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

In the Matter of	)	
	)	
Viasat, Inc.	)	Callsign S2985
	)	File No. SAT−MPL−20200526−00056
Application to Modify	)	
NGSO System Authorization	)	
	)	

PETITION TO DENY OR DEFER CONSIDERATION

Telesat Canada ("Telesat")[1] hereby submits this Petition to Deny or Defer Consideration (the "Petition") of the above-captioned application (the "Application") filed by Viasat, Inc. ("Viasat") seeking modification of the authorization for its NGSO FSS system. Viasat's original application was granted as part of the first Ku/Ka-band processing round; Viasat has requested that its modification Application also be considered part of the first processing round.[2] For the reasons stated herein, Viasat's Application as filed cannot be granted, and consideration of the Application should be deferred while Viasat is given an opportunity to provide additional information.

[1] A Declaratory Ruling in the initial processing round for NGSO FSS Ku-band and Ka-band constellations granted Telesat access to the U.S. market. Telesat Canada, Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation, Call Sign S2976, IBFS File No. SAT-PDR-20161115-00108, Order and Declaratory Ruling, FCC 17-147, 32 FCC Rcd 9663 (2017). Telesat has pending an application to modify its market access grant. *Telesat Canada, Application to Modify Authorization to Access US Market for Telesat's NGSO Constellation, Call Sign S2976*, IBFS File No. SAT-MPL-20200526-00053 (filed May 26, 2020). Accordingly, Telesat is an interested party in this proceeding.

[2] See Viasat Application, Exhibit A, at 2.

Section 25.117 of the rules[3] governs applications to modify NGSO FSS space station authorizations granted in a processing round.[4] Pursuant to Section 25.117, such modification applications should be granted, subject to certain exceptions that are inapplicable here, if the applicant demonstrates that its modification would "serve the public interest, convenience and necessity."[5] Satisfying this standard requires a demonstration that the proposed modification would not present significant interference issues.[6] "If a modification would worsen the interference environment, that would be a strong indication that grant of the modification would not be in the public interest."[7]

As shown in this Petition and in the attached Technical Appendix, Viasat's Application as filed does not satisfy Section 25.117 requirements. Consideration of Viasat's Application should be deferred until the following issues, which are addressed in the Technical Appendix, have been resolved:

1. Viasat's analysis is only a partial analysis; it addresses only two of the four interference scenarios the Commission has found need to be taken into account.[8] Although Viasat measures whether its system as

[3] 47 C.F.R. § 25.117.
[4] *See Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorizations, 34 FCC Rcd 2526 (IB 2019), ¶¶ 6-7.
[5] 47 C.F.R. § 25.117.
[6] *Teledesic LLC*, 14 FCC Rcd 2261, 2264 (IB 1999). Viasat quotes a different passage of the same decision that reflects the same overall standard: "the Commission considers whether a modification would' create any significant interference problems to other systems or make sharing [with] other NGSO FSS systems significantly more difficult.'" *See* Application, Exhibit A, at 3.
[7] *Space Exploration Holdings LLC*, 34 FCC Rcd 2526, 2529 (IB 2019).
[8] See Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System, Order and Authorization, 34 FCC Rcd 2526 (IB 2019) at ¶¶14-17.

modified would cause more interference to other systems on the uplink or the downlink, it never determines whether its modified system would become more susceptible to interference on the uplink or the downlink. Such susceptibility would constrain the operation of other systems by increasing the number of in-line interference events during which the other systems would have to divide their band with Viasat.[9]

2. Telesat's analysis demonstrates Viasat's modification would, in fact, make its system more susceptible to interference from Telesat's uplinks, thereby constraining Telesat's operations.

3. Viasat's examination of the two scenarios in which its modified system might cause additional interference on the uplink or the downlink cannot be analyzed because Viasat provides insufficient details concerning critical information that other parties and the Commission would need to replicate Viasat's conclusions.

4. An assessment of the interference environment in these two scenarios that takes into account available data and makes reasonable assumptions about Viasat's system where such data is not available suggests

[9] *See* 47 C.F.R. § 25.261(c) ("Absent coordination between two or more satellite systems, whenever the increase in system noise temperature of an earth station receiver, or a space station receiver for a satellite with on-board processing, of either system, $\Delta T/T$, exceeds 6 percent due to interference from emissions originating in the other system in a commonly authorized frequency band, such frequency band will be divided among the affected satellite networks.").

that Viasat's proposed modification would increase interference to Telesat's system.

Conclusion

Telesat understands the importance and value of giving NGSO FSS operators the flexibility to update their technical designs. The Commission's rules and precedents strike a balance between this need for flexibility and, given how critical the interference environment is to the operation of NGSO systems, the need for authorized systems to be developed in reliance on an interference environment that cannot subsequently be worsened by other licensees.

In this case, however, Viasat's analysis is incomplete, in one of the scenarios that Viasat did not analyze they in fact worsen the interference environment for Telesat, and the analysis Telesat was able to perform based on information Viasat did provide, other available data, and reasonable assumptions suggests that Viasat's proposed modification would , in fact, create more interference for Telesat.

In light of these issues, Viasat's Application as filed cannot be granted. The Commission should defer consideration of the Application; give Viasat an opportunity

to provide additional information that would permit a properly informed judgment; and permit Viasat to address Telesat's demonstration that the proposed modification would make Viasat's system more susceptible to interference from Telesat's uplinks.

