EXHIBIT A

MODIFICATION NARRATIVE

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
VIASAT, INC.	)	File Nos. SAT-LOA-20070314-00051,
	)	SAT-MOD-20071204-00168, SAT-
Application to Modify Authorization to	)	MOD-20080718-00144
Launch and Operate a Ka-Band Satellite at the	)	
Nominal 77º W.L. Orbital Location	)	Call Sign S2737
	)	
	)	

APPLICATION FOR LICENSE MODIFICATION

ViaSat, Inc. ("ViaSat") hereby files this application to modify ViaSat's existing license to launch and operate VIASAT-77 at the 77.3º W.L. orbital location to provide fixed satellite service ("FSS"). ViaSat seeks authority to operate in the 18.8-19.3 GHz band on a non-conforming, non-interference basis and in the 28.6-29.1 GHz band on a secondary, non-interference basis. The attached Supplemental Technical Annex and the associated Schedule S contain the relevant technical details.

I. BACKGROUND

On July 18, 2007, the Commission granted ViaSat a license to launch and operate VIASAT-77, a Ka-band GSO FSS satellite at 77.3º W.L.[1] The Commission subsequently modified that license to permit ViaSat to operate VIASAT-77 using the 28.1-28.35 GHz band on a secondary basis.[2] Today, ViaSat is authorized to operate VIASAT-77 in the 18.3-18.8 GHz and 19.7-20.2 GHz downlink bands and the 28.1-28.6 GHz and 29.5-30.0 GHz uplink bands.

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1 Public Notice, SAT-00458, Policy Branch Information, Actions Taken, DA 07-3322 at 1 (rel. July 20, 2007).

2 Public Notice, SAT-00524, Policy Branch Information, Actions Taken, DA 08-1204 at 2 (rel. May 23, 2008).

ViaSat had previously notified the Commission that VIASAT-77 would be constructed at ViaSat's own risk with the capability of also operating in the 18.8-19.3 GHz and 28.6-29.1 GHz bands.[3] In this application, ViaSat seeks authority to operate in these bands on a non-interference basis.

II. PUBLIC INTEREST BENEFITS

Grant of authority to operate VIASAT-77 at 18.8-19.3 GHz and 28.6-29.1 GHz would serve the public interest in several important respects. Most significantly, using these long-fallow spectrum bands would significantly increase the capacity on the satellite and the number of broadband consumers that the satellite can support, and also would lower the "per bit" cost of providing service.

VIASAT-77 will provide a cost-effective means of extending high-quality broadband service to households who simply do not have that option available today. This system is designed to use spectrum in the most efficient manner to allow reliable, high-speed broadband service at low per-bit transmission costs. The spectrum-efficient satellite design, coupled with the use of spot beams and ViaSat's innovative ground terminal hardware technology, enable the provision of affordable broadband service that is comparable in both speed and service quality to cable modem and DSL services. By enabling the provision of this high quality of service to a greater number of subscribers, grant of this modification application will enhance competition and promote the growth and development of cost-effective broadband services.

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[3] SAT-MOD-20080717-00144, Exhibit D.

III. SPECTRUM AVAILABILITY AND REQUEST FOR WAIVERS

The 500 MHz of spectrum in the 18.8-19.3 GHz and 28.6-29.1 GHz bands is currently unlicensed at 77º W.L., and, in fact, is not licensed to any NGSO system. Moreover, as ViaSat demonstrates in the attached Supplemental Technical Annex, no other satellite operates in those parts of the Ka-band within two degrees of the proposed orbital location, and VIASAT-77 would be able to share this spectrum with any NGSO system that may be authorized in the future.

The application of AtContact Communications, LLC ("AtContact") for an orbital reassignment from the 34º E.L. location to the 77º W.L. location is not a barrier to this application for two reasons.[4] As an initial matter, the first-come, first-served procedures expressly contemplate multiple pending applications for the same resources.[5] More fundamentally, AtContact has surrendered its authorization at 34º E.L.,[6] thus rendering moot its pending request for orbital reassignment to 77º W.L. Therefore, this request is fully consistent with the procedures set forth by the Commission in the *Space Station Licensing Reform Order* regarding the processing of applications for GSO-like services.

The 28.6-29.1 GHz and 18.8-19.3 GHz bands are allocated internationally for GSO and NGSO use on a co-primary basis, but in the U.S. Table of Allocations are allocated only to the NGSO FSS on a primary basis. ViaSat seeks to operate at 28.6-29.1 GHz pursuant to

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4 *See* Application of AtContact Communications, LLC, File Nos. SAT-MOD-20070924-00132, SAT-AMD-20080930-00194, Call Sign S2682.

5 *See Space Station Licensing Reform Order* at ¶¶ 113, 114.

