup>66</sup>

31. SkyBridge proposed to use the entire 12.75-13.25 GHz frequency band for its NGSO FSS service uplinks from gateway earth stations.<sup>67</sup> We have reviewed the EPFD<sub>up</sub> calculations provided by SkyBridge and find that they comply with our EPFD limits. SkyBridge will be allowed to provide uplinks from gateway earth stations from 12.75-13.15 GHz and from 13.2125-13.25 GHz. In the frequency band from 13.15-13.2125 GHz, SkyBridge may operate service uplinks only from gateway earth stations located outside a 50 km radius of the top 100 television markets.

(ii) 13.75 - 14.0 GHz

32. In the *First Report and Order*, the Commission allowed NGSO FSS gateway uplink operations in the 13.75-14.0 GHz band.<sup>68</sup> To facilitate NGSO FSS sharing with GSO FSS operations, the Commission adopted the same EPFD<sub>up</sub> limits for the 13.75-14.0 GHz band that it adopted for the 12.75-13.25 GHz and 14.0-14.5 GHz bands.<sup>69</sup> The Commission also found that technical requirements it adopted are adequate to permit NGSO FSS gateway uplink spectrum sharing with incumbent operations in the band.<sup>70</sup>

33. The 13.75-14.0 GHz band has been allocated domestically and internationally to the fixed-satellite service, subject to restrictions embodied in footnotes to the domestic and international tables of allocations. The 13.75-14.0 GHz band is shared on a primary basis with the Government radiolocation service and with the forward space-to-space and space-to-Earth links of the National Aeronautics and Space Administration (NASA) Tracking and Data Relay Satellite System (TDRSS) in the space research service. Consequently, earth stations in the United States and its possessions (US&P) operating with the SkyBridge satellite system will require coordination through the National Telecommunications and Information Administration (NTIA) Interdepartment Radio Advisory Committee's (IRAC) Frequency Assignment Subcommittee (FAS).<sup>71</sup> We have received a letter from the NTIA requesting that we identify this requirement in any grant of authority to operate a satellite in the 13.75-14.0 GHz band.<sup>72</sup>

34. Domestically, footnotes US337, US356, and US357 are applicable.<sup>73</sup> These footnotes place certain restrictions on FSS operations in order to protect government operations in the band, including manned space flight.<sup>74</sup> Internationally, footnotes 5.502 and 5.503 to the International Telecommunication

<sup>66</sup> *Second MO&O*, 18 FCC Rcd at 2328 ¶ 11.

<sup>67</sup> 1999 Amendment at A-20.

<sup>68</sup> *First Report and Order*, 16 FCC Rcd at 4153 ¶ 143.

<sup>69</sup> *First Report and Order*, 16 FCC Rcd. at 4155 ¶ 147; also 47 C.F.R. §2.106 Footnote 5.484A.

<sup>70</sup> *First Report and Order*, 16 FCC Rcd. at 4155 ¶ 146.

<sup>71</sup> See Amendment of Parts 2, 25, and 90 of the Commission's Rules to Allocate the 13.75-14.0 GHz band to the Fixed-Satellite Service, *Report and Order*, ET Docket No. 96-20, 11 FCC Rcd 11951, 11960-61 (para. 20) (1996).

<sup>72</sup> See May 11, 1999 Letter from William Hatch, Acting Associate Administrator, Office of Spectrum Management, NTIA, to Roderick Porter, Acting Chief, International Bureau, FCC.

<sup>73</sup> Footnote US337 requires that earth stations operating in the 13.75-13.8 GHz band be coordinated through NTIA's IRAC FAS to minimize interference to the forward space-to-space link of the NASA TDRSS. 47 C.F.R. § 2.106 US337.

<sup>74</sup> Footnote US356 places a restriction minimum antenna size of 4.5 meters for earth stations operating in the 13.75-14.0 GHz band and indicates a minimum equivalent isotropically radiated power (EIRP) that should be used. Footnote US357 limits FSS earth station EIRP spectral density in the 13.77-13.78 GHz band until those

(continued....)



Union (ITU) Radio Regulations place certain similar restrictions on FSS operations.<sup>75</sup> For non-geostationary satellite networks, there are no fundamental differences between the domestic and international footnotes, e.g., require a minimum earth station diameter of 4.5 meters. We require that earth stations in the US&P operate in accordance with the U.S. footnotes US337, US356 and US357. For non-US&P earth stations accessing the SkyBridge satellite system, we require operation to be consistent with the international footnotes 5.502 and 5.503.