Respectfully submitted,

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TECHNICAL APPENDIX

1. INTRODUCTION AND SUMMARY

On May 26, 2020, Viasat, Inc. ("Viasat") requested authority to modify the authorization for its VIASAT-NGSO satellite system (the "Viasat system") that was granted as part of processing rounds for Ku/Ka-band and V-band systems commenced, respectively, in 2016 and 2017. Its request is accompanied by a "Technical Annex[1]" that purports to assess how its modification would affect the interference environment *vis-à-vis* four NGSO systems authorized in the Commission's initial Ka-band processing round – SpaceX, OneWeb, Telesat, and O3b[2]. Viasat claims this technical study shows its modification would not adversely affect the interference environment with respect to other FCC-authorized NGSO systems.

Although Telesat agrees with some elements of Viasat's analysis, there are four crucial flaws in that analysis:

1. Viasat's analysis is only a partial analysis; it addresses only two of four interference scenarios. Although Viasat measures whether its system as modified would cause more interference to other systems on the uplink or the downlink, it never determines whether its modified system

[1] See Viasat Application, Exhibit B.

[2] Viasat also included an analysis for one system (SpaceX) authorized through the Commission's initial V-band processing round which is not discussed in this document.

would become more susceptible to interference on the uplink or the downlink. Such susceptibility would constrain the operation of other systems by increasing the number of in-line interference events during which the other systems would have to divide their band with Viasat.[3]

2. Telesat's analysis demonstrates Viasat's modification would, in fact, make its system more susceptible to interference from Telesat's uplinks, thereby constraining Telesat's operations.

3. Viasat's examination of the two scenarios in which its modified system might cause additional interference on the uplink or the downlink cannot be analyzed because Viasat provides insufficient details concerning critical information that other parties and the Commission would need to replicate Viasat's conclusions; and

4. An assessment of the interference environment in these two scenarios that takes into account available data and makes reasonable assumptions about the Viasat system where such data is not available, suggests that Viasat's proposed modification would create more interference for Telesat's system.

[3] *See* 47 C.F.R. § 25.261(c) ("Absent coordination between two or more satellite systems, whenever the increase in system noise temperature of an earth station receiver, or a space station receiver for a satellite with on-board processing, of either system, $\Delta T/T$, exceeds 6 percent due to interference from emissions originating in the other system in a commonly authorized frequency band, such frequency band will be divided among the affected satellite networks.").

II. VIASAT'S ANALYSIS RAISES METHODOLGICAL ISSUES AND IS INCOMPLETE

Telesat agrees with some, but not all, of Viasat's interference assessment. Most importantly, Viasat has overlooked essential elements of the interference environment.

A. Areas of Agreement and Disagreement with Viasat's Methodology

In its application, Viasat provided "I/N cumulative distribution functions ("CDFs") [showing] the fraction of time the I/N value is exceeded versus the I/N value for the presently authorized system (pre-modification curve) and the modified system (post-modification curve)[4]." Telesat agrees that any impact on the interference environment of another first-round NGSO system should be evaluated based on an analysis of I/N CDF curves. However, as discussed in Section V, Telesat disagrees with Viasat's approach[5] to assess the I/N CDF curves only at I/N = -12.2 dB.

In fact, the interference environment between two NGSO systems is probabilistic and time varying, because the occurrence and magnitude of potential interference events are not constant but change as the satellites in the two NGSO systems move relative to each other. Therefore, to determine whether a proposed amendment to an NGSO system would degrade the interference environment of another system, a computer-based simulation of the two systems operating in relation to each other should be carried out over a long enough time to produce meaningful results. The data

[4] See Viasat Application, Exhibit B, Figures E1-1 through 10.

[5] *Id*. at 13

so obtained can then be used to generate the I/N CDF curves that, in turn, can be analyzed to determine whether the interference environment of another system is affected in the interference scenario studied.

Viasat also stated that, when considering "the dynamic, time-varying interference calculated from a time-domain simulation of the two NGSO systems over sufficient time to produce meaningful statistics[6]", it had assumed[7] that the Viasat system earth station and the earth station of the other NGSO victim system analyzed (i) were collocated and that (ii) each of them could communicate with any satellite in its respective system following the rules applicable for that system (*e.g.* GSO avoidance angle and minimum elevation angle). Telesat agrees that assumptions (i) and (ii) are appropriate.

Viasat claimed it had assumed in its simulations that (iii) "the satellites [were] chosen randomly", and (iv) it used "operational EPFD spectral densities" to model the transmitters of the Viasat system. A discussion about these last two assumptions and an explanation of why they are unclear can be found in Section IV.

[6] *Id.* at 12

[7] *Id.* at 13

B. Viasat's Analysis is Incomplete

In order to assess whether the proposed modification of the Viasat system would lead to a change of the interference environment of another NGSO system, all of the following four scenarios must be analyzed:[8]

➢ **Scenario 1, Uplink, Viasat as Victim:** another NGSO system's earth station potentially interfering with a Viasat satellite receiver in the Earth-to-space direction;

➢ **Scenario 2, Uplink, Viasat as Interferer:** a Viasat earth station potentially interfering with another NGSO system's satellite receiver in the Earth-to-space direction;

➢ **Scenario 3, Downlink, Viasat as Victim:** another NGSO system's satellite transmitter potentially interfering with a Viasat earth station receiver in the space-to-Earth direction; and

[8] *See Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC Rcd 2526 (IB 2019) at ¶¶14-17; Telesat Canada, Application to Modify Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation, FCC File No. SAT-MPL-20200526-00053, Exhibit 4 at 12-14, Exhibit 5 Technical Information Supplement to Schedule 2 at Annex 3; Reply of Kuiper Systems LLC, File No. SAT-MOD-20200417-00037 (Aug. 7, 2020) at 23.

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➢ **Scenario 4, Downlink, Viasat as Interferer:** a Viasat satellite transmitter potentially interfering with another NGSO system's earth station receiver in the space-to-Earth direction

Viasat's interference analysis is only a partial analysis, since it studied only Scenarios 2 and 4. Viasat never addressed the circumstances in which Viasat could be the victim of interference in the downlink and uplink directions (*i.e.*, Scenarios 1 and 3).

