



Federal Communications Commission
Washington, D.C. 20554

November 10, 2004

Mr. David Castiel
President and Manager
Virtual Geosatellite, L.L.C.
1133 21st Street, NW, 8th Floor
Washington, DC 20036

Re: Application of Virtual Geosatellite, L.L.C. for Authority to Launch and Operate a Global Fixed-Satellite Service System Employing Nongeostationary Satellites in Sub-Geosynchronous Elliptical Orbits, File Nos. SAT-LOA-19990108-00007, and SAT-AMD-20020916-00173, Call Sign S2366

Dear Mr. Castiel:

The Satellite Division is reviewing the above-referenced application of Virtual Geosatellite, L.L.C. ("Virgo") to operate a Ku-Band non-geostationary satellite orbit ("NGSO") fixed-satellite service ("FSS") system. Staff examination of the application has indicated two issues with respect to which additional information is needed. One concerns the showing that the proposed system meets the required equivalent power flux-density limits. The other involves the required orbital debris mitigation showing. This letter requests that Virgo supplement its application to provide this information. If Virgo does not provide the requested information through an amendment filed by December 10, 2004, its application will be dismissed without prejudice to re-filing.

Equivalent Power Flux-density Showing

On November 29, 2000, the Commission adopted the *First Report and Order* in a proceeding that permitted non-geostationary satellite systems to operate in the Ku-band frequency range.¹ In that *First Report and Order*, the Commission adopted technical sharing criteria to allow NGSO FSS and geostationary satellite orbit FSS to operate on a co-primary basis in certain Ku-band frequencies, consistent with decisions taken at the 2000 World Radiocommunication Conference. The adopted technical criteria are based upon uplink and downlink limits on equivalent power flux-density ("EPFD"). The Commission also adopted rules, codified in section 25.146(a) of the FCC rules, requiring a pre-licensing technical showing

¹ *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*").

that a proposed system will meet the adopted EPFD limits.² There is no exception to this requirement for systems employing highly-elliptical orbits.

On April 18, 2002, the Commission adopted its *Report and Order and Further Notice of Proposed Rulemaking*, establishing the policies and service rules for the non-geostationary satellite orbit FSS systems operating in the Ku-band frequency range.³ Applicants were afforded 30 days after a summary of this *Report and Order* was published in the Federal Register to amend their filings. Although Virgo filed an amendment by that deadline, its conforming amendment did not include a computer program for determining compliance with the EPFD limits.⁴

In February 2003, the Commission adopted a *Third Memorandum Opinion and Order* in the NGSO FSS Ku-band proceeding, further refining the rules for establishing the required comprehensive technical showing, specifically, the rules for demonstrating that limits on EPFD are met.⁵ We note that the International Telecommunication Union Working Party 4A has also issued a "Functional Description To Be Used In Developing Software Tools For Determining Conformity Of Non-Geostationary-Satellite Orbit Fixed-Satellite System Networks With Limits Contained In Article 22 Of The Radio Regulations" and that two software development companies have already independently developed EPFD validation software based on the software specifications contained in Recommendation ITU-R S.1503. With these rule refinements and readily available software, Virgo should now be able to provide a computer program for determining its compliance with the EPFD limits as part of the required comprehensive technical showing.

Orbital Debris Mitigation Showing

In the orbital debris mitigation statement provided by Virgo in its conforming amendment, Virgo stated that it was not possible to provide the Commission with a comprehensive orbital debris mitigation plan for its Virgo satellite system. However, Virgo asserted that it intended to incorporate standard orbital debris mitigation techniques into the design and construction of its satellites.⁶ In order to evaluate Virgo's application, we request that

² 47 C.F.R. § 25.146(a).

³ *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, FCC 02-123, 17 FCC Rcd. 7841 (2002).

⁴ See 47 C.F.R. § 25.146(a)(1)-(2).

⁵ *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, FCC 03-24, ET Docket No. 98-206.

⁶ Amendment to application, SAT-AMD-20020916-00173, Form 312, Exhibit No.5 "Orbital Debris Mitigation".

Virgo provide the following information pursuant to Section 25.111(a) of the Commission's Rules:

1. Spacecraft Hardware Design: A statement that Virgo has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. As part of this statement Virgo must identify steps taken to limit the effects of collisions with small debris or meteoroids, such as, through the use of shielding, the placement of components, and or use of redundant systems. In addition, Virgo must confirm whether any debris is planned to be released during the course of normal operations and to describe any such planned release with particularity.
2. Minimizing Debris Generated by Accidental Explosions: A statement that Virgo has assessed and limited the probability of accidental explosions during and after completion of mission operations.
3. Collisions with Large Objects: A statement that Virgo has assessed and limited the probability of its satellites becoming a source of debris by collision with large debris or other functioning satellites.
 - a) Please indicate whether there are any other NGSO constellations, currently in orbit or planned, with similar orbital characteristics (i.e. apogee, perigee, inclination, or RAAN) such that the volumes in which the satellites will orbit substantially overlap. If there are, please provide an analysis of the potential risk of in-orbit collision and a description of any measures Virgo plans to take to avoid such collision.
 - b) Please specify the tolerance, during the operational life of the satellite, to which the following orbital parameters will be maintained:
 - a. Apogee;
 - b. Perigee;
 - c. Inclination;
 - d. RAAN;
 - e. Satellite phasing, for orbits with more than one satellite.
4. End-of-life disposal: Virgo stated that it has no plans to dispose of its satellites via atmospheric re-entry.⁷ Therefore, we request that Virgo provide the following information with respect to its plans for storage orbit:

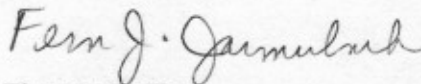
⁷ Amendment to application, SAT-AMD-20020916-00173, Form 312, Exhibit No.5 "Orbital Debris Mitigation".

- a) A statement disclosing the anticipated initial altitudes (apogee and perigee) and orbital parameters of the storage orbit and an analysis of the stability of the storage orbit (e.g. a plot of apogee and perigee altitude of the storage orbit verses time, over a period of more than 100 years);
- b) An analysis, including all assumptions, of the amount of fuel, in kilograms, that would be required to accomplish the post-mission disposal and the amount of fuel Virgo intends to reserve for this purpose;
- c) An analysis, including all assumptions, of fuel gauging uncertainty and a statement of whether Virgo has or will compensate for such uncertainty.

Virgo must amend its pending application with a comprehensive technical showing, including the masks generated by a computer program, proving Virgo's proposed network can meet the EPFD limits in Article 22 of the Radio Regulations and Sections 25.146(a) and 25.208 of the Commission's rules, and a comprehensive orbital debris mitigation plan. If Virgo fails to file this amendment by December 10, 2004, Virgo's application will be dismissed pursuant to Sections 25.112(c) and 25.152(b) of the Commission's rules.⁸

If you have any questions on the requirements for the EPFD Showing, you may either contact Mark Young by telephone at (202) 418-0762 or by e-mail at mark.young@fcc.gov; or Kal Krautkramer at (202) 418-1335 or by e-mail at kal.krautkramer@fcc.gov. If you have any questions on the Orbital Debris Mitigation Showing, you may contact Sankar Persaud by telephone at (202) 418-2441 or by e-mail at sankar.persaud@fcc.gov.

Sincerely,


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⁸ See also *Amendment of the Commission's Space Station Licensing Rules and Policies* (First Report and Order), FCC 03-102, 18 FCC Rcd 10760 at ¶ 244 (2003).