35. ITU Radio Regulation footnote 5.503A required the fixed-satellite service not to cause harmful interference to non-geostationary space stations in the space research and Earth exploration-satellite services prior to the January 1, 2000 and for some earth stations to accommodate the needs of spaceborne precipitation radars operating in the band 13.793-13.805 GHz.<sup>76</sup> We have received a letter from NTIA noting that NASA's Tropical Rainfall Measuring Mission (TRMM) satellite system radar in the band 13.793-13.805 GHz is still operating.<sup>77</sup> Because TRMM is a highly valuable and visible U.S. asset, with a broad range of international users, NTIA has requested cooperation from the Commission and non-Federal Government entities in providing assistance in reducing interference with the TRMM radar.<sup>78</sup> NTIA notes that it desires that FSS earth stations in the 13.793 - 13.805 GHz frequency band located south of 39° N. and east of 110° W. operate with emission levels below -150 dBW/600 kHz at the TRMM space station receiver. Because this is a request and not a requirement, considering the secondary nature of the TRMM operation, we will urge, but not require, operators of earth stations accessing the SkyBridge satellite system in the 13.75 - 14.0 GHz band to cooperate voluntarily with NASA in order to facilitate continued operation of the TRMM satellite. NTIA also notes that none of the other space-based radar operations covered by 5.503A will seek continued cooperation in this respect.<sup>79</sup>

36. SkyBridge proposes to use the 13.75-14.0 GHz frequency band for its NGSO FSS gateway service uplinks.<sup>80</sup> SkyBridge has provided the Commission the appropriate EFPD<sub>up</sub> calculations as required under 47 C.F.R. § 25.146(a) and, upon review of such information, has been found to be in compliance. SkyBridge is authorized to operate gateway uplinks in the 13.75-14.0 GHz frequency band.

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geostationary space stations in the space research service for which advance publication information was received by the ITU prior to 31 January 1992 cease to operate in this band.

<sup>75</sup> Footnote 5.502 to the ITU Radio Regulations establishes minimum antenna diameters for earth stations of geostationary and non-geostationary satellite networks, and places certain restrictions on either the minimum EIRP or the power flux-density (PFD) levels produced by earth stations operating in the 13.75-14.0 GHz band. Footnote 5.503 limits FSS earth station EIRP spectral density in the 13.770-13.780 GHz band for earth stations in the FSS operating with geostationary-orbit space stations, until those geostationary space stations in the space research service for which advance publication information was received by the ITU prior to 31 January 1992 cease to operate in this band.

<sup>76</sup> Footnote 5.503A was suppressed at WRC-03. It stated that: "Until 1 January 2000, stations in the fixed-satellite service shall not cause harmful interference to non-geostationary space stations in the space research and Earth exploration-satellite services. Additionally, when planning earth stations in the fixed-satellite service to be brought into service between 1 January 2000 and 1 January 2001, in order to accommodate the needs of spaceborne precipitation radars operating in the band 13.793-13.805 GHz, advantage should be taken of the consultation process and the information given in Recommendation ITU-R SA.1071."

<sup>77</sup> See February 28, 2002 Letter from Frederick R. Wentland, Acting Associate Administrator, Office of Spectrum Management, NTIA, to Don Abelson, Chief, International Bureau, FCC.

<sup>78</sup> *Id.*

<sup>79</sup> *Id.*

<sup>80</sup> 1999 Amendment at A-20.

**(iii) 14.0 - 14.5 GHz**

37. The Commission found that the EPFD<sub>up</sub> limits adopted for the 12.75-13.25 GHz band were equally applicable to this 14.0-14.5 GHz band.<sup>81</sup> These limits will protect GSO FSS satellites from NGSO FSS user terminal uplink operations. Since NGSO FSS gateway uplinks are subject to the same EPFD<sub>up</sub> limits as NGSO FSS user terminal uplinks, gateways, too, are permitted in the band.

38. SkyBridge proposes to use the 14.0-14.5 GHz frequency band for NGSO FSS service uplinks from user terminal earth stations or gateway earth stations. SkyBridge has provided the Commission with a demonstration that it will meet the appropriate EPFD<sub>up</sub> limits required by our rules.<sup>82</sup> SkyBridge is authorized to operate service uplinks from either gateway earth stations or end user terminal earth stations in the 14.0-14.5 GHz frequency band.

39. NASA's TDRSS earth station facilities are located on Guam (latitude: 13° 36' 55" N, longitude: 144° 51' 22" E) and at White Sands, New Mexico (latitude: 32° 20' 59" N, longitude: 106° 36' 31" W; and latitude: 32° 32' 40" N, longitude: 106° 36' 48" W). These stations receive downlinked data at low elevation angles from TDRSS geostationary satellites in the space research service allocation 14.0-14.2 GHz. We note that these stations could receive interference from SkyBridge satellite network uplink gateway or end user terminal earth stations if located in the vicinity of these TDRSS earth station facilities. We also note that NASA plans to establish another TDRSS receive facility on the east coast of the United States within two to three years, with several mid-Atlantic region sites under consideration. Because TDRSS is a highly valuable and visible United States asset, supporting critical national assets, including the International Space Station and NASA's Space Shuttle, NTIA has requested cooperation from the Commission and non-Federal entities in providing assistance in avoiding interference to TDRSS operations.<sup>83</sup> NTIA notes that it desires that NGSO FSS earth stations in the 14.0-14.2 GHz frequency band not be located within line of sight of TDRSS earth station facilities, or that discussions between SkyBridge and NASA be conducted to determine possible methods of protecting this limited number of TDRSS earth stations. Accordingly, we will urge operators of earth stations accessing the SkyBridge satellite system in the 14.0-14.2 GHz band to cooperate voluntarily with NASA, after contact is made with them by NASA, in order to facilitate continued operation of the TDRSS satellite network.