In fact, absent coordination, if the proposed modification makes Viasat's system more susceptible to interference from other first-round NGSO systems in Scenario 1 or Scenario 3, it will be necessary to invoke band segmentation more frequently, thereby constraining the operation of the other systems. Hence, at a minimum, the Commission should require Viasat to provide its analysis of the missing scenarios, so that a full assessment of the impact of the modified Viasat system can be carried out. In fact, as discussed in the next section, Telesat's analysis suggests Viasat's proposed modification would have an adverse impact on the interference environment with respect to Telesat in Scenario 1.

III. VIASAT'S PROPOSED MODIFICATION WOULD MAKE ITS SYSTEM MORE SUSCEPTIBLE TO INTERFERENCE FROM TELESAT'S UPLINKS

Telesat analyzed the missing Scenarios 1 and 3 with respect to its own system and found that, in Scenario 1 (*i.e.*, when Viasat is the victim of the interference caused by Telesat in the uplink), the modified Viasat system is more susceptible to interference, thereby increasing the operating constraints on Telesat to protect Viasat.

As discussed in the preceding Section, the interference environment of the Telesat system with respect to the Viasat system is probabilistic and time varying, because the occurrence and magnitude of potential interference events are not constant but change as satellites in the two systems move relative to each other. Accordingly, to determine whether the proposed amendment of the Viasat system would degrade the interference environment of the Telesat system, Telesat performed an analysis that simulates that the two systems operate together, over a long enough time to produce meaningful results.

In particular, the analysis in Scenario 1 is based on the CDF of the I/N ratio measured at the input of the satellite receiver of the Viasat system. Telesat computed the CDF curves for the Viasat original system, as amended[9], and for the Viasat system modified as proposed,[10] and compared them to determine whether the modification would worsen the interference environment with respect to the Telesat system.

To carry out the analysis, Telesat used the following reasonable assumptions:

1. The Telesat earth station is collocated with the earth station of the Viasat system;

2. Each earth station can communicate with any satellite in its own system following the rules applicable for that system (e.g. the GSO avoidance angle and/or minimum elevation angle);

[9] ViaSat, Inc., Petition for a Declaratory Ruling Granting Access to the U.S. Market for a Non-U.S. Licensed Non-geostationary Orbit Satellite Network, IBFS File No. SAT-PDR-20161115-00120 (filed Nov. 15, 2016) ("ViaSat Petition") and SAT-APL-20180927-00076 (filed Sept. 27, 2018) ("ViaSat Amendment").

[10] Viasat Application.

3. For the Telesat system, at every time-step, two satellites receive simultaneously from the earth station and the receiving satellites of the Telesat system are randomly chosen;

4. All possible valid cases are considered in evaluating the CDF of the I/N ratio at the input of the victim satellite receiver of the Viasat system.

The results for the same location near the center of the CONUS that Viasat chose for its analysis[11] show a severe degradation of the interference environment for the Telesat system (see figures A1-1 and A1-2 of Annex 1 hereto). In fact, the CDF plots show that the probability that any I/N value is exceeded is greater *after* the proposed modification of the Viasat system than the corresponding probability for the Viasat system as currently granted; this conclusion is valid also for I/N = -12.2 dB, which corresponds to the criterion with which NGSO systems must segment their spectrum resources, absent coordination.

This means that absent coordination Telesat would bear a bigger burden to protect the Viasat system, including being required to segment its usable spectrum more often.

[11] Corresponding to 39°50′ North and 98°35′ West. *See* Viasat Application, Exhibit B at 13. Similar results can be obtained at other locations.

IV. TWO OF VIASAT'S KEY ASSUMPTIONS ARE UNCLEAR, MAKING IT IMPOSSIBLE TO REPLICATE VIASAT'S INTERFERENCE ANALYSIS

The Viasat analysis cannot be replicated because key assumptions for the methodology it used to generate the data underlying the I/N CDF plots are unclear and open to varying interpretations.

First, with respect to assumption 3 of the methodology Viasat followed to compute "the dynamic, time-varying interference" between its NGSO system and those of certain other first-round applicants, including Telesat's, it cannot be determined from Viasat's explanation which satellites are "chosen randomly."[12] It should be noted that, in line with the methodology used by another applicant[13], with which Telesat agrees, only the "Nco" receiving or the "Nco" transmitting satellites of the interfering system, depending on the scenario analyzed, should be randomly chosen in evaluating the I/N CDF, but *not* the satellites of the victim system. Rather, with respect to the victim system, all possible valid cases should be considered in evaluating the I/N CDF, so that a full assessment can be carried out on the impact of the interference on all possible links of the victim system at any time-step.

Second, the meaning of Viasat's assumption 4 of its methodology (*i.e.*, that "Operational [Equivalent Power Flux Density] (EPFD) spectral densities" were used to

[12] *Id*.

[13] See Space Exploration Holdings, LLC, Application for Modification of Authorization for the SpaceX NGSO Satellite System, FCC File No. SAT-MOD-20200417-00037, Attachment A: Technical Information to Supplement Schedule S, Annex 1: Potential Interference With Respect To Other NGSO Satellite Systems at A1-2 and A1-3.

model the transmitters of the Viasat system) is unclear. In fact, there is no such thing as "Operational EPFD spectral densities" that can be used to determine with certainty which power levels a NGSO system operates, and, consequently, what is the interference that it would cause to other NGSO systems. The levels of EPFD, which relates to the sum of the power flux-densities produced at a geostationary-satellite orbit (GSO) satellite or at an earth station communicating with a GSO satellite, is relevant only when assessing the impact of a NGSO system on a GSO network. Since Viasat has made this assumption in the context of assessing the interference *between two NGSO systems*, it is not clear how to model the transmitters of the Viasat system based on "Operational EPFD spectral densities".

