

## REQUEST FOR SPECIAL TEMPORARY AUTHORITY

O3b Limited (“O3b”), pursuant to Section 25.120 of the Commission’s rules, hereby respectfully requests special temporary authority (“STA”) to operate an earth station to be located at AT&T Headquarters in Houston, Texas (“AT&T Earth Station”) that will communicate with the satellite system operated by O3b.<sup>1</sup> In this filing, O3b seeks a 30-day STA for the period between December 1, 2014 and December 31, 2014.<sup>2</sup>

The AT&T Earth Station will be used for non-commercial testing and demonstration purposes, so that the capabilities of O3b’s system can be exhibited at the AT&T Facility in Houston, Texas to a large number of representatives from the U.S. energy industry. The AT&T Earth Station will simulate diverse data applications on the O3b satellite system, including interactive video and audio teleconferencing, access to enterprise cloud services and very large file transfers. As discussed below, grant of the requested authority is in the public interest as it will allow O3b to test and demonstrate O3b services that could benefit the U.S. energy industry.

### Test Details and Public Interest Showing

The AT&T Earth Station will communicate with O3b’s UK-authorized, Ka-band, Medium Earth Orbit, non-geostationary satellite orbit (“NGSO”) Fixed-Satellite Service (“FSS”) system<sup>3</sup> and O3b’s gateway earth station in Vernon, TX.<sup>4</sup>

The frequencies to be used by the AT&T Earth Station are:

- 28.35-28.4 GHz, 28.6-29.1 GHz (uplink)
- 18.3-18.6 GHz, 18.8-19.3 GHz (downlink)

The AT&T Earth Station will consist of two (2) 1.2m Orbit antennas. O3b has previously been granted an STA to operate an identical earth station at the CODA Lab location in San Diego, California<sup>5</sup> and has requested STAs to operate an identical earth station at the Data Technology Solution (“DTS”) facility in Breaux Bridge, Louisiana,<sup>6</sup> at Oil Comm 2014,<sup>7</sup> and at a U.S. Department of Defense facility.<sup>8</sup>

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<sup>1</sup> Although the AT&T Earth Station will be located at a corporate facility during the term of the STA, it will be operated and controlled by O3b.

<sup>2</sup> O3b notes that it is concurrently filing herewith a second STA request for an additional 180 days to continue operation of the subject facility from January 1, 2015.

<sup>3</sup> O3b’s first four satellites were launched on June 25, 2013. O3b’s next batch of four satellites was launched on July 10, 2014.

<sup>4</sup> See O3b Limited, Call Sign E130021, File No. SES-LIC-20130124-00089, granted June 20, 2013 (“O3b Texas License”).

<sup>5</sup> See O3b Limited, File No. SES-STA-20131228-01209, filed Dec. 23, 2013 (“O3b CODA STA Application”), and which was placed on Public Notice on April 2, 2014 and granted on April 29, 2014.

<sup>6</sup> See O3b Limited, File No. SES-STA-20140731-00627, filed July 31, 2014 (“O3b DTS STA Application”).

<sup>7</sup> See O3b Limited, File No. SES-STA-20140819-00666, filed Aug. 19, 2014 (“O3b Oil Comm STA Application”).

<sup>8</sup> See O3b Limited, File No. SES-STA-20140903-00686, filed Sep. 3, 2014 (“O3b Ft. Belvoir STA Application”).

The AT&T Earth Station antennas will be mounted on the rooftop of the building structure. Although the pointing angle of the antennas will change as O3b's in-orbit satellites are tracked, the platform will remain stationary during the demonstration.

Grant of this application will serve the public interest, convenience and necessity by allowing O3b to show how its system can effectively deliver low latency, high throughput service to and from isolated resource extraction operations, such as offshore oil platforms.<sup>9</sup> This capability will allow for better connectivity and living conditions at these remote facilities while supporting the data flow for the safe and efficient extraction of important energy resources. O3b will demonstrate the system's capabilities for providing a variety of valuable communications, including voice and video conferencing and enterprise data applications.