**c. Foreign Operations: 12.7-12.75 GHz, 17.3-17.8 GHz, 17.8-18.1 GHz**

40. In the application it filed in 1997, SkyBridge sought authority to operate service links, infrastructure links, and tracking, telemetry and command links in a frequency band stretching from 17.3 GHz to 18.1 GHz.<sup>84</sup> In the 1997 Amendment, SkyBridge withdrew its request to operate in the 17.8-18.1 GHz band, recognizing United States government operations in that segment.<sup>85</sup> In 2000, the Commission

<sup>81</sup> *First Report and Order*, 16 FCC Rcd. at 4149 ¶ 131, 4183 ¶ 231.

<sup>82</sup> 2002 Conforming Amendment.

<sup>83</sup> See March 9, 2005 Letter from Frederick R. Wentland, Acting Associate Administrator, Office of Spectrum Management, NTIA, to Don Abelson, Chief, International Bureau, FCC.

<sup>84</sup> SkyBridge Application at 75-76; 1999 Amendment at A-19.

<sup>85</sup> 1997 Amendment at 3. In 2000, the Commission also designated the 17.7-18.3 GHz frequency band to terrestrial fixed service on a primary use basis, noting the required coordination between non-Government operations and Government operations in the band. 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*, IB Docket No. 98-172, FCC 00-212, 15 FCC Rcd 13430, 13445 (2000) (*18 GHz Band Plan Order*).



allocated the 17.3-17.7 GHz band to the broadcast satellite service on a primary basis, effective April 1, 2007.<sup>86</sup> The Commission later found that NGSO FSS sharing in the band would be difficult, and therefore declined to allocate the 17.3-17.8 GHz band to the NGSO FSS.<sup>87</sup> Consequently, SkyBridge's amended request for authority to operate in the 17.3-17.8 GHz band in ITU Region 2 is denied.<sup>88</sup>

41. SkyBridge requested authority to operate in additional frequency bands outside the United States. SkyBridge requested authorization to use the 12.7-12.75 GHz band (space-to-Earth) outside ITU Region 2, and to use the 17.3-17.8 GHz (Earth-to-space) and 17.8-18.1 GHz (Earth-to-space) bands outside the United States.<sup>89</sup> We will authorize SkyBridge's operations in these additional bands outside the United States. SkyBridge must coordinate with GSO FSS networks using sensitive receiving earth stations with very large antennas in the 12.7-12.75 GHz band (space-to-Earth) outside ITU Region 2.<sup>90</sup> SkyBridge must coordinate the use of the bands 17.3-17.8 GHz (Earth-to-space) and 17.8-18.1 GHz (Earth-to-space) outside Region 2 with other non-geostationary-satellite systems in the fixed-satellite service and shall not claim protection from nor cause unacceptable interference to geostationary-satellite networks in the fixed-satellite service in these bands.<sup>91</sup> All earth stations communicating with the SkyBridge system must comply with all licensing regulations for earth stations in the respective countries in which they are operating.

#### 4. Tracking, Telemetry and Command

42. Under the Commission's rules, TT&C operations may be provided at the edges of the frequency bands in which the particular satellite will be providing service.<sup>92</sup> SkyBridge proposes to use 5 MHz within the 12.75-13.25 GHz and 13.75-14.5 GHz uplink frequency bands for command and 30 MHz within the 10.7-12.7 MHz downlink frequency band for telemetry.<sup>93</sup> SkyBridge does not provide a summary of the center frequencies for its TT&C operations.

43. We will permit SkyBridge to defer its choice of TT&C frequencies until it has executed a binding contract for construction. We require that SkyBridge file a modification application specifying the exact frequencies for TT&C functions for its satellite system on, or prior to, the date by which it is required to execute a binding construction contract. We remind SkyBridge that, consistent with 47 C.F.R. § 25.202(g), the frequencies selected for TT&C functions must be at either or both edges of the allocated bands.<sup>94</sup>

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<sup>86</sup> *18 GHz Band Plan Order*, 15 FCC Rcd at 13476 ¶ 96.

<sup>87</sup> *First Report and Order*, 16 FCC Rcd at 4158 ¶ 158.

<sup>88</sup> See 47 C.F.R. § 2.104 (definition of ITU Region 2).

<sup>89</sup> Operations in this frequency band requires coordination with government space station operations. 47 C.F.R. § 2.106 US334.

<sup>90</sup> See also 47 C.F.R. § 25.146(f).

<sup>91</sup> See Radio Regulation No. 5.516.

<sup>92</sup> 47 C.F.R. § 25.202(g).

<sup>93</sup> 1999 Amendment at A-21

<sup>94</sup> See 47 C.F.R. § 25.202(g).