Perhaps, by using such wording for assumption 4, Viasat actually meant that it used the same Power-Flux Density (PFD) and Effective Isotropic Radiated Power (EIRP) masks that are necessary to show compliance with the EPFD limits following the methodology of Recommendation ITU-R S.1503-2. Telesat notes that Viasat provided such masks to a previously-filed amendment of its original application, *i.e.* an amendment to the Viasat MEO application that already has been granted. Assuming this is a correct understanding of the meaning of assumption 4 as worded, Telesat assessed whether the PFD and EIRP masks data are compatible with the I/N CDF plots Viasat included for Scenarios 2 and 4 with respect to the Telesat system[14], but it found important discrepancies, as the analysis in Annex 2 shows.

[14] See Viasat Application, Exhibit B, Figures E1-7 and E1-8

Accordingly, it is impossible to replicate Viasat's analysis for Scenarios 2 and 4 and to verify the results. At a minimum, the Commission should require Viasat to clarify the meaning of assumptions 3 and 4 of the methodology it followed to generate the data underlying the I/N CDF plots it included in its application.

V. AN ANALYSIS BASED ON REASONABLE ASSUMPTIONS SHOWS THAT VIASAT'S SYSTEM AS MODIFIED WOULD CAUSE MORE INTERFERENCE IN BOTH SCENARIOS 2 AND 4

Notwithstanding Viasat's lack of clarity, one can assess the impact of Viasat's proposed modification on the interference environment by making a few reasonable assumptions. This additional study suggests that Viasat's conclusions are incorrect and that in fact Viasat's modification would increase interference to Telesat.

First, Viasat based its analysis on the wrong interference threshold. Viasat compared the pre-mod and post-mod probability of exceeding the 6% $\Delta T/T$ threshold (above which the operators of NGSO systems are required to segment their spectrum absent coordination) before and after the proposed modification, or, equivalently, by checking whether "the postmodification [CDF] curve is below the pre-modification [CDF] curve on the I/N = -12 dB line.[15]" That is the wrong approach because it does not take into account the full impact that Viasat's system has on other NGSO systems.

In order to determine whether the interference environment would worsen following the proposed modification of a system it is necessary to determine whether the entire noise-dominated environment of a victim link (*e.g.*, for $I/N \leq 0$ dB) would

[15] *Id*. at 13

worsen *after* the proposed modification, not just the environment "at the I/N = -12 dB line." Viasat itself has acknowledged elsewhere the necessity of taking into account the full noise-dominated environment. In its Petition to Deny SpaceX's third modification application, Viasat stated it "agrees that, in this case, the noise-dominated environment ([*e.g.*, for] I/N ≤ 0 dB) is the critical area for assessing harmful interference."[16]

In other words, the CDF curve of the I/N ratio computed for the system *after* modification at the victim earth station or satellite receiver, depending on the scenario analyzed, must "lie below" the CDF curve of the I/N ratio computed for the system *before* modification in the entire noise-dominated environment (*e.g.*, for I/N ≤ 0 dB) of the link analyzed[17]. Carrying out just a "spot-check" on the CDF curves at the I/N value of -12.2 dB is insufficient to determine whether the interference environment is affected.

Second, once the data included in the relevant Schedule S is taken into account, it can be shown based on an I/N analysis that Viasat's modified system would cause significant additional interference to Telesat's system in the two scenarios, Scenarios 2

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[16] *See* Petition to Deny or Defer of Viasat, Inc., Space Exploration Holdings, LLC, Modification of Authorization for the SpaceX NGSO Satellite System, FCC File No. SAT-MOD-20200417-00037, at 44 (filed Jul 13, 2020).

[17] In fact, in line with the methodology and criteria that SpaceX used to support the application for its third modification (*see* Space Exploration Holdings, LLC, Modification of Authorization for the SpaceX NGSO Satellite System, FCC File No. SAT-MOD-20200417-00037, Attachment A: Technical Information to Supplement Schedule S, Annex 1: Potential Interference with Respect to Other NGSO Satellite Systems.), focusing on the effects of the interference in the noise-dominated environment (i.e., I/N ≤ 0 dB) of a victim link ensures that all scenarios in which the link can be exploited are assessed to determine the change in interference environment. In the interference-dominated environment (i.e., I/N > 0 dB), typically, the victim system already experiences a receiver de-sensitivity significant enough that the contribution of any additional interference is not relevant.

and 4, that Viasat analyzed. Accordingly, Viasat's analysis of these scenarios—which purports to show that its modification would not worsen the interference environment—appears incorrect.

To illustrate the above, Telesat performed an interference analysis similar to the one it carried out with respect to Scenario 1 (discussed in Section III above). This analysis consisted of computing the CDF of the I/N ratio measured at the input of the satellite or earth station receiver of the Telesat system, depending on the Scenario analyzed. For each of the considered cases, Telesat has computed the CDF curves for the Viasat original system, as amended[18], and for the Viasat system modified as proposed[19] and compared them to determine whether the modification would worsen the interference environment with respect to the Telesat system. Below, Telesat addresses its analysis of these two scenarios in more detail.

➢ **Scenario 2, Uplink, Viasat as Interferer**

To carry out the analysis in this Scenario, Telesat used the following assumptions:

1. The Telesat earth station is collocated with the earth station of the Viasat system;

[18] *ViaSat, Inc., Petition for a Declaratory Ruling Granting Access to the U.S. Market for a Non-U.S. Licensed Non-geostationary Orbit Satellite Network*, IBFS File No. SAT-PDR-20161115-00120 (filed Nov. 15, 2016) (ViaSat Petition) and SAT-APL-20180927-00076 (filed Sept. 27, 2018) (ViaSat Amendment)

[19] Viasat Application.