6 Letter from James M. Talens, Counsel to AtContact Communications, LLC, to Marlene H. Dortch, Secretary, FCC, Re: AtContact Communications, LLC, File Nos. SAT-MOD-20080813-00155 (S2346); SAT-AMD-20080930-00195 (S2680); SAT-AMD-20080505-00098 (S2381); SAT-AMD-20080930-00194 (S2682); SAT-MOD-20060511-00057 (S2683), at n.7, 7 (filed Feb. 6, 2009); *see also*, Letter from James M. Talens, Counsel to AtContact Communications, LLC, to Marlene H. Dortch, Secretary, FCC, Re: Letter of February 6, 2009 by AtContact Communications, LLC (Apr. 22, 2009) (together, "*AtContact Letters*").

the secondary U.S. allocation of this band for GSO FSS use. Additionally, and consistent with Commission precedent, ViaSat requests a waiver of the U.S. Table of Frequency Allocations to use the 18.8-19.3 GHz band on a GSO FSS spacecraft on a non-conforming basis.

A. 18.8-19.3 GHz Band Waiver Request

ViaSat seeks authority to use spectrum in the 18.8-19.3 GHz band for both gateway and user terminal downlinks in the United States. The 18.8-19.3 GHz band is allocated in the United States for NGSO FSS operations on a primary basis, with no secondary allocation for GSO FSS operations. Accordingly, ViaSat requests a waiver of Section 2.106 of the Commission's rules, and specifically footnote NG165 thereto, to permit ViaSat to operate its GSO FSS system in this band on a non-conforming, non-interference basis.[7]

Grant of this waiver is appropriate because such a grant "would better serve the public interest than strict adherence to the general rule."[8] ViaSat's Ka-band service promises to bring a new and innovative alternative for broadband Internet access to residential consumers and businesses of all sizes, using technologies that make efficient use of currently unused spectrum. As discussed above, ViaSat's innovative satellite design enables the provision of affordable broadband satellite services to U.S. consumers at the level of quality demanded by the market. Through the use of efficient satellite design, spot beam capabilities and innovative ground terminal design, access to this additional Ka-band segment would allow ViaSat to both (i) expand significantly the capacity of the satellite and thus the number of supportable

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7 *See* 47 C.F.R. § 2.106 & n.NG165.

8 *See WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969). *See also Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1166 (D.C. Cir. 1990) (waiver appropriate where "the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest."); *Fugro-Chance, Inc.*, 10 FCC Rcd 2860, at ¶ 2 (IB 1995) (waiver of U.S. Table of Allocations appropriate "when there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the non-conforming operator accepts any interference from authorized services.").

customers, and (ii) reduce the cost-per-bit of providing service, and thereby provide more cost-effective broadband services. Grant of this waiver thus would increase the availability of affordable high-data-rate communications services in the United States and therefore help satisfy the demand for satellite broadband access. Moreover, because there is no operating commercial NGSO system that uses these frequencies, grant of the waiver would allow ViaSat to make efficient use of an unused spectrum resource.

Significantly, the VIASAT-77 satellite is designed to be able to use this spectrum resource without causing harmful interference into any NGSO system that may be deployed in the future, as discussed further below. Grant of the requested waiver therefore is consistent with Commission precedent and with the Commission's orders allocating the 18.8-19.3 GHz band primarily for NGSO FSS use.

When the Commission established rules for licensing satellites in the 18 GHz band, it lacked record evidence that sharing between NGSO FSS and GSO FSS operations would be feasible in the 18.8-19.3 GHz band. The Commission thus did not broadly allow for GSO use of the 18.8-19.3 GHz band.[9] Rather, the Commission left open the possibility that parties would submit information demonstrating that such sharing was possible[10] and found that, in principle, secondary use of the 18.8-19.3 GHz band would "be feasible if the stations of the secondary service could be designed to operate without impact on the primary service."[11] Since then, the

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9 *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*, First Order on Reconsideration, 16 FCC Rcd 19808, at ¶ 29 (2001) ("We find the record in this proceeding to be insufficient to determine whether and how GSO/FSS systems can operate on a secondary basis in NGSO/FSS bands . . . .").

10 *Id.*

11 *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*

Commission has entertained multiple requests for GSO use, but only a few of them contained an adequate showing that sharing was possible.[12] In granting each of Northrop Grumman Space & Mission Systems Corporation ("Northrop Grumman") and AtContact a waiver of Section 2.106 to permit the operation of GSO FSS satellites at 18.8-19.3 GHz on a non-conforming, non-interference basis, the Commission found that each applicant submitted a sufficient "quantitative demonstration" of how its GSO FSS satellites would operate in these bands while protecting the primary NGSO FSS systems.[13] Below, ViaSat provides a similar quantitative showing of how it will protect primary NGSO users.

B. Non-Interference Showing for the 18.8-19.3 GHz and 28.6-29.1 GHz Bands

As demonstrated in the Supplemental Technical Annex, neither ViaSat's operations in the 28.6-29.1 GHz band pursuant to the secondary GSO FSS allocation, nor its operations in the 18.8-19.3 GHz band on a non-conforming, non-interference basis, will cause harmful interference to any NGSO FSS system (including those that are similar to the design of the previously authorized Northrop Grumman and AtContact systems).[14] The VIASAT-77

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, at ¶ 57 (2000).