### **The O3b Satellite System**

In its initial FCC application, which sought authority for a gateway earth station located in Hawaii, O3b stated that it planned to operate eight NGSO satellites that would be spaced equally, *i.e.*, at 45° intervals.<sup>10</sup> The Commission granted this application.<sup>11</sup>

O3b has filed an application seeking to modify its Hawaii license to give it the flexibility to operate up to two of its eight NGSO satellites as in-orbit spares.<sup>12</sup> The remaining satellites would be equally spaced in O3b's authorized orbital plane, and each in-orbit spare would be co-located with a non-spare satellite.<sup>13</sup> O3b has been granted an STA pending action on its modification application.<sup>14</sup>

### **Earth Station Technical Parameters**

The following documents containing technical details of the operations proposed under the requested STA are attached:

- Annex 1: FCC Form 312, Schedule B. O3b proposes to operate the AT&T Earth Station during this 30-day term in accordance with the parameters specified in the attached Schedule B.<sup>15</sup>

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<sup>9</sup> The AT&T Earth Station will not, for purposes of the STA, communicate with any offshore platforms or other offsite facilities. The only other points of communication will be O3b's space stations and O3b's gateway earth station in Vernon, Texas.

<sup>10</sup> See Application for Hawaii Earth Station, File No. SES-LIC-20100723-00952, Legal Narrative, Section III and Attachment A thereto (Technical Statement), Section A.2.

<sup>11</sup> See O3b Limited, Call Sign E100088, File No. SES-LIC-20130124-00089, granted Sept. 25, 2012 ("O3b Hawaii License").

<sup>12</sup> See O3b Limited, Call Sign E100088, File No. SES-STA-20140814-00656. See also O3b Limited, Call Sign E100088, File No. SES-MOD-20140814-00652.

<sup>13</sup> No changes were sought to the technical parameters identified in the licenses and STAs held by O3b and its customers. No changes were made to O3b's Schedule S, either, but O3b noted that the number of satellites and phase angles in Section S4 and S5 of Schedule S will vary to the extent that O3b operates one or more in-orbit spare satellites.

<sup>14</sup> See O3b Limited, Call Sign E100088, File No. SES-STA-20140814-00656.

<sup>15</sup> O3b is providing a Schedule B containing technical parameters for the Commission's convenience.

- Annex 2: Link Budgets. Representative links for the AT&T Earth Station are provided.
- Annex 3: Characteristics of the 1.2m Orbit Antenna are provided for the Commission's convenience. O3b previously submitted this information to the Commission.<sup>16</sup>

Further, O3b incorporates by reference the following technical parameters previously provided by O3b:

- Schedule S. In its application for a gateway earth station in Hawaii, O3b submitted a Schedule S describing its satellite system's technical characteristics.<sup>17</sup> The Schedule S correctly described the O3b satellite system for that application, and numerically enveloped all of the necessary parameters for future earth station applications. In order to assist the Commission in processing present and future applications, O3b subsequently provided a modified Schedule S that incorporates additional information submitted to the Commission since the Hawaii application was filed.<sup>18</sup> O3b will operate its AT&T Earth Station within the parameters described in O3b's modified Schedule S.
- U.S. Government Coordination. O3b has completed all necessary coordination with U.S. government satellite networks operating in Ka-band, including GSO and NGSO networks, as well as their associated specific earth stations filed under 9.7A and 9.7B of the ITU Radio Regulations through other administrations. O3b has also completed coordination, according to US footnote 334 of the FCC table of frequency allocations, with the U.S. government, and this US334 coordination agreement specifically provides for additional earth stations in U.S. territory operating with O3b's satellites, such as the AT&T Earth Station. As a result, O3b's existing US334 coordination agreement covers the use of the AT&T Earth Station as requested in this application.
- Antenna Patterns. O3b previously submitted measured 30 GHz band antenna performance data for the 1.2m Orbit antenna to the Commission in the Coda Lab STA request<sup>19</sup> and the pending DTS and Oil Comm STA requests.<sup>20</sup>

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<sup>16</sup> See O3b blanket maritime earth station application, File No. SES-LIC-20130528-00455, Technical Attachment at A.6. See also O3b DTS STA Application; O3b Oil Comm STA Application.

<sup>17</sup> See O3b Limited, Call Sign E100088, File No. SES-LIC-20100723-00952, granted Sept. 25, 2012 ("O3b Hawaii License").

<sup>18</sup> See O3b Limited, Call Sign E130098, File No. SES-AMD-20131025-01138 ("O3b ESV Answers").