2. Each earth station can communicate with any satellite in its own system following the rules applicable for that system (e.g. the GSO avoidance angle and/or minimum elevation angle);

3. For the Viasat system, at every time-step, two[20] satellites receive simultaneously from the location of the Telesat and the Viasat earth stations, and the receiving satellites of the Viasat system are randomly chosen in evaluating the I/N CDF;

4. All possible valid cases are considered in evaluating the CDF of the I/N ratio at the input of the victim satellite receiver of the Telesat system;

5. As Viasat did not provide any information on the power at which the earth stations of its system would operate after the proposed modification, Telesat assumed they would operate at the levels indicated in the EIRP spectral density masks attached to the application of the Viasat granted system, as amended[21].

Results are represented in figures A1-3 and A1-4 of Annex 1, for a location at 18 deg N latitude, as an example, and show a degradation of the interference environment for the Telesat system. The CDF plots show that the probability that any I/N value in the interference-dominated environment of the victim link (*e.g.*, for I/N ≤ 0 dB),

[20] Viasat, Inc., Petition for Declaratory Ruling Granting Access to the U.S. for a Non-U.S.-Licensed Non-geostationary Orbit Satellite Network, FCC File No. SAT-PDR-20161115-00120, Attachment A: Technical Annex, Exhibit 1 at 2 and parameter "nbr_op_sat" in table "sat_oper" in the "SRS database" provided with the downlink PFD data for the Viasat system, as amended Telesat has assumed that Nco=2 also for the Viasat system *after* modification. This assumption is consistent with 47 C.F.R. § 25.117(d)(1), and with Viasat's statement that "except as addressed in [its] modification application, the information required under Section 25.114 and previously provided remains unchanged."

[21] This assumption is consistent with 47 C.F.R. § 25.117(d)(1), and with Viasat's statement that "except as addressed in [its] modification application, the information required under Section 25.114 and previously provided remains unchanged" (see Viasat Application, Exhibit A at 2).

including I/N= -12.2 dB, is exceeded is greater *after* the proposed modification of the Viasat system than the corresponding probability for the Viasat system currently granted. Therefore, it can be concluded that the interference environment for the Telesat system would be degraded should the Commission grant Viasat request of amending its NGSO system.

- **Scenario 4, Downlink, Viasat as Interferer**

To carry out the analysis in this Scenario, Telesat used the following assumptions:

1. The Telesat earth station is collocated with the earth station of the Viasat system;

2. Each earth station can communicate with any satellite in its own system following the rules applicable for that system (e.g. the GSO avoidance angle and/or minimum elevation angle);

3. For the Viasat system, at every time-step, two[22] satellites transmit simultaneously toward the location of the Telesat and the Viasat earth stations, and the transmitting satellites of the Viasat system are randomly chosen in evaluating the I/N CDF;

4. All possible valid cases are considered in evaluating the CDF of the I/N ratio at the input of the victim earth station receiver of the Telesat system;

[22] Viasat, Inc., Petition for Declaratory Ruling Granting Access to the U.S. for a Non-U.S.-Licensed Non-geostationary Orbit Satellite Network, FCC File No. SAT-PDR-20161115-00120, Attachment A: Technical Annex, Exhibit 1 at 2 and parameter "nbr_op_sat" in table "sat_oper" in the "SRS database" provided with the downlink PFD data for the Viasat system, as amended. As Viasat has certified, in accordance with 47 C.F.R. § 25.117(d)(1), that "except as addressed in [its] modification application, the information required under Section 25.114 and previously provided remains unchanged" (*see* Viasat Application, Exhibit A at 2), Telesat has assumed that Nco=2 for the Viasat system *after* modification, too.

5. Using the data contained in the Schedules S for the Viasat system *before* and *after* the proposed modification, the power levels in Table 1 below were used for the interfering satellites of the Viasat system.

Table 1 – EIRP spectral density for the Viasat system indicated in Schedule S

Parameter	**Value before MOD**		**Value after MOD**		**Variation**	
Maximum EIRP spectral density (17800-18600 MHz band)	-24.0	dB(W/Hz)	-31.7	dB(W/Hz)	-7.7	dB
Maximum EIRP spectral density (18800-19300 MHz band)	-15.7	dB(W/Hz)	-31.7	dB(W/Hz)	-16.0	dB
Maximum EIRP spectral density (19700-20200 MHz band)	-39.0	dB(W/Hz)	-31.7	dB(W/Hz)	+7.3	dB

Even before carrying out a dynamic assessment, a static analysis considering the values in the table above suggest that the Viasat system would be likely to cause more interference should the Commission grant the proposed amendment. In its modification application, Viasat proposes to lower the altitude of its satellites from 8200 km to 1300 km, which corresponds to a decrease in "spreading loss" of 16 dB. Therefore, any decrease in the satellite EIRP spectral density smaller than this value would increase the power-flux density on the ground and, consequently, the potential to cause more interference into the earth stations of other NGSO systems. A comparison of the satellite EIRP spectral densities indicated in the Schedule S forms suggests that Viasat proposes to decrease the satellite EIRP spectral density just by the

amount needed to compensate for the decrease in spreading loss only in the 18800-19300 MHz band. In the 19700-20200 MHz band, Viasat proposes to increase the satellite EIRP spectral densities by a considerable amount while, in the 17800-18600 MHz band, it falls short of the 16 dB of attenuation needed to keep the Power-Flux Density on the ground the same. Results are represented in figures A1-5 to A1-8 of Annex 1, for the same location near the center of the CONUS that Viasat chose for its analysis[23] and, once again, show a severe degradation of the interference environment for the Telesat system. In fact, the CDF plots show that the probability that any I/N value, including I/N= -12.2 dB, is exceeded is greater *after* the proposed modification of the Viasat system than the corresponding probability for the Viasat system currently granted. Therefore, it can be concluded that the interference environment for the Telesat system would be severely degraded should the Commission grant Viasat request of amending its NGSO system.