12 *See Northrop Grumman Space & Mission Systems Corporation,* Order and Authorization, DA 09-428, at ¶¶ 86, 88 (rel. Feb. 23, 2009) ("*Northrop Grumman Order*"); *contactMEO Communications, LLC*, Order and Authorization, DA 06-864, at ¶¶ 33, 35 (rel. Apr. 14, 2006) ("*AtContact Order*"). *Compare, e.g., EchoStar Satellite LLC*, 19 FCC Rcd 7846, at ¶¶ 19-20 (2004) (rejecting EchoStar's request to operate GSO FSS system in 18.8-19.3 GHz band because EchoStar had failed to demonstrate that there would be a low potential for interference into any NGSO system).

13 *Northrop Grumman Order* at ¶¶ 86, 88; *AtContact Order* at ¶¶ 33, 35.

14 Northrop Grumman surrendered its system license on March 26, 2009, and AtContact surrendered its NGSO authorization on February 6, 2009. *See AtContact Letters*; Letter from Stephen D. Baruch, counsel to Northrop Grumman Space & Mission Systems Corporation, to Marlene H. Dortch, Secretary, FCC, Re: Surrender of Space Station and Satellite System Authorizations (File Nos. SAT-LOA-19970904-00080, *et seq*., Call Signs S2254, S2255, S2256, S2257, and S2258).

satellite employs technology that will allow it to operate in a manner that protects NGSO FSS systems in the 18.8-19.3 GHz and 28.6-29.1 GHz bands from harmful interference, while still maintaining service in other frequency bands. In this respect, ViaSat notes that it had negotiated a coordination agreement with AtContact after establishing to AtContact's satisfaction that ViaSat's technology and VIASAT-77's novel satellite design would protect the AtContact system from harmful interference.

Specifically, the satellite has been designed with the capability to cease operations in the 18.8-19.3 GHz downlink band and in the associated 28.6-29.1 GHz uplink band in any spot beams where the predicted physical alignment of either (i) the VIASAT-77 satellite and an earth station communicating with an NGSO space station, or (ii) an NGSO space station and an earth station communicating with the VIASAT-77 satellite, is such that the angular separation between operational links of the two satellite networks would be equal to or less than a specified minimum line-of-sight separation angle. In that case, and for the short duration of the event, the affected VIASAT-77 satellite spot beam will continue providing service in a portion of the currently-authorized spectrum bands—namely, 18.3-18.8 GHz and 28.1-28.6 GHz.

In the Supplemental Technical Annex, ViaSat demonstrates that the VIASAT-77 satellite's operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands will not interfere with primary NGSO operations. As part of this quantitative demonstration, ViaSat analyzed the NGSO systems of AtContact and Northrop Grumman and determined that the calculated interference-to-noise ratio based on worst case scenarios is -20.4 dB, which corresponds to a $\Delta T/T$ of only 0.92%. This level is well below the 6% $\Delta T/T$ threshold that triggers coordination between satellite systems under the ITU Radio Regulations, and which the Commission considered in finding that GSO use of these bands by Northrop Grumman and AtContact would

not cause harmful interference to other NGSO systems.[15] Moreover, ViaSat's technical showing contains the same type of quantitative data provided by Northrop Grumman and AtContact and relied upon by the Commission when it granted those licensees authority to operate GSO satellites in the 18.8-19.3 GHz and 28.6-29.1 GHz bands on a non-interference basis.[16]

ViaSat commits to abide by the terms of any coordination agreements that it may enter into with NGSO system operators, and otherwise will cease operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands in the unlikely event that it does cause harmful interference into NGSO FSS operations. ViaSat will also accept interference that it may receive from NGSO FSS operations in these bands.

C. Cross Polarization Isolation Waiver

With respect to the 18.8-19.3 GHz and 28.6-29.1 GHz frequencies that are the subject of this application, ViaSat requests a waiver of the requirement that space station antennas in the FSS be designed to meet the cross-polarization isolation threshold specified in the Commission's rules. As discussed further in the Supplemental Technical Annex, the VIASAT-77 satellite will have a small cross-polarization shortfall in the satellite receive antenna, which will have no adverse affect on the operation of other satellite networks. Grant of this waiver is consistent with the Commission's grant of the same waiver request with respect to this satellite in a previous modification application.[17] The instant modification application does not seek to change the cross-polarization isolation of the licensed satellite.

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15 *Northrop Grumman Order* at ¶ 86; *AtContact Order* at ¶ 33.

16 The non-interference analyses provided by Northrop Grumman and AtContact for each of their networks of four GSO satellites using the NGSO primary bands are equally applicable to a single GSO satellite.

17 *See* IBFS File No. SAT-MOD-20080718-00144, Conditions of Authorization ¶ 2 (granted Mar. 25, 2009).

IV. REVISED OWNERSHIP INFORMATION

To supplement the ownership information provided in the Modification filing, ViaSat adds to the list of Officers and Senior Management, Thomas E. Moore, Senior Vice President. Mr. Moore can be reached c/o ViaSat, Inc., 6155 El Camino Real, Carlsbad, CA 92009.