## 5. Coverage Requirement

44. In the *Ku-band NGSO FSS Service Rules Order*, the Commission required that NGSO FSS systems in the Ku-band must be capable of providing service on a continuous basis throughout the fifty states, Puerto Rico, and the United States Virgin Islands. These systems must also be capable of serving locations as far north as 70 degrees latitude and as far south as 55 degrees latitude for at least 75 percent of every 24-hour period.<sup>95</sup> The SkyBridge constellation is designed to permit continuous, real-time coverage between 72 degrees north and 72 degrees south latitudes.<sup>96</sup> The proposed constellation therefore meets the coverage requirement for the Ku-band NGSO FSS.

45. Based on the foregoing review of the required technical constraints and SkyBridge's amended application for authority to operate, we find that SkyBridge's planned system meets the Commission's technical requirements.

### B. License Conditions

#### 1. Validation EPFD Demonstration

46. In the *First Report and Order*, the Commission adopted technical sharing criteria to allow the NGSO FSS and GSO FSS to operate on a co-primary basis in certain Ku-band frequencies, consistent with decisions taken at the 2000 World Radiocommunication Conference (WRC-2000). The adopted technical criteria consist of uplink and downlink limits on EPFD. As subsequently amended on reconsideration in the *Third Memorandum Opinion and Order*,<sup>97</sup> the Commission's rules require that each NGSO FSS applicant demonstrate, prior to licensing, that it meets the single-entry validation EPFD limits by using a software simulation developed in accordance with an ITU software specification. The Commission requires that applicants provide the results of the computer program in a cumulative probability distribution function of EPFD<sub>down</sub>.<sup>98</sup> For the validation EPFD<sub>up</sub> limits, the Commission's rules require a comparable cumulative probability distribution function of EPFD<sub>up</sub>.<sup>99</sup>

47. SkyBridge provided the required computer program, developed in accordance with the specifications stipulated in the ITU-R Recommendation BO.1503, or S.1503, for the single-entry EPFD validation computation, including both the source code and the executable file.<sup>100</sup> SkyBridge provided the results of the computer program in a cumulative probability distribution function of EPFD<sub>down</sub> and in a comparable cumulative probability distribution function of EPFD<sub>up</sub>.<sup>101</sup> Commission review of the submission finds SkyBridge to be in compliance with 47 C.F.R. § 25.146(a) of the Commission Rules.

48. SkyBridge must annually certify that its system continues to operate within required EPFD limits.<sup>102</sup> Since Commission Rules parallel ITU-R Recommendation BO.1503, any revisions to the ITU

<sup>95</sup> *Ku-band NGSO FSS Service Rules Order*, 17 FCC Rcd. at 7860 ¶ 64.

<sup>96</sup> 1999 Amendment at A-14, A-17.

<sup>97</sup> *Third MO&O*, 18 FCC Rcd. 2307 (2003).

<sup>98</sup> 47 C.F.R. § 25.146(a)(1)(v) (2003).

<sup>99</sup> 47 C.F.R. § 25.146(a)(2)(v) (2003).

<sup>100</sup> 2002 Conforming Amendment

<sup>101</sup> 2002 Conforming Amendment and 1999 Amendment at Appendix C

<sup>102</sup> 47 C.F.R. § 25.146(c).



Recommendation or associated ITU-R publications, must be incorporated into the software program used to demonstrate SkyBridge's continued ability to meet all applicable EPFD limits. A revision of ITU-R Recommendation S.1503 was approved by ITU Study Group 4 in October 2004. The ITU-BR is unable to examine non-GSO FSS systems subject to the validation EPFD limits due the persistent lack of software to perform these validations. The United States will send a commitment to the Bureau that the SkyBridge system complies with the EPFD limits provided these conditions are met. Finally, the Commission may request, at any time, additional information concerning the EPFD levels and related technical showings.<sup>103</sup>

## 2. Operational and Additional Operational EPFD<sub>down</sub> Limits Demonstration

49. In the *First Report and Order*, the Commission adopted single-entry operational and additional operational EPFD<sub>down</sub> limits in order to protect 3 and 10 meter GSO FSS earth station antennas from unacceptable interference.<sup>104</sup> Operational emissions from NGSO FSS space stations cannot exceed the operational EPFD<sub>down</sub> limits<sup>105</sup> or the additional operational EPFD<sub>down</sub> limits<sup>106</sup> at any point on the Earth's surface. NGSO FSS licensees must demonstrate that they meet these operational and additional operational limits, at selected GSO earth station locations, prior to commencing commercial service.<sup>107</sup> No later than ninety days prior to its initiation of service to the public, SkyBridge must submit to the Commission a comprehensive technical showing demonstrating that its system is not expected to operate in excess of the operational EPFD<sub>down</sub> limits and the additional operational EPFD<sub>down</sub> limits and coordinate with GSO FSS networks using sensitive receiving earth stations with very large antennas.<sup>108</sup>