[23] Corresponding to 39°50′ North and 98°35′ West. *See* Viasat Application, Exhibit B at 13. Similar results can be obtained at other locations

ANNEX 1

Analysis of the impact of the proposed modification to the Viasat system with respect to the interference environment of the Telesat system for Scenario 1 (Uplink, Viasat as Victim), Scenario 2 (Uplink, Viasat as Interferer) and Scenario 4 (Downlink, Viasat as Interferer)

Figure A1-1

Scenario 1 (Uplink), Interferer: Telesat (1m terminal), Victim: Viasat (Beam before MOD: RK2L, beam after MOD: R1HL), Latitude: 39°50′ N

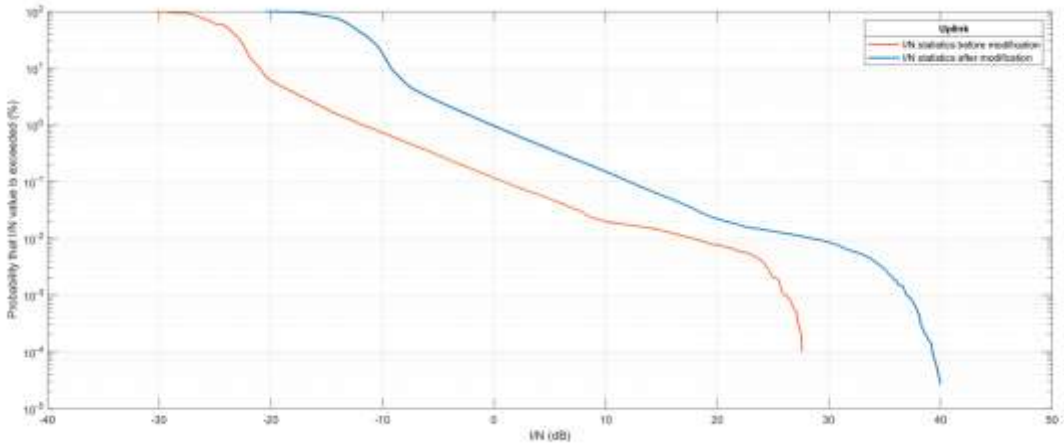


Figure A1-2

Scenario 1 (Uplink), Interferer: Telesat (3.5m terminal), Victim: Viasat (Beam before MOD: RK2L, beam after MOD: R1HL), Latitude: 39°50′ N

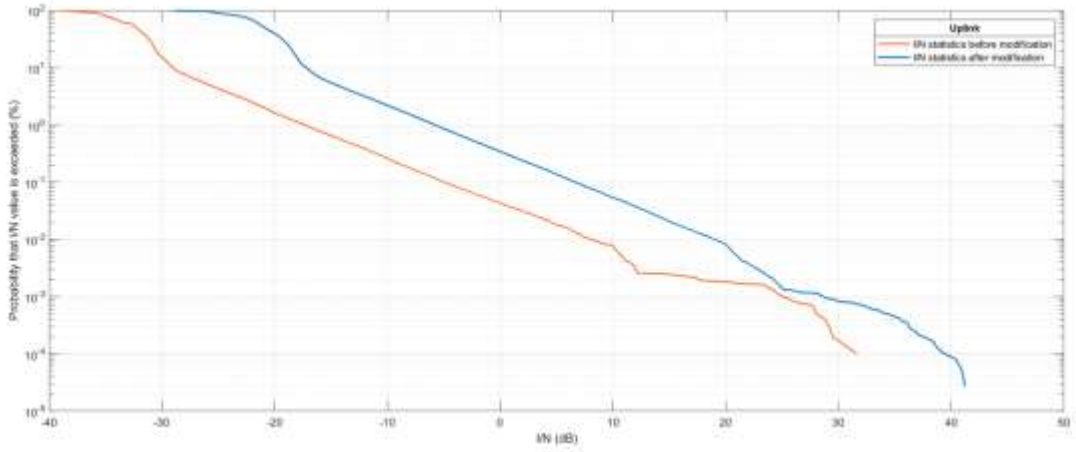


Figure A1-3

Scenario 2 (Uplink), Interferer: Viasat (0.3m terminal), Victim: Telesat, Latitude: 18° N