V. WAIVER PURSUANT TO SECTION 304 OF THE COMMUNICATIONS ACT

In accordance with Section 304 of the Communications Act of 1934, as amended, ViaSat hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise.

VI. CONCLUSION

For the foregoing reasons, granting ViaSat's request to modify its Ka-band satellite authorization at the nominal 77° W.L. location to use the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands on a non-interference basis will serve the public interest, convenience and necessity. ViaSat respectfully requests that the Commission act promptly to grant this modification application.

Respectfully submitted,

/s/

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Supplemental Technical Annex

A.1 SCOPE AND PURPOSE

The purpose of this Annex is to describe the technical and operational characteristics of the 28.6-29.1 GHz and 18.8-19.3 GHz bands of the VIASAT-77 satellite. ViaSat has previously informed the Commission that the VIASAT-77 satellite would be constructed with the capability of operating in these bands; however ViaSat did not seek Commission authorization to use the bands at that time[1].

This Annex provides the technical information relating to the requested modification and is intended to supplement the information regarding the VIASAT-77 satellite previously submitted to the Commission in approved license and license modification applications. The substance of this modification application coupled with the structure of this Annex and the Schedule S form make it necessary to reiterate certain information previously provided to the Commission. Any Part 25 requirements not included in this Annex or the associated Schedule S form have been previously provided to the Commission and have not changed.

A.2 GENERAL DESCRIPTION

The VIASAT-77 satellite at 77.3° W.L. will provide Ka-band services to CONUS, Puerto Rico, the U.S. Virgin Islands and portions of Canada and Mexico. The satellite will operate in the 28.1-29.1 GHz and 29.5-30.0 GHz bands (Earth-to-space) and the 18.3-19.3 GHz and 19.7-20.2 GHz bands (space-to-Earth). The satellite network will provide service to small user antennas. In addition, a limited number of larger gateway antennas will be employed. The gateway antennas will have the capability of transmitting in any channel within the 28.1-29.1 GHz and

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[1] *See* SAT-MOD-20080718-00144.

29.5-30.0 GHz bands. Uplink transmissions from the small user terminals will be restricted to the 28.35-29.1 GHz and 29.5-30.0 GHz bands.

The satellite utilizes a bent-pipe architecture with asymmetric forward (gateway-to-subscriber) and return (subscriber-to-gateway) links. Forward links consist of a single TDM 500 MHz wide carrier (416.67 Msym/s), while the return links use MF-TDMA with a variety of bandwidths/data rates employed. The network uses adaptive coding and modulation to combat rain fades. That is, the modulation type, amount of coding and/or user data rate is dynamically varied to meet the link requirements during rain events (in addition to employing uplink power control). The forward links vary between 16-APSK, 8PSK and QPSK modulations, depending on the amount of rain fade, while the return links use 8PSK, QPSK and BPSK modulation schemes.

A.3 SPACE STATION TRANSMIT AND RECEIVE CAPABILITY

ViaSat has previously provided the Commission with the characteristics of the transmit and receive beams in terms of each beam's capabilities, their locations and gain contours[2] for the 28.1-28.6 GHz, 29.5-30 GHz, 18.3-18.8 GHz and 19.7-20.2 GHz bands. These characteristics apply equally to the 28.6-29.1GHz and 18.8-19.3 GHz bands, and thus, are not changed by this modification application. The proposed addition of the 28.6-29.1 GHz and 18.8-19.3 GHz frequency bands would add capacity to some (but not all beams), but does not affect the technical beam characteristics already approved by the Commission. The beams that would be able to utilize these additional bands are identified in the associated Schedule S.

A.4 FREQUENCY AND POLARIZATION PLAN

The VIASAT-77 satellite's frequency plan for normal operating mode is given in Table A.4-1, indicating channel center, polarization and bandwidth. Circular polarization is used on both the uplink and downlink with the downlink polarization being orthogonal to the uplink polarization.

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[2] *See* SAT-AMD-20081203-00220.

The satellite will employ a four-frequency re-use pattern such that any channel is re-used multiple times by a combination of polarization and spatial isolation. This satisfies the requirements of §25.210(d) of the Rules.

Table A.4-1. Frequency Plan (Normal Mode)

Uplink Center Frequency (MHz)	Polarization	Downlink Center Frequency (MHz)	Polarization	Bandwidth (MHz)
28600	RHCP, LHCP	18800	LHCP, RHCP	1000
29750	RHCP, LHCP	19950	LHCP, RHCP	500

As explained in section A.7, the 1000 MHz channel, which supports two 500 MHz carriers, will be reduced to a single 500 MHz channel (supporting one 500 MHz carrier) in the event that there is a need to cease operating in a portion of the assigned spectrum to protect an NGSO network. During the short period of time that the reduced bandwidth mode is in use, the frequency plan is represented by Table A.4-2.