<sup>19</sup> See O3b Limited, File No. SES-STA-20131228-01209, filed December 23, 2013 ("O3b CODA STA Application"), and which was placed on Public Notice on April 2, 2014 and granted on April 29, 2014.

<sup>20</sup> See O3b DTS STA Application. See also O3b Oil Comm STA Application.

## Proposed Spectrum Use

O3b's proposed AT&T Earth Station operations in shared bands are consistent with the Commission's rules and policies. O3b addresses each of these bands below.

### UPLINK

#### 28.35-28.4 GHz – Secondary uplink band shared with primary GSO FSS stations.

In the 28.35-28.4 GHz band, there is a primary allocation for GSO FSS systems and a secondary allocation for NGSO FSS systems. O3b's AT&T Earth Station transmissions in this band will be consistent with their secondary status vis-à-vis GSO FSS transmissions. The Commission has allowed similar secondary use of frequencies in the Ka-band uplink allocated to GSO FSS on a primary basis where applicants are prepared to accept interference from primary operations and can demonstrate that their proposed operations are not likely to cause harmful interference to primary operations.<sup>21</sup> O3b agrees to both of these standards.

As a secondary user of the 28.35-28.4 GHz band in the United States, O3b makes no claim of protection from interference from U.S.-licensed GSO FSS networks in this band segment. As for O3b's uplink operations in the 28.35-28.4 GHz band, the ITU has developed uplink equivalent power flux density limits ("EPFD<sub>up</sub>") limits to protect co-frequency GSO FSS operations from unacceptable interference from NGSO FSS systems operating in the same frequencies. Specifically, in accordance with Article 22 of the ITU Radio Regulations, if the applicable EPFD<sub>up</sub> limits are met, the NGSO FSS satellite system is considered to have met its obligations to protect GSO FSS networks from unacceptable interference. O3b demonstrated that its gateway located at Hawaii operating at the authorized power levels will meet the applicable ITU EPFD<sub>up</sub> limits in all frequency ranges where these limits apply, due to the inherent angular separation between the O3b and geostationary orbits when viewed from the Earth at latitudes away from the equator.<sup>22</sup>

The AT&T Earth Station is located further north in latitude than the Hawaii gateway,<sup>23</sup> which results in an even greater angular separation between the O3b and geostationary orbits as viewed from the Earth and an even greater assurance that the applicable ITU EPFD<sub>up</sub> limits will be met by O3b's proposed operations. The proposed AT&T Earth Station operations, therefore, also will meet the applicable ITU EPFD<sub>up</sub> limits. In any event, O3b confirms that its operations will be on a secondary basis relative to U.S.-licensed GSO FSS networks in the same band.

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<sup>21</sup> *Northrop Grumman Space & Missions Systems Corporation*, 24 FCC Rcd 2330, at ¶¶ 72-73 (Int'l Bur. 2009); *contactMEO Communications, LLC*, 21 FCC Rcd 4035, at ¶¶ 23-24, (Int'l Bur., 2006).

<sup>22</sup> O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1.

<sup>23</sup> The O3b Hawaii gateway latitude is 21° 40' 17.8" N; the AT&T Earth Station latitude is 29° 42' 32.9" N.

### 28.6-29.1 GHz – Primary uplink band for licensed NGSO FSS Systems.

Under the Commission’s Ka-band frequency plan, the frequencies 28.6-29.1 GHz may be used on a primary basis by licensed NGSO FSS systems.<sup>24</sup> O3b recognizes, however, that operations under an STA for the AT&T Earth Station demonstrations will be on a secondary, non-harmful interference basis. As shown below, the AT&T Earth Station demonstrations will provide the requisite protection to allocated services operating in this band.

*Avoidance of interference to GSO FSS systems.* The proposed demonstrations will not cause any interference into, or require protection from, any co-frequency GSO satellites. As previously shown,<sup>25</sup> there is an inherent angular separation between the O3b and GSO arcs from the perspective of earth stations located away from the equator. The AT&T Earth Station is located further north in latitude than the Hawaii gateway,<sup>26</sup> which results in an even greater angular separation between the O3b and geostationary orbits as viewed from the Earth. This means that the angular separation between the O3b and GSO arcs from the AT&T Earth Station will be greater than the 7 degree separation accepted by the Commission when it approved O3b’s Hawaii gateway. This ensures that GSO FSS systems will be adequately protected.