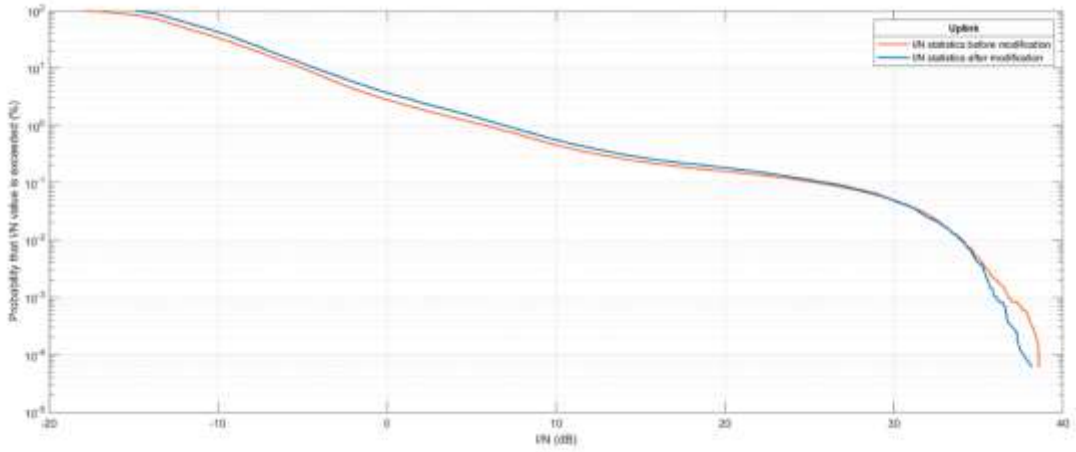


Figure A1-4

Scenario 2 (Uplink), Interferer: Viasat (7.0m terminal), Victim: Telesat,

Latitude: 18° N

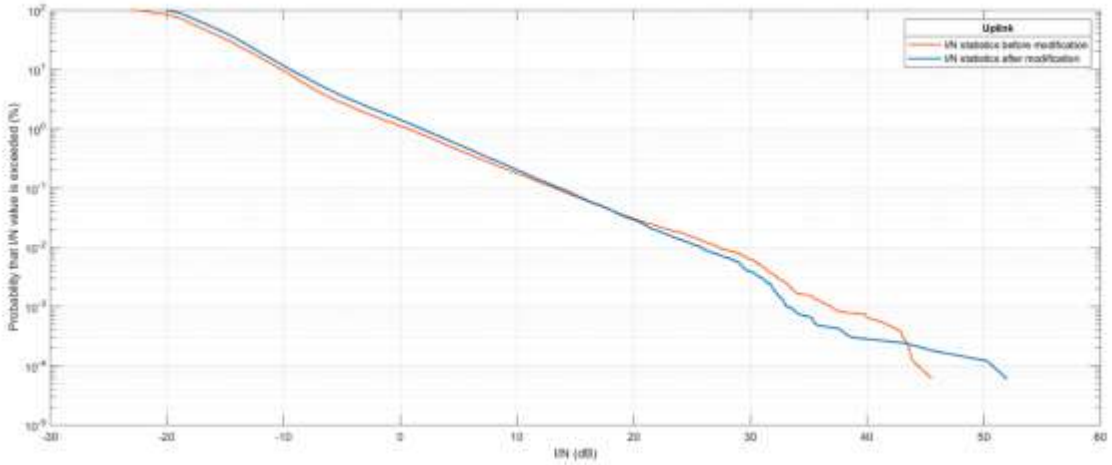


Figure A1-5

Scenario 4 (Downlink), Interferer: Viasat, Victim: Telesat (1m terminal), 17800-18600

MHz band, Latitude: 39°50′ N

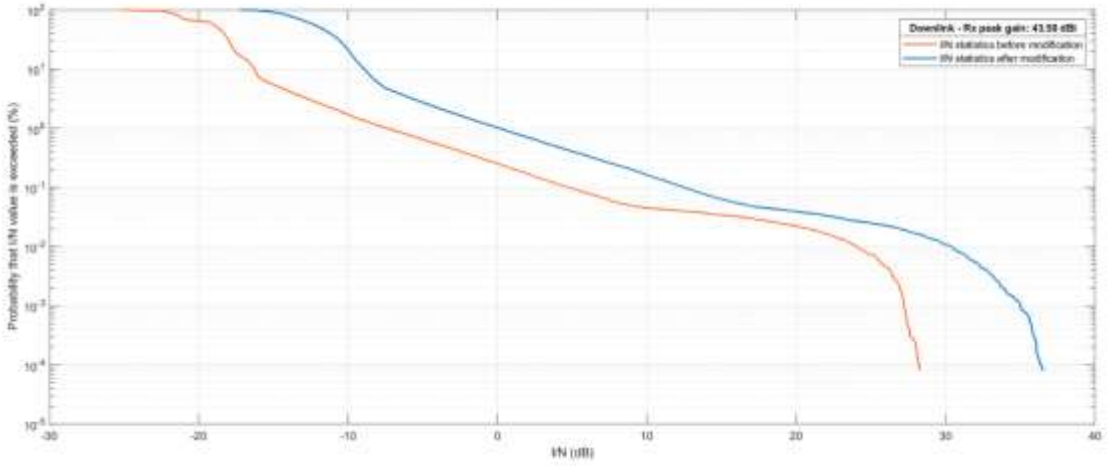


Figure A1-6

Scenario 4 (Downlink), Interferer: Viasat, Victim: Telesat (3.5m terminal), 17800-18600 MHz band, Latitude: 39°50′ N

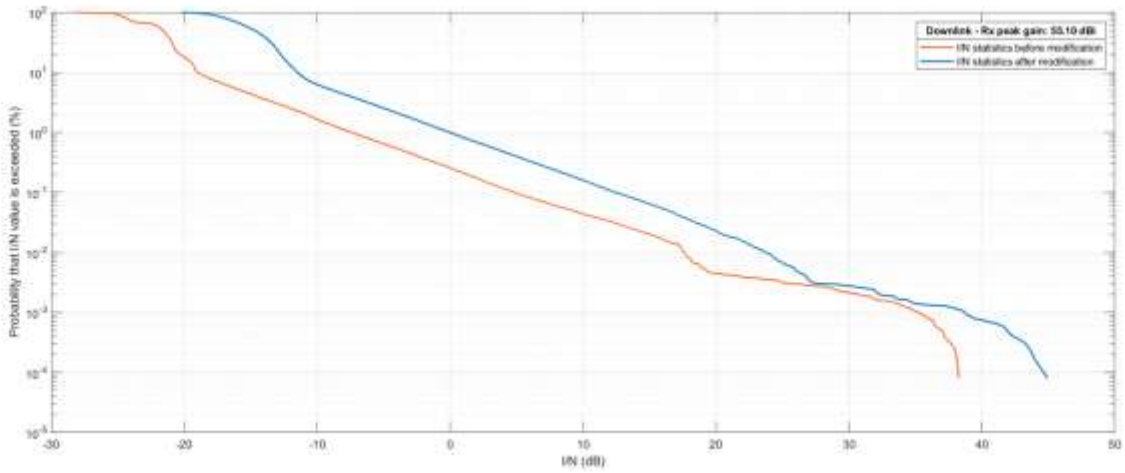


Figure A1-7

Scenario 4 (Downlink), Interferer: Viasat, Victim: Telesat (1m terminal), 19700-20200 MHz band, Latitude: 39°50′ N