Table A.4-2. Frequency Plan (Reduced Bandwidth Mode)

Uplink Center Frequency (MHz)	Polarization	Downlink Center Frequency (MHz)	Polarization	Bandwidth (MHz)
28350	RHCP, LHCP	18550	LHCP, RHCP	500
29750	RHCP, LHCP	19950	LHCP, RHCP	500

The transponder bandwidth configuration provided in the Schedule S form is for the normal mode configuration shown in Table A.4-1 above.

A.5 PREDICTED RECEIVER AND TRANSMITTER CHANNEL FILTER RESPONSE CHARACTERISTICS

The predicted receiver and transmitter frequency responses of each 500 MHz or 1000 MHz channel, as measured between the receive antenna input and transmit antenna, fall within the

limits shown in Table A.5-1 below. In addition, the frequency tolerances of §25.202(e) and the out-of-band emission limits of §25.202(f) (1), (2) and (3) will be met.

Table A.5-1: Predicted Channel Receiver and Transmitter Frequency Responses

Frequency Rx/Tx (MHz)	Receiver Frequency Response (dB) (without NGSO)	Receiver Frequency Response (dB) (with NGSO)	Transmit Frequency Response (dB) (without NGSO)	Transmit Frequency Response (dB) (with NGSO)
28000/18200	<-20.0	<-20.0	<-20.0	<-20.0
28100/18300	> -3.0	>-3.0	>-3.0	>-3.0
28200/18400	> -1.7	>-2.0	>-1.5	>-1.5
28300/18500	> -1.5	>-1.7	>-0.75	>-0.75
28400/18600	>-1.5	>-1.5	>-0.5	>-0.5
28500/18700	>-1.7	>-1.5	>-0.5	>-0.5
28600/18800	>-3.0	>-1.5	>-0.5	>-0.5
28700/18900	<-20.0	>-1.5	>-0.5	>-0.5
28800/19000	<-20.0	>-1.5	>-0.5	>-0.5
28900/19100	<-20.0	>-1.7	>-0.5	>-0.5
29000/19200	<-20.0	>-2.0	>-0.5	>-0.5
29100/19300	<-20.0	>-3.0	>-0.5	>-0.5
29200/19400	<-20.0	<-20.0	N/A	N/A
29300/19500	<-20.0	<-20.0	N/A	N/A
29400/19600	<-20.0	<-20.0	N/A	N/A
29500/19700	>-3.0	<-20.0	>-0.5	>-0.5
29600/19800	>-1.7	<-20.0	>-0.5	>-0.5
29700/19900	>-1.5	<-20.0	>-0.5	>-0.5
29800/20000	>-1.5	<-20.0	>-0.75	>-0.75
29900/20100	>-1.7	<-20.0	>-1.5	>-1.5
30000/20200	>-3.0	<-20.0	>-3.0	>-3.0
30100/20300	<-20.0	<-20.0	<-20.0	<-20.0

Note: "N/A" indicates that transmit frequency response is not applicable because signal is attenuated by the input frequency response.

A.6 POWER FLUX DENSITY AT THE EARTH'S SURFACE

§25.208(c) contains PFD limits that apply in the 18.3-18.8 GHz band. The PFD limits of §25.208(c) are as follows:

- -115 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;
- -115+(δ-5)/2 dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and
- -105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

In addition, §25.208(d) contains PFD limits that apply in the 18.6-18.8 GHz band produced by emissions from a space station under assumed free-space propagation conditions as follows:

- -95 dB(W/m^2) for all angles of arrival. This limit may be exceeded by up to 3 dB for no more than 5% of the time.

§25.208 does not contain any PFD limits that apply in the 18.8-19.3 GHz band for GSO satellite networks, however it is noted that Article 21 of the ITU Radio Regulations does include PFD limits applicable to GSO satellites using the 18.8-19.3 GHz band. The ITU limits are identical to those in §25.208(c).

Compliance with the applicable FCC and ITU PFD limits is demonstrated below using a simple worst-case methodology. The maximum downlink EIRP that the VIASAT-77 satellite can transmit is 67 dBW in 500 MHz. The shortest distance from the satellite to the Earth is 35,786 km, corresponding to a spreading loss of 162.06 dB. Therefore the maximum possible PFD at the Earth's surface could not exceed -95.1 dBW/m^2 in this 500 MHz (*i.e.*, 67 -162.06). When the system is operating in normal mode (*i.e.*, using a 1000 MHz channel in the 18.3-19.3 GHz and 28.1-29.1 GHz frequencies), the two 500 MHz carriers within the 1000 MHz channel will each meet the PFD performance described here. Allowing for the use of digital modulation with an almost flat spectrum, the corresponding maximum PFD at an elevation angle of 90° measured in a 1 MHz band would not exceed -122.1 dBW/m^2. The -122.1 dBW/m^2/MHz level is less than the -

115 dBW/m^2/MHz PFD limit value that applies at elevation angles of 5° and below. Therefore, compliance with the PFD limits is assured.

A.6.1 Frequency Bands Not Subject to §25.138

This section demonstrates that uplink transmissions in the 28.6-29.1 GHz bands and downlink transmissions in the 18.8-19.3 GHz band are two-degree compatible.