*Avoidance of interference to or from Fixed Service (i.e., terrestrial) stations.* Interference from the O3b AT&T Earth Station transmissions into U.S. terrestrial Fixed Service (“FS”) receivers in the 28 GHz band is a non-issue because there is no allocation in the Commission’s Ka-band Frequency Plan for FS stations operating in the 28.6-29.1 GHz band in the United States.<sup>27</sup>

### DOWNLINK

#### 18.3-18.6 GHz – Non-conforming downlink band shared with primary GSO FSS stations.

The 18.3-18.6 GHz band is allocated in the United States on a primary basis to GSO FSS. In the 18.3-18.6 GHz downlink band, the ITU has developed downlink equivalent power flux density (“EPFD<sub>down</sub>”) limits to protect GSO FSS networks from unacceptable interference from NGSO FSS systems operating in the same frequencies. Specifically, in accordance with Article 22 of the ITU Radio Regulations, if the applicable EPFD<sub>down</sub> limits are met, the NGSO FSS satellite system is considered to have met its obligations to protect GSO FSS networks from unacceptable interference. O3b confirms

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<sup>24</sup> See *In the Matter of 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 Service and for Fixed Satellite Services*, 11 FCC Rcd. 19005, ¶¶59-62 and 79 (1996). See also *In the Matter of 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*, 15 FCC Rcd 13430, ¶ 28 (2000).

<sup>25</sup> O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1.

<sup>26</sup> See n. 23, *supra*.

<sup>27</sup> See *In the Matter of Verizon Washington D.C., Application for Renewal of License for Common Carrier Fixed Point to Point Microwave Station KGC79*, 26 FCC Rcd 13511, 13516 (WTB 2011).

that its system will meet the applicable ITU EPFD<sub>down</sub> limits in all frequency ranges where these limits apply.<sup>28</sup>

As an example of how these limits will be satisfied, O3b provided EPFD<sub>down</sub> calculations for transmissions to its Hawaii gateway earth station.<sup>29</sup> O3b also showed how the EPFD<sub>down</sub> limits can be satisfied at all latitudes.<sup>30</sup> Compliance with the EPFD<sub>down</sub> limits is even more easily achieved in the case of transmissions to O3b's AT&T Earth Station than it is in the case of transmissions to O3b's Hawaii earth station. O3b is able to satisfy the limits by taking advantage of the inherent angular separation of the O3b and the GSO orbits when viewed from the surface of the Earth at latitudes away from the equator,<sup>31</sup> and O3b's AT&T Earth Station will be located further from the equator than O3b's Hawaii earth station. The AT&T Earth Station location, therefore, presents a strong case for non-interference to GSO FSS networks.

#### 18.8-19.3 GHz – Primary downlink band for licensed NGSO FSS Systems.

Under the Commission's Ka-band frequency plan, the frequencies 18.8-19.3 GHz may be used on a primary basis by licensed NGSO FSS systems.<sup>32</sup> O3b recognizes, however, that operations under an STA for the AT&T Earth Station demonstrations will be on a secondary, non-harmful interference basis. The AT&T Earth Station demonstrations will provide the requisite protection to GSO FSS networks and terrestrial stations operating in this band.

*Avoidance of interference to GSO FSS systems.* This band is not allocated for GSO FSS networks.<sup>33</sup> Nevertheless, the proposed demonstrations will not cause any interference into, or require protection from, any co-frequency GSO satellites. As previously shown,<sup>34</sup> there is an inherent angular separation between the O3b and GSO arcs from the perspective of earth stations located away from the equator. As mentioned above, the AT&T Earth Station is located further north in latitude than the Hawaii gateway, which results in an even greater angular separation between the O3b and geostationary orbits as viewed from the Earth. This means that the angular separation between the O3b and GSO arcs from

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<sup>28</sup> See ITU Radio Regulations, Article 22. See also O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1 for a discussion of O3b's compliance with the operational limits in Article 22 of the ITU Radio Regulations. See also Letter from Brian D. Weimer, to Marlene H. Dortch, in re O3b Application for Hawaii Earth Station, File No. SES-LIC-20100723-00952 (Apr. 22, 2011), Annex A.

<sup>29</sup> O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1.

<sup>30</sup> See id.

<sup>31</sup> See id.