## 3. Bond Requirement

50. In its *First Space Station Reform Order*, the Commission eliminated the financial requirements then in place and replaced them with a bond requirement. The bond requirement is intended to ensure that licensees are financially able and committed to implementing their licensed systems in a timely manner. Under this requirement, any entity awarded a satellite license must execute a performance bond, payable to the U.S. Treasury, within 30 days of the date of the license grant. The bond is payable upon failure to meet any of the implementation milestones included in every license, where adequate justification for extending that milestone is not provided. Licensees may reduce the amount of the bond owed upon meeting each milestone. In its *First Order on Reconsideration and Fifth Report and Order*, the Commission reduced the bond amount required for NGSO systems to \$5 million.<sup>109</sup>

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<sup>103</sup> 47 C.F.R. § 25.146(d).

<sup>104</sup> *First Report and Order*, 16 FCC Rcd at 4134 ¶ 90.

<sup>105</sup> 47 C.F.R. § 25.208(j).

<sup>106</sup> 47 C.F.R. § 25.208(i).

<sup>107</sup> *First Report and Order*, 16 FCC Rcd at 4134 ¶ 96; see also, *Third MO&O*, 18 FCC Rcd at 2313 ¶ 24.

<sup>108</sup> 47 C.F.R. § 25.146(b) and 25.146(f).

<sup>109</sup> *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Order on Reconsideration and Fifth Report and Order, 19 FCC Rcd 12637 (2004).

51. Thus, SkyBridge must execute a \$5 million performance bond payable to the United States Treasury within 30 days of release of this license as a condition of its license.<sup>110</sup> Should it fail to do so, its license will be null and void.

#### 4. Milestone Schedule

52. Consistent with the Commission's decisions in the *Ku-band NGSO FSS Service Rules Order*<sup>111</sup> and the *First Space Station Reform Order*,<sup>112</sup> SkyBridge must enter into a non-contingent satellite manufacturing contract for its system within 12 months of this authorization, complete critical design review within two years of authorization, begin physical construction of all satellites in the system within two and a half years of this authorization, and complete construction and launch of the first two satellites in its system within three and a half years of grant. The entire SkyBridge system must be launched and operational within six years of this authorization. In addition, SkyBridge must file a certification with the Commission within ten days following each of the milestones dates specified.<sup>113</sup>

#### 5. International Coordination

53. We will follow the applicable advance-publication, coordination, due diligence, and notification procedures set forth in the ITU Radio Regulations in coordinating SkyBridge's satellites with other affected administrations. No protection from interference caused by radio stations authorized by other administrations is guaranteed unless coordination procedures are timely completed or, with respect to individual administrations, by successfully completing coordination agreements. In order to do so, we require that SkyBridge provide the Commission with the international coordination information specified in our rules.<sup>114</sup> SkyBridge will be responsible for all cost recovery fees associated with any ITU filings on behalf of its system.

#### 6. Orbital Debris Showings

54. As required by FCC rules,<sup>115</sup> SkyBridge submitted a showing concerning the design and operational strategies it will use to mitigate orbital debris.<sup>116</sup> SkyBridge also submitted, in response to a Satellite Division Public Notice,<sup>117</sup> an amendment indicating that disposal of its satellites would be through atmospheric reentry, and analyzing the risk of casualty from such reentries. In response to an

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<sup>110</sup> 47 C.F.R. § 25.165.

<sup>111</sup> *Ku-band NGSO FSS Service Rules Order*, 17 FCC Rcd at 7864 ¶ 75.

<sup>112</sup> *Amendment Of The Commission's Space Station Licensing Rules And Policies*, First Report and Order and Further Notice of Proposed Rulemaking in IB Docket No. 02-34, and First Report and Order in IB Docket No. 02-54, 18 FCC Rcd at 10760, 10827 ¶¶ 175-75 (2003) (*First Space Station Reform Order*).

<sup>113</sup> See 47 C.F.R. § 25.146(k).

<sup>114</sup> See 47 C.F.R. § 25.111(b).

<sup>115</sup> See 47 C.F.R. § 25.146(i)(4).

<sup>116</sup> 2002 Conforming Amendment, File No. SAT-AMD-20020917-00167, at Exhibit C, pages 7-9.

<sup>117</sup> Orbital Debris Mitigation: Clarification of 47 C.F.R. Sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d) Regarding Casualty Risk Assessment for Satellite Atmospheric Re-entry, *Public Notice*, Report No. SPB-208, DA 04-1724 (released June 16, 2004) (*Casualty Risk PN*).



inquiry from Commission staff,<sup>118</sup> SkyBridge also provided additional information concerning its station-keeping parameters, and the strategies it will use to identify and mitigate potential collision risks.<sup>119</sup>

55. SkyBridge indicates that it will dispose of its satellites at end of life through an uncontrolled atmospheric re-entry. Its analysis indicates that a limited amount of material will survive reentry, and that this material will present a casualty risk area<sup>120</sup> of approximately 2.786 square meters. Furthermore, SkyBridge observes that this figure is well below the 8 square meter figure used in some safety standards.<sup>121</sup> For the SkyBridge constellation, this would correspond to a casualty risk of approximately  $2.0 \times 10^{-5}$  (1 in 50,000) per satellite.<sup>122</sup> The United States Government's Standard Practices for debris mitigation specify that atmospheric reentry of a spacecraft should present a risk of human casualty of no more than 1 in 10,000. Thus, the risk presented by reentry of a SkyBridge spacecraft is consistent with the guidelines applied to U.S. Government missions.