Currently there are no operational GSO Ka-band satellites that use the 28.6-29.1 GHz and 18.8-19.3 GHz bands within two degrees of the 77.3º W.L. location.[3] Therefore, in order to demonstrate two-degree compatibility, the transmission parameters of the VIASAT-77 satellite have been assumed as both the wanted and victim transmissions.

Table A.6-2 provides a summary of the uplink and downlink transmission parameters. These parameters were derived from the VIASAT-77 link budgets that are embedded in the Schedule S form included with this modification application and were used in the interference analysis. The interference calculations assumed a 1 dB advantage for topocentric-to-geocentric conversion, all wanted and interfering carriers are co-polarized and all earth station antennas conform to a sidelobe pattern of 29-25 log(θ). The C/I calculations were performed on a per Hz basis.

Table A.6-3 shows the results of the interference calculations in terms of the overall C/I margins. The table is provided in a format similar to that of the output of the Sharp Adjacent Satellite Interference Analysis program. It can be seen that the C/I margins are positive in all cases.

Table A.6-2. VIASAT-77 transmission parameters.

[3] The Commission's database includes a pending modification application by AtContact to move its authorization for a GSO satellite at the 34º E.L. location to the 77º W.L. location. However, AtContact has declared its intent to surrender its authorization at 34º E.L. Therefore, AtContact's pending modification for orbital reassignment to 77º W.L. is moot.

Carrier ID	Emission Designator	Bandwidth (MHz)	Tx E/S Gain (dBi)	Uplink EIRP (dBW)	Downlink EIRP (dBW)	Rx E/S Gain (dBi)	C/I Criterion (dB)
1	500MG7D	500	64.6	75.0	62.0	49.3	20.3
2	500MG7D	500	64.6	75.0	62.0	40.7	13.6
3	500MG7D	500	64.6	75.0	62.0	40.7	7.2
4	6M25G7D	6.25	44.1	48.6	39.2	61.1	16.2
5	3M13G7D	3.125	44.1	48.6	36.2	61.1	14.9
6	1M57G7D	1.563	44.1	48.6	33.1	61.1	9.9
7	782KG7D	0.7813	44.1	46.4	30.1	61.1	8.7
8	25M0G7D	25	64.6	67.3	45.2	61.1	20.8

Table A.6-3. Summary of the overall C/I margins (dB).

		Interfering Carriers							
	Carrier ID	1	2	3	4	5	6	7	8
Wanted Carriers	1	8.5	8.5	8.5	8.5	6.5	4.1	3.4	11.5
	2	6.7	6.7	6.7	9.7	9.0	7.9	7.6	10.4
	3	13.0	13.0	13.0	16.1	15.4	14.3	13.9	16.7
	4	17.6	17.6	17.6	7.4	4.4	1.4	0.6	14.8
	5	20.2	20.2	20.2	11.6	8.7	5.8	4.9	18.7
	6	26.0	26.0	26.0	19.5	16.6	13.7	12.9	25.9
	7	27.4	27.4	27.4	21.5	18.7	15.8	14.9	27.7
	8	15.9	15.9	15.9	14.2	11.9	9.2	8.4	18.3

A.7 SHARING WITH NGSO FSS IN THE 28.6-29.1 GHZ AND 18.8-19.3 GHZ BANDS

While the 28.6-29.1 GHz and 18.8-19.3 GHz bands are allocated internationally for GSO and NGSO use on a co-primary basis, these bands are allocated to NGSO FSS on a primary basis in the U.S. Table of Allocations. The U.S. Table allocates the 28.6-29.1 GHz band to GSO FSS on a secondary basis, while the 18.8-19.3 GHz band has no current GSO FSS allocation. ViaSat proposes to serve the United States using the 28.6-29.1 GHz band on a secondary, non-interference basis, and the 18.8-19.3 GHz band on a non-conforming, non-interference basis, and thus, requests a waiver of Section 2.106 of the FCC's rules to permit the use of the 18.8-19.3 GHz band on the VIASAT-77 satellite. The FCC granted such a waiver to AtContact and to Northrop Gumman Space & Mission Systems Corporation ("NGST") for the GSO spacecraft in their respective systems.[4] The non-interference analysis for that network of GSO satellites using the NGSO primary bands is equally applicable to ViaSat's single GSO satellite, as demonstrated below. This analysis demonstrates that the operations of VIASAT-77 will protect from harmful

[4] *See Northrop Grumman Space & Mission Systems Corporation*, Order and Authorization, DA 09-428, at ¶¶ 86, 88 (rel. Feb. 23, 2009); *contactMEO Communications, LLC*, Order and Authorization, DA 06-864, at ¶ 35 (2006).

interference the HEO satellite systems previously licensed to AtContact and NGST.[5] The VIASAT-77 spacecraft employs technology that will allow it to operate in a manner that will protect these and any other NGSO FSS systems from harmful interference in the 18.8-19.3 GHz and 28.6-29.1 GHz bands. ViaSat was able to negotiate a coordination agreement with AtContact after establishing to AtContact's satisfaction that this technology and VIASAT-77's novel satellite design would ensure that AtContact's system is protected from harmful interference.