<sup>32</sup> See *In the Matter of 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 Service and for Fixed Satellite Services*, 11 FCC Rcd. 19005, ¶¶59-62 and 79 (1996). See also *In the Matter of 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*, 15 FCC Rcd 13430, ¶ 28 (2000).

<sup>33</sup> See id.

<sup>34</sup> O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1.

the AT&T Earth Station will be greater than the 7 degree separation accepted by the Commission when it approved O3b's Hawaii gateway. This ensures that GSO FSS systems will be adequately protected.

However, because the demonstrations O3b proposes in this STA request will be conducted on a secondary basis, O3b agrees to accept any interference that its AT&T Earth Station may receive from 18.8-19.3 GHz band GSO FSS networks.

*Avoidance of interference to or from Fixed Service (i.e., terrestrial) stations.* FS stations operating in the 18.8-19.3 GHz band are no longer co-primary with FSS users in this band.<sup>35</sup> However, because the demonstrations O3b proposes in this STA request will be conducted on a secondary basis, O3b agrees to accept any interference that its AT&T Earth Station may receive from 18.8-19.3 GHz band FS stations. O3b will protect the 18.8-19.3 GHz band FS stations by complying with the space station PFD limits specified in Section 25.208 of the FCC rules.

### **Conclusion**

The requested STA will allow O3b to evaluate and demonstrate the O3b system's operational capabilities and will not result in harmful interference to other authorized spectrum users. Accordingly, and for good cause shown, O3b respectfully requests that its STA be granted in time for it to commence testing under this 30-day STA on December 1, 2014.

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<sup>35</sup> See 47 C.F.R. § 101.85(b)(2).

**ANNEX 1 – Form 312, Schedule B**

The Form 312, Schedule B is provided on the following pages.



**SATELLITE EARTH STATION AUTHORIZATIONS**  
**FCC Form 312 - Schedule B:(Technical and Operational Description)**

Location of Earth Station Site		
E1. Site Identifier:	AT&T Headquarters	E5. Call Sign: N/A
E2. Contact Name:	Howard Herscher	E6. Phone Number:713-567-1300
E3. Street:	6500 West Loop South	E7. City: Houston
		E8. County: Harris
E4. State	TX	E9. Zip Code: 77401
E10. Area of Operation:	Fixed	
E11. Latitude:	29° 42' 32.9" N	
E12. Longitude:	95° 27' 39.9" W	
E13. Lat/Lon Coordinates are:	<input type="radio"/> NAD-27	<input checked="" type="radio"/> NAD-83
E14. Site Elevation (AMSL):	19 meters	N/A
E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide a technical analysis showing compliance with two-degree spacing policy.	Yes	<input checked="" type="radio"/> No <input type="radio"/> N/A
E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	<input checked="" type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	<input type="radio"/> Yes	<input checked="" type="radio"/> No
E18. Is frequency coordination required? If YES, attach a frequency coordination report as	Yes	<input checked="" type="radio"/> No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	<input type="radio"/> Yes	<input checked="" type="radio"/> No
<b>E20. FAA Notification - (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and or the FAA's study regarding the potential hazard of the structure to aviation?</b> <b>FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.</b>	<input type="radio"/> Yes	<input checked="" type="radio"/> No

**POINTS OF COMMUNICATION**

Satellite Name:O3B-A   O3B-A   Eq. NGSO If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

**POINTS OF COMMUNICATION (Destination Points)**

E25. Site Identifier:
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E26. Common Name:	E27. Country:
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**ANTENNA**

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size	E41/42. Antenna Gain Transmit and/or Receive (___dBi at ___GHz)		
AT&T	Orbit 1.2m	2	Orbit Communications	AL-7103-Ka	1.2	45 dBi at 19.2		
						48.0 dBi at 28.3 GHz		
E28. Antenna Id	E33/34. Diameter Minor/Major(meters)		E35. Above Ground Level (meters)	E36. Above Sea Level (meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for all carriers (dBW)
Orbit 1.2m	1.2/1.2		17	19	0.0	20.0	2.0	60.5