56. SkyBridge's application does not indicate in any detail the process that will be used to remove satellites from their operational orbits at end of life, nor the orbits to which such satellites would be moved. In the absence of more detailed information concerning the planned end of life maneuvers, we are not in a position at this time to authorize such maneuvers. Instead, we will condition SkyBridge's authorization upon it filing, six months prior to its CDR milestone, an application detailing and seeking approval for end-of-life operations. Our action today is also conditioned on a requirement that SkyBridge's application demonstrate that its end-of-life operations will leave satellites in an orbit from which they will reenter the Earth's atmosphere within 25 years,<sup>123</sup> and upon a requirement that it demonstrate that SkyBridge will obtain adequate insurance, listing the United States as an additional insured party, in connection with any reentry of the SkyBridge satellites.<sup>124</sup>

## 7. Reporting Requirements

57. SkyBridge must follow the Part 25 rules reporting requirements for FSS systems, including an annual report describing the status of satellite construction and anticipated launch dates, and a detailed description of the use made of each transponder on each of the in-orbit satellites.<sup>125</sup> Beginning in the first year following launch of the first two space stations in its system, SkyBridge must file a report on June 30

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<sup>118</sup> October 1, 2004 Letter from Thomas S. Tycz, Chief, Satellite Division, to Jeffrey Olson, Attorney for SkyBridge, L.L.C.

<sup>119</sup> November 10, 2004 Letter from Jeffrey H. Olson and Diane C. Gaylor, Attorneys for SkyBridge, L.L.C., to Marlene H. Dortch, Secretary, FCC (SkyBridge Orbital Debris Letter).

<sup>120</sup> For a discussion of the method used in deriving casualty risk area, see *Casualty Risk PN*, at n. 2.

<sup>121</sup> NASA Safety Standard 1740.14.

<sup>122</sup> This estimate is based upon population projections for the year 2050, at latitudes corresponding to the ground tracks of the operational SkyBridge satellites.

<sup>123</sup> See *Orbital Communications Corp., Order and Authorization*, DA 02-772, 17 FCC Rcd 6337 (2002) (conditioning approval of an increase in the proposed orbital altitude of a licensee's Little LEO satellite constellation on measures being taken to reduce the orbital lifetime of the satellites to 25 years following end-of-life).

<sup>124</sup> See *Space System Licensee, et al., Memorandum Opinion, Order and Authorization*, DA 02-307, 17 FCC Rcd at 2271, 2290 ¶ 48 (Int'l Bur. 2002).

<sup>125</sup> See 47 C.F.R. §§ 25.146(l), 25.210(l).

of each year, containing information current as of May 31 of that year. In addition, SkyBridge must certify in its annual reports that its system continues to operate within required EPFD limits.<sup>126</sup>

#### 8. Ephemeris Data Requirements

58. The Commission has noted that GSO FSS operators must have the information necessary to locate satellites in each NGSO FSS constellation at any given time.<sup>127</sup> The avoidance of in-line interference events method for co-frequency sharing operations among NGSO FSS systems in the Ku-band likewise requires updated ephemeris data. The Commission therefore adopted a requirement that NGSO FSS licensees publish their satellites' orbital elements in the North American Aerospace Defense Command 2-line element format on an Internet web site maintained by the licensee.<sup>128</sup> Once operational, SkyBridge must meet this requirement, and its 2-line element data must be updated every three days.

#### 9. Replacement Satellites and In-Orbit Spare Satellites

59. After its NGSO FSS system is fully operational, if SkyBridge develops a need to replace any space station in its system, it must certify to the Commission, at least thirty days prior to the launch of any replacement, that the space station it intends to launch is technically identical to the space stations authorized in this license.<sup>129</sup> In addition, SkyBridge must certify that no replacement space station or in-orbit spare launch will cause SkyBridge to exceed the total number of operating space stations specified in this authorization.<sup>130</sup>

### IV. ORDERING CLAUSES

60. Accordingly, IT IS ORDERED that, pursuant to Section 309(a) of the Communications Act, as amended, 47 U.S.C. § 309(a), the application of SkyBridge L.L.C. for launch and operating authority, IBFS File Nos. SAT-LOA-19970228-00021, SAT-AMD-19970703-00058, SAT-AMD-19980630-00056, SAT-AMD-19990108-00004, SAT-AMD-20020917-00167, and SAT-AMD-20040719-00135 IS GRANTED, and SkyBridge L.L.C. IS AUTHORIZED to launch and operate a system of 80 non-geostationary satellite orbit satellites in low-Earth orbit in the 12.75-13.25 GHz (Earth-to-space) and 13.75-14.5 GHz (Earth-to-space) bands for its uplinks, and in the 10.7-12.7 GHz (space-to-Earth) band for downlinks, in accordance with the terms, conditions, and technical specifications set forth in its amended application, so far as is permitted in this *Order and Authorization*.