The United States submitted to the ITU a study regarding frequency sharing among multiple NGSO FSS systems in the Ka band frequencies in which it determined that frequency sharing between two NGSO FSS systems is feasible if the minimum topocentric line-of-sight ("TLOS") angular separation between the satellites is 7º.[6] Subsequently, the FCC adopted a rule regarding default procedures for avoidance of in-line interference events for NGSO FSS satellites in the Ka band. The rule provides a 10º TLOS angular separation threshold for coordination requirements for NGSO satellites.[7]

Sharing with NGSO FSS in the 28.6-29.1 GHz and 18.8-19.3 GHz bands will be accomplished by ensuring that both ground earth stations and the VIASAT-77 spacecraft disable operations in the 28.6-29.1 GHz uplink band (and thus the corresponding 18.8-19.3 GHz downlink band) when conditions warrant. The specific characteristics of each proposed NGSO system must be evaluated prior to becoming operational in order to determine the minimum allowable TLOS angular separation between the VIASAT-77 satellite and the proposed NGSO system.

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5 Although NGST has surrendered its system license and AtContact has surrendered the NGSO portion (as well as certain GSO portions) of its license, ViaSat includes these systems in its analysis to demonstrate that systems like AtContact and NGST's previously licensed systems would be protected from harmful interference from ViaSat's system.

6 ITU-R Working Party 4A (Document 4A/287) (1999).

7 47 C.F.R. § 25.261(b).

Both of the two NGSO systems currently identified, AtContact and NGST, were authorized to use identical HEO constellations of three satellites with orbital characteristics as defined in Table A.7-1. The sharing analyses submitted by NGST and AtContact each state that the minimum operational altitude of the HEO spacecraft is 16,000 km. Additionally, the minimum operational elevation angle from the NGST or AtContact earth stations to the HEO satellites is given as 10°.

Parameters	ViaSat System	NGST / AtContact Systems
Orbital Parameters • # Satellites • # Planes • # Satellites / Plane • Inclination Angle • Apogee • Perigee • Period	 • 1 satellite at 77.3° W • N/A • N/A • N/A • N/A • N/A • N/A	 • 3 satellites • 3 planes • 1 • 63.4° • 39352 km • 1111 km • 43064 s
Minimum Operational Altitude	N/A	16000 km
Minimum Operational ES Elevation Angle	5°	10°
Frequency • Uplink • Downlink	 • 28.6 – 29.1 GHz • 18.8 – 19.3 GHz	 • 28.6 – 29.1 GHz • 18.8 – 19.3 GHz
Earth Terminal Antenna Size	0.67 m & 1.2 m	0.7 m & 1.2 m
Earth Station Tx EIRP Density	-12.5 dBW/Hz	-14.15 dBW/Hz
Satellite Rx Antenna Gain	53.2 dBi	46.5 dBi
Satellite Rx System Noise Temp	1230 K	504 K
Satellite Tx EIRP Density	-20.0 dBW/Hz	-18 dBW/Hz
Earth Station Rx System Noise Temperature	224 K	315 K

Table A.7-1

After examining the range of potential earth station locations in the service area for VIASAT-77, the minimum predicted TLOS angular separation between either (i) the VIASAT-77 and an earth station communicating with an NGSO space station, or (ii) an NGSO space station and an earth station communicating with VIASAT-77, given the system characteristics in Table A.7-1, has been determined to be 32.6°. However, to be conservative, the following interference calculation

shows the expected interference degradation to the NGST or the AtContact system due to operation of the ViaSat system at an angular separation of 30°.

Earth Station Location • Latitude • Longitude	 • 70° N • Any	
Parameters	**ViaSat System**	**NGST / AtContact Systems**
UpLink		
Frequency Band	28.85 GHz	28.85 GHz
Orbital Location	77.3° WL	HEO
E/S Uplink EIRP Density	-12.5 dBW/Hz	-14.15 dBW/Hz
E/S Antenna Gain	44.1 dBi	49.3 dBi
TLOS Angular Separation	30°	30°
Off-Axis EIRP density	-61.5 dBW/Hz	-68.4 dBW/Hz
Slant Range	40957.5 km	16000 km
Path and Atmospheric Losses	215.1 dB	206.9 dB
Satellite Receive Antenna Gain	53.2 dBi	46.5 dBi
System Noise Temperature	1230 K	504.0 K
Thermal Noise Density, N_o	-197.7 dBW/Hz	-201.6 dBW/Hz
Interference Noise Density, I_o	-230.3 dBW/Hz	-222.0 dBW/Hz
I_o/N_o	-32.9 dB	-20.4 dB
Uplink Degradation	0.0024 dB	0.0400 dB
$\Delta T/T$	0.0554 %	0.916 %
Downlink		
Frequency Band	19.05 GHz	19.05 GHz
Satellite EIRP Density	-20.0 dBW/Hz	-18.0 dBW/Hz
Path and Atmospheric Losses	211.29 dB	203.12 dB
Off-axis Antenna Gain	-4.93 dBi	-4.93 dBi
E/S System Noise Temperature	224 K	315 K
Thermal Noise Density	-205.1 dBW/Hz	203.6 dBW/Hz
Interference Noise Density	-234.2 dBW/Hz	-228.1 dBW/Hz
I_o/N_o	-29.12 dB	-24.43 dB
Downlink Degradation	0.0053 dB	0.0157 dB
$\Delta T/T$	0.123 %	0.360 %