**FREQUENCY**

E28. Antenna Id	E43/44. Frequency Bands(MHz)	E45. T/R Mode	E46. Antenna Polarization(H,V,L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier(dBW)	E49. Maximum EIRP Density per Carrier(dBW/4kHz)
Orbit 1.2m	18300 – 18600	R	Left and Right Circular	216MG7D	45.6	-1.7
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	18300 – 18600	R	Left and Right Circular	54MG7D	45.6	4.3
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	18800 – 19300	R	Left and Right Circular	216MG7D	45.6	-1.7
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	18800 – 19300	R	Left and Right Circular	54MG7D	45.6	4.3
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	28350 – 28400	T	Left and Right Circular	216MG7D	60.6	13.3
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	28350 – 28400	T	Left and Right Circular	54MG7D	60.6	19.3
E50. Various Modulations up to 32APSK; Digital Data Link						

Orbit 1.2m	28600 - 29100	T	Left and Right Circular	216MG7D	60.6	12.3
E50. Various Modulations up to 32APSK; Digital Data Link						
Orbit 1.2m	28600 - 29100	T	Left and Right Circular	54MG7D	60.6	19.3
E50. Various Modulations up to 32APSK; Digital Data Link						

**FREQUENCY COORDINATION**

<b>E28. Antenna Id</b>	<b>E51. Satellite Orbit Type</b>	<b>E52/53. Frequency Limits(MHz)</b>	<b>E54/55. Range of Satellite Arc E/W Limit</b>	<b>E56. Earth Station Azimuth Angle Eastern Limit</b>	<b>E57. Antenna Elevation Angle Eastern Limit</b>	<b>E58. Earth Station Azimuth Angle Western Limit</b>	<b>E59. Antenna Elevation Angle Western Limit</b>	<b>E60. Maximum EIRP Density toward the Horizon(dBW/4kHz)</b>
Orbit 1.2	Non-Geostationary	18300 – 18600	NON-GEO	118.7	20.0	205.5	10.0	--
Orbit 1.2	Non-Geostationary	18800 – 19300	NON-GEO	118.7	20.0	205.5	10.0	--
Orbit 1.2	Non-Geostationary	28350 – 28400	NON-GEO	118.7	20.0	205.5	10.0	-39.8
Orbit 1.2	Non-Geostationary	28600 – 29100	NON-GEO	118.7	20.0	205.5	10.0	-39.8

**REMOTE CONTROL POINT LOCATION**

E61. Call Sign				E65. Phone Number			
<b>NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.</b>							
E62. Street Address							
E63. City			E67. County			E64/68. State/Country	E66. Zip Code

## ANNEX 2 – Link Budgets

Representative link budgets for the 1.2m Orbit antenna at the AT&T Earth Station are provided on the following two pages. Please see the chart below for reference.

Link Description	Carrier	MODCOD	Table #
1.2m at AT&T	54MHz by 54 MHz	16APSK 2/3rds FWD QPSK 2/3rds RTN	1,2