61. IT IS FURTHER ORDERED that SkyBridge L.L.C. is granted 30 days from the date of the release of this *Order and Authorization* to decline this authorization as conditioned. Failure to respond within that period will constitute formal acceptance of the authorization as conditioned.

62. IT IS FURTHER ORDERED that the request of SkyBridge L.L.C. for authority to operate in the 17.3-17.8 GHz band in ITU Region 2 IS DENIED.

<sup>126</sup> 47 C.F.R. § 25.146(c).

<sup>127</sup> *First Report and Order*, 16 FCC Rcd at 4138 ¶ 102.

<sup>128</sup> *Id.*; see 47 C.F.R. § 25.271(e).

<sup>129</sup> 47 C.F.R. § 25.146(m).

<sup>130</sup> 47 C.F.R. § 25.146(n).



63. IT IS FURTHER ORDERED that SkyBridge L.L.C. IS AUTHORIZED to transmit in the 12.7-12.75 GHz (space-to-Earth) band to earth stations outside International Telecommunication Union Region 2, and to receive transmissions from such earth stations in the 17.3-17.8 GHz (Earth-to-space) and 17.8-18.1 GHz (Earth-to-space) bands outside International Telecommunication Union Region 2, in accordance with the technical specifications set forth in its application and the pertinent provisions of Part 25 of the Commission's rules, where permitted by other telecommunications administrations, and subject to the conditions that SkyBridge L.L.C. is obligated to comply with the applicable laws, regulations, rules, and licensing procedures for those countries it proposes to serve.

64. IT IS FURTHER ORDERED that when requesting international coordination of proposed use of frequencies in the 12.7-12.75 GHz band for downlinks to earth stations in foreign countries, SkyBridge L.L.C. shall certify in an affidavit filed with the Satellite Division of the Commission's International Bureau, that it has coordinated the proposed operation with other licensees with authority from this Commission for non-U.S.-authorized geostationary or non-geostationary satellite operation in that band. When requesting international coordination of proposed use of frequencies in the 17.3-17.8 GHz and 17.8-18.1 GHz bands for links with earth stations in foreign countries, SkyBridge L.L.C. shall certify that it has coordinated the proposed operation with other licensees with authority from the Commission for non-U.S.-authorized geostationary satellite operation in that band. The filing shall include certification of service on the licensees with whom such coordination is required.

65. IT IS FURTHER ORDERED that SkyBridge L.L.C. must coordinate its operations in the 17.8-18.1 GHz (Earth-to-space) uplink band with United States government systems, including Government operations to earth stations in foreign countries, in accordance with footnote US334 to the Table of Frequency Allocations, 47 C.F.R. § 2.106, and in accordance with the *18 GHz Band Report and Order*. 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, 13473 (2000) (*18 GHz Band Report and Order*).

66. IT IS FURTHER ORDERED that in the band 10.7-12.75 GHz SkyBridge L.L.C. shall complete coordination with GSO FSS networks using sensitive receiving earth stations with very large antennas prior to its initiation of service to the public.

67. IT IS FURTHER ORDERED that SkyBridge L.L.C. must coordinate its operations in the bands 17.3-17.8 GHz (Earth-to-space) and 17.8-18.1 GHz (Earth-to-space) outside Region 2 with other non-geostationary-satellite systems in the fixed-satellite service and shall not claim protection from nor cause unacceptable interference to geostationary-satellite networks in the fixed-satellite service in these bands.

68. IT IS FURTHER ORDERED that in the band 10.7-11.7 GHz, SkyBridge satellites, prior to commencing operations, shall be coordinated with the radio astronomy observatories to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities listed in footnote US355 to the table of allocations, 47 C.F.R. § 2.106.

69. IT IS FURTHER ORDERED that in the 13.75-14.0 GHz band, all earth stations in the United States and its Possessions are required to coordinate through NTIA's Interdepartment Radio Advisory Committee's Frequency Assignment Subcommittee, in accordance with footnote US337 to the table of allocations, 47 C.F.R. § 2.106.

70. IT IS FURTHER ORDERED that operation of the SkyBridge satellite network in the 13.75-14.0 GHz band shall be in accordance with footnotes US356 and US357 to 47 C.F.R. § 2.106 in the United States and its Possessions, and with footnotes 5.502 and 5.503 to the ITU Radio Regulations outside of the United States and its Possessions.

71. IT IS FURTHER ORDERED that operators of earth stations accessing the SkyBridge satellites in the 13.75 - 14.0 GHz band are urged to cooperate voluntarily with NASA in order to facilitate continued operation of the TRMM satellite.