Table A.7-2

The results show that both the AtContact and NGST systems are adequately protected. The calculated interference-to-noise ratio based on worst case scenarios is -20.4 dB, which

corresponds to a ΔT/T of 0.92%. This value is well below the 6% ΔT/T threshold that triggers coordination between satellite systems under the ITU Radio Regulations.

Consistent with the default rule for NGSO/NGSO in-line events in § 25.261(b), the VIASAT-77 satellite and ground segment have been designed to be capable of protecting future NGSO systems whose orbital characteristics may result in TLOS angular separations of 10° or less. Thus, even if an NGSO system is brought into operation with an architecture that results in a separation angle of 10º or less, ViaSat's system will still successfully protect such an NGSO system from harmful interference. ViaSat will coordinate with future NGSO operators to determine the minimum required TLOS angular separation necessary to protect each system.

The VIASAT-77 spacecraft has been designed with the capability to disable operation in the 18.8-19.3 GHz and 28.6-29.1 GHz bands upon receipt of appropriate ground command signals – a capability that provides a technical basis for the coordination agreement between ViaSat and AtContact. Each spot beam is individually controllable. When operations cease in these bands in an affected spot beam, the 1000 MHz channel is reduced to a 500 MHz channel in the 18.3-18.8 GHz and 28.1-28.6 GHz frequencies, with services in the affected spot beam continuing in this single 500 MHz carrier. During these events, the power and power density levels in the 18.3-18.8 GHz and 28.1-28.6 GHz bands comply with the applicable limits, as discussed above in this Technical Annex.

A processor at the central control site for the satellite will determine the predicted orbits of the victim NGSO satellites through the use of well understood algorithms and regularly updated 2-line element set data obtained from reliable on-line sources and directly from the NGSO operator itself. The processor will then calculate the current TLOS angular separation for earth stations in each of the spot beams.

When the angular separation is predicted to be equal to, or below the desired value, the earth stations in the affected spot beam will be commanded to stop transmitting in the 28.6-29.1 GHz band and, similarly, the VIASAT-77 satellite will be commanded to switch off operations in the

18.8-19.3 GHz and 28.6-29.1 GHz bands for the spot beam in question. When the angular separation increases to a value above the cut-off threshold, normal operation is restored to the earth stations and satellite.

Note that the normal or fail-safe condition on the VIASAT-77 spacecraft is to disable operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands to protect NGSO networks.

A.8 WAIVER REQUEST

A.8.1 Section 25.210(i)

With respect to the 18.8-19.3 GHz and 28.6-29.1 GHz frequencies that are the subject of this application, ViaSat requests a waiver of the requirement in Section 25.210(i) of the Commission's rules, which requires that space station antennas in the FSS be designed to meet a cross-polarization isolation of 30 dB within the primary coverage area of the antenna. The VIASAT-77 satellite's uplink spot beam receive antennas (for all spot beams) provide a minimum cross-polarization of 26 dB. In support of its requested waiver, ViaSat notes that the small cross-polarization shortfall is in the uplink direction only and therefore will have no adverse affect on other satellite networks.[8] Further, the satellite's cross-polarization isolation performance has been fully taken into account in the design of the link budgets for the services that the satellite will provide. The link budgets are sufficiently robust to compensate for the negligible effect of the slightly reduced cross-polarization isolation performance. Grant of the requested waiver is also consistent with prior Commission decisions granting similar waivers of

[8] Receive cross-polarization interference is an intra-system design issue, and does not affect other satellite networks.

Section 25.210(i), including the Commission's grant of this same waiver request for the VIASAT-77 satellite.[9] This aspect of satellite will not be changed by the license modification requested in this application to merely operate in additional frequencies.

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[9] *See* IBFS File No. SAT-MOD-20080718-00144, Conditions of Authorization ¶ 2 (granted Mar. 25, 2009); *see also*, *EchoStar Satellite Operating Corporation, Application for Authority to Operate the EchoStar 9 Satellite in the Lower 500 MHz Portion of the Ka-band Frequencies at the 121º W.L. Orbital Location*, File Nos. SAT-MOD-20060830-00092, SAT-STA-20050608-00116, Order and Authorization, DA 06-2590 ¶¶ 7-8 (rel. Dec. 22, 2006).

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this pleading, that I am familiar with Part 25 of the Commission's rules that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is complete and accurate to the best of my knowledge and belief.

/s/

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