<b>O3b Network Link Analysis - Tier 1 Service For Houston, United States</b>			
<b>Link Budget Creator - Rev 3.2.9: July 17, 2014</b>		<b>Tier 1</b>	<b>Tier 1</b>
<b>Ground Parameter</b>		<b>Teleport</b>	<b>Telco</b>
Location		Vernon (RHCP), United States	Houston, United States
Latitude	(°)	34.2	29.8
Longitude (East)	(°)	260.7	264.6
E/S Range to SV	(km)	10824.6	10792.4
E/S Elevation to SV	(°)	21.5	21.9
E/S Altitude	(km)	0.3	0.0
SV Beam Identifier	(#)		14
Minutes Into Pass (Sample #1)	(Min)		0:0
Telco Spot Beam Off-Angle	(°)		0.20
Telco Spot Beam Diameter	(km)		66.00
Maximum Roundtrip Latency	(msec)		144.21
<b>Modulation Parameters</b>		<b>Forward</b>	<b>Return</b>
Enter Receiver	Type	DVB-S2	
Modem Overhead	(%)	1.0%	
Number of Carriers per Channel	(#)	1	
Available Bandwidth	(Hz)	54,000,000	
Channel Symbol Rate	(sps)	45,000,000	
Channel Modulation Type		16APSK	
Channel FEC Rate		0.75	
Channel Spectral Efficiency	(bits/Sym)	3.00	
Channel Throughput (100% / 100% of Full Rate)	(bps)	133,650,000	
<b>Uplink</b>		<b>Forward</b>	<b>Return</b>
E/S Tx Channels per HPA	(#)	5	
E/S Tx Carrier Frequency	(MHz)	28,709	
E/S Tx HPA Power Level	(W)	125	
E/S Tx OBO	(dB)	-14.00	
E/S Tx Post-HPA Losses	(dB)	-2.24	
E/S Tx Antenna Gain (7.3 m / 1.2 m)	(dB)	65.03	
E/S Tx EIRP Per Channel	(dBW)	62.77	
E/S Tx Pointing Loss	(dB)	-0.50	
E/S Tx RF Link Availability	(%)	75.000	
E/S Tx Atmospheric Losses	(dB)	-1.66	
E/S Tx Spreading Loss	(dB)	-151.68	
<b>Satellite</b>		<b>Forward</b>	<b>Return</b>
SV Number of Channels per HPA	(#)	1	
SV Rx G/T	(dB/K)	5.58	
SV Rx Power Per Tier	(dBW)	-136.12	
SV Rx Flux Density Per Tier	(dBW/m <sup>2</sup> )	-91.08	
SV Tx OBO (ALC / FGM)	(dB)	-3.80	
SV Tx Post-TWTA Losses	(dB)	-1.50	
SV Tx Antenna Gain	(dBi)	31.92	
SV Tx EIRP Per Channel/Carrier	(dBW)	44.75	
SV Tx Pointing Loss	(dB)	0.00	
<b>Downlink</b>		<b>Forward</b>	<b>Return</b>
E/S Rx Carrier Frequency	(MHz)	18,909	
E/S Rx Wavelength	(m)	0.015854	
E/S Rx RF Link Availability	(%)	70	
E/S Rx Atmospheric Losses	(dB)	-1.35	
E/S Rx Pointing Loss	(dB)	-1.00	
E/S Rx Antenna Gain (1.2 m / 7.3 m)	(dBi)	42.7	
E/S Rx Effective G/T	(dB/K)	18.8	
E/S Rx Power Per Channel	(dBW)	-113.5	
E/S Rx Flux Density Per Channel	(dBW/m <sup>2</sup> )	-109.3	
<b>Total Link</b>		<b>Forward</b>	<b>Return</b>
Carrier / Noise Bandwidth	(dB)	76.53	
Carrier / Noise Uplink	(dB)	15.95	
Carrier / Noise Downlink	(dB)	14.67	
Carrier / Intermodulation Im (C/Im)	(dB)	29.35	
(C/N) - Total Actual	(dB)	11.95	
(C/N) - Total Required	(dB)	11.40	
(E <sub>v</sub> /N <sub>0</sub> ) - Total Actual	(dB)	7.18	
(E <sub>v</sub> /N <sub>0</sub> ) - Total Required	(dB)	6.63	
<b>Excess Margin</b>	<b>(dB)</b>	<b>0.55</b>	
<b>Fade Margin</b>	<b>(dB)</b>	<b>14.55</b>	