72. IT IS FURTHER ORDERED that in the 14.0-14.2 GHz band, SkyBridge is urged to cooperate voluntarily with NASA, after contact is made with them by NASA, in order to facilitate the protection of the TDRSS earth stations.

73. IT IS FURTHER ORDERED that SkyBridge L.L.C., in accordance with 47 CFR § 25.111(b), shall prepare the necessary information, as may be required, for submission to the ITU to initiate and complete the advance publication, international coordination, due diligence, and notification process of this satellite system, in accordance with the ITU Radio Regulations. SkyBridge L.L.C. shall be held responsible for all cost recovery fees associated with these ITU filings. We also note that no protection from interference caused by radio stations authorized by other administrations is guaranteed unless coordination and notification procedures are timely completed or, with respect to individual administrations, by successfully completing coordination agreements. Any radio station authorization for which coordination has not been completed may be subject to additional terms and conditions as required to effect coordination of the frequency assignments of other administrations.

74. IT IS FURTHER ORDERED that SkyBridge L.L.C. must design its satellite system to avoid in-line interference events with any other non-geostationary satellite orbit fixed satellite system operating in the Ku-band frequencies. An "in-line interference event" is defined as the interference associated with an occurrence of any physical alignment of space stations of two or more satellite networks with an operating earth station of one of these networks in such a way that the angular separation between operational links of the two networks is less than 10 degrees as measured at the earth station.

If no agreed coordination exists between SkyBridge L.L.C. and one or more other satellite networks, then the bands will be divided among the affected satellite networks involved in an in-line interference event in accordance with the following default procedure:

- (1) Each of  $n$  (number of) satellite networks involved in a particular in-line interference event shall select  $1/n$  of the assigned spectrum available in each frequency band for its home base spectrum. The selection order for each satellite network shall be determined by and be in accordance with the date that the first space station in each satellite network is launched and operating;
- (2) The affected space station(s) of the respective satellite networks shall only operate in the selected ( $1/n$ ) spectrum associated with its satellite network, its home base spectrum, for the duration of the in-line interference event;
- (3) All affected space station(s) may resume operations throughout the assigned frequency bands once the angular separation between the affected space stations in the in-line interference event is again greater than 10 degrees.

Any coordination procedure agreed among the affected operating satellite networks, which allows operations of the satellite networks when each network's respective space stations are within the 10 degrees avoidance angle associated with an in-line interference event, shall supersede the default procedure. Coordination may be effected using



information relating to the space stations and the parameters of one or more typical earth stations. All parties are required to coordinate in good faith.

75. IT IS FURTHER ORDERED that this authorization shall become NULL and VOID with no further action required on the Commission's part in the event that SkyBridge L.L.C.'s space stations are not constructed, launched and placed into operation in accordance with the technical parameters and terms and conditions of the authorization by the following dates:

Milestone	Deadline
Enter Non-contingent Satellite Manufacturing Contract	July 18, 2006
Complete Critical Design Review	July 18, 2007
Begin Physical Construction of All Satellites	January 18, 2008
Complete Construction and Launch First Two Satellites in System	January 18, 2009
Certify Entire System Operational	January 18, 2011

SkyBridge L.L.C. must file a performance bond with the Commission in the amount of \$5 million, pursuant to the procedures set forth in Public Notice, DA 03-2602, 18 FCC Rcd 16283 (2003), within 30 days of the date of this grant, by August 17, 2005.

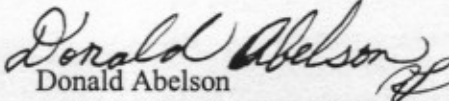
76. IT IS FURTHER ORDERED that SkyBridge L.L.C. shall submit to the Commission an application for modification of this authorization, specifying the exact frequencies for the TT&C functions of its satellite system, prior to July 18, 2006.

77. IT IS FURTHER ORDERED that SkyBridge L.L.C. shall submit to the Commission, prior to January 18, 2007, an application for modification of its authorization, detailing and seeking approval for its end-of-life operations, and demonstrating i.) that its end-of-life operations will leave satellites in an orbit from which they will reenter the Earth's atmosphere within 25 years, and ii.) that it will obtain adequate insurance, listing the United States as an additional insured party, in connection with atmospheric reentry of its satellites. IT IS FURTHER ORDERED that SkyBridge L.L.C. is not authorized to launch any space station until receives affirmative approval of such application.

78. IT IS FURTHER ORDERED that the license term for the SkyBridge L.L.C. satellite system, Call Sign S2241, is fifteen years that will begin to run on the date that SkyBridge L.L.C. certifies to the Commission that its initial space station has been successfully placed into orbit and that the operations of its satellite fully conforms to the terms and conditions of this space station system authorization.

79. This *Order and Authorization* is issued pursuant to Section 0.261 of the Commission's rules on delegated authority, 47 C.F.R. § 0.261, and is effective upon release.

FEDERAL COMMUNICATIONS COMMISSION

  
Donald Abelson  
Chief, International Bureau