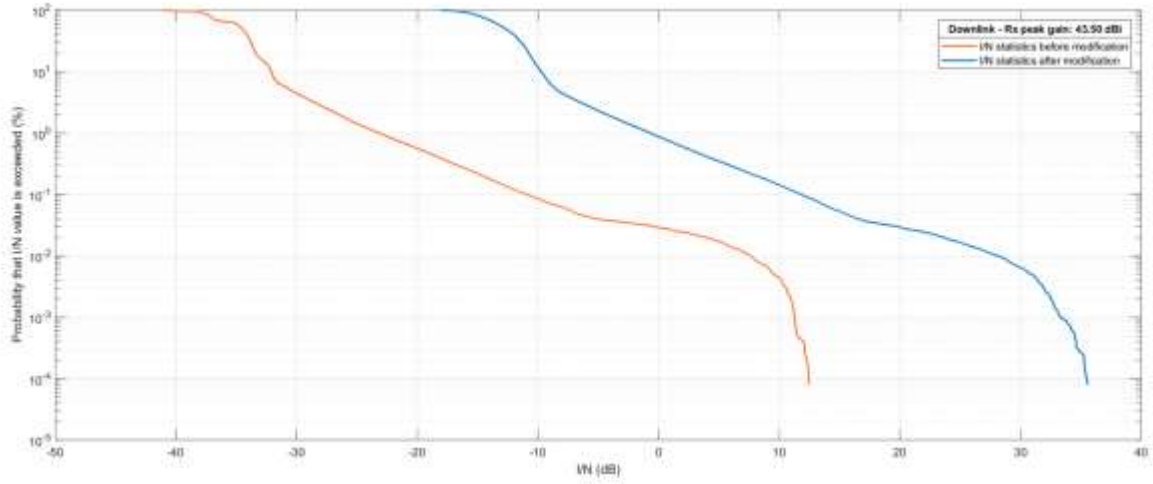
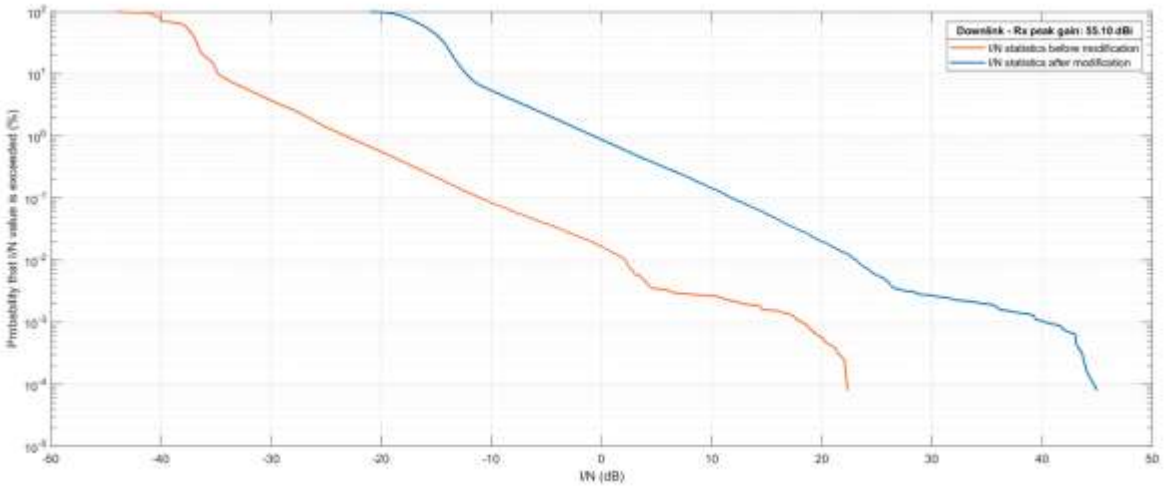


Figure A1-8

Scenario 4 (Downlink), Interferer: Viasat, Victim: Telesat (3.5m terminal), 19700-20200 MHz band, Latitude: 39°50′ N



ANNEX 2

Analysis of the consistency between the PFD and EIRP mask data of the Viasat system and the I/N CDF plots for the Viasat system before modification with respect to the Telesat system in Scenario 2 (Uplink, Viasat as Interferer) and Scenario 4 (Downlink, Viasat as Interferer)

In order to clarify the meaning of Viasat's assumption 4, Telesat assumed that, to model the transmitters of its system, Viasat actually meant that it used the same Power-Flux Density (PFD) and Effective Isotropic Radiated Power (EIRP) masks data that are necessary to show compliance with the EPFD limits following the methodology of Recommendation ITU-R S.1503-2 and that it attached to the amendment of its original application. Nevertheless, even by making that assumption, Telesat could not replicate the results represented in the plots shown in Figures A2-1 and A2-2 below[24].

[24] Viasat Application, Exhibit B at 17, figures E1-7 and E1-8.

Figure A2-1

"Telesat Uplink Comparison for Typical User Terminal Antennas"