#1

## O3b Network Link Analysis - Tier 1 Service For Houston, United States

Link Budget Creator - Rev 3.2.9: July 17, 2014			Tier 1	Tier 1
Ground Parameter			Teleport	Telco
Location			Vernon (RHCP), United States	Houston, United States
Latitude	(°)		34.2	29.8
Longitude (East)	(°)		260.7	264.6
E/S Range to SV	(km)		10824.6	10792.4
E/S Elevation to SV	(°)		21.5	21.9
E/S Altitude	(km)		0.3	0.0
SV Beam Identifier	(#)		14	
Minutes Into Pass (Sample #1)	(Min)		0:0	
Telco Spot Beam Off-Angle	(°)		0.20	
Telco Spot Beam Diameter	(km)		66.00	
Maximum Roundtrip Latency	(msec)		144.21	
Modulation Parameters			Forward	Return
Enter Receiver	Type			DVB-S2
Modem Overhead	(%)			1.0%
Number of Carriers per Channel	(#)			1
Available Bandwidth	(Hz)			54,000,000
Channel Symbol Rate	(sps)			45,000,000
Channel Modulation Type				8PSK
Channel FEC Rate				0.67
Channel Spectral Efficiency	(bits/Sym)			2.00
Channel Throughput (100% / 100% of Full Rate)	(bps)			<b>89,100,000</b>
Uplink			Forward	Return
E/S Tx Channels per HPA	(#)			1
E/S Tx Carrier Frequency	(MHz)			28,709
E/S Tx HPA Power Level	(W)			40
E/S Tx OBO	(dB)			-3.00
E/S Tx Post-HPA Losses	(dB)			-0.28
E/S Tx Antenna Gain (7.3 m / 1.2 m)	(dB)			46.5
E/S Tx EIRP Per Channel	(dBW)			59.21
E/S Tx Pointing Loss	(dB)			-1.00
E/S Tx RF Link Availability	(%)			70.000
E/S Tx Atmospheric Losses	(dB)			-2.02
E/S Tx Spreading Loss	(dB)			-151.65
Satellite			Forward	Return
SV Number of Channels per HPA	(#)			5
SV Rx G/T	(dB/K)			5.03
SV Rx Power Per Tier	(dBW)			-141.05
SV Rx Flux Density Per Tier	(dBW/m <sup>2</sup> )			-95.47
SV Tx OBO (ALC / FGM)	(dB)			-18.87
SV Tx Post-TWTA Losses	(dB)			-1.50
SV Tx Antenna Gain	(dBi)			31.95
SV Tx EIRP Per Channel/Carrier	(dBW)			22.72
SV Tx Pointing Loss	(dB)			0.00
Downlink			Forward	Return
E/S Rx Carrier Frequency	(MHz)			18,909
E/S Rx Spreading Loss	(dB)			-151.68
E/S Rx RF Link Availability	(%)			75.000
E/S Rx Atmospheric Losses	(dB)			-1.13
E/S Rx Pointing Loss	(dB)			-0.50
E/S Rx Antenna Gain (1.2 m / 7.3 m)	(dBi)			62.24
E/S Rx Effective G/T	(dB/K)			38.84
E/S Rx Power Per Channel	(dBW)			-115.34
E/S Rx Flux Density Per Channel	(dBW/m <sup>2</sup> )			-130.59
Total Link			Forward	Return
Carrier / Noise Bandwidth	(dB)			76.53
Carrier / Noise Uplink	(dB)			11.02
Carrier / Noise Downlink	(dB)			13.33
Carrier / Intermodulation Im (C/Im)	(dB)			25.81
(C/N) - Total Actual	(dB)			8.81
(C/N) - Total Required	(dB)			7.60
(E <sub>v</sub> /N <sub>0</sub> ) - Total Actual	(dB)			5.80
(E <sub>v</sub> /N <sub>0</sub> ) - Total Required	(dB)			4.59
<b>Excess Margin</b>	<b>(dB)</b>			<b>1.21</b>
<b>Fade Margin</b>	<b>(dB)</b>			<b>11.41</b>

#2

### ANNEX 3 –Terminal Characteristics

The O3b 1.2 meter (“1.2m”) terminals offers service data rates of up to 150 Mbps. The figure below shows this terminal.

**Figure: O3b’s 1.2 meter terminal**



The 1.2m terminal is fully stabilized to account for the movement of the O3b satellite in its orbit. Each antenna is enclosed within a radome to protect it from the environment.

The Commission’s rules for C-band and Ku-band maritime terminals include a pointing accuracy requirement and a shut-off requirement. In these bands, there must be a pointing error of less than 0.2° between the orbital location of the target satellite and the axis of the main lobe of each maritime terminals antenna.<sup>36</sup> O3b observes these requirements with its 1.2m Orbit terminal operations, and the manufacturer of O3b’s 1.2m terminals has certified that the terminals comply with these requirements.

The internal controller software continuously monitors the instantaneous antenna tracking error and will cease transmissions within 100ms if an unexpected event occurs that causes the tracking error to exceed 0.5 degrees. Transmissions will not restart until the tracking error, relative to the target O3b satellite, is less than 0.2 degrees.

The 1.2m terminals are no smaller in antenna size than the range of antenna sizes that O3b has previously described to the Commission as its “Tier 2” service.<sup>37</sup> Therefore these 1.2m terminals present no new technical issues in terms of interference with respect to GSO or other NGSO satellite networks or terrestrial operators.

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<sup>36</sup> See 47 C.F.R. §§ 25.221(a)(6) and 25.222(a)(6).

<sup>37</sup> See O3b’s Hawaii application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at Section A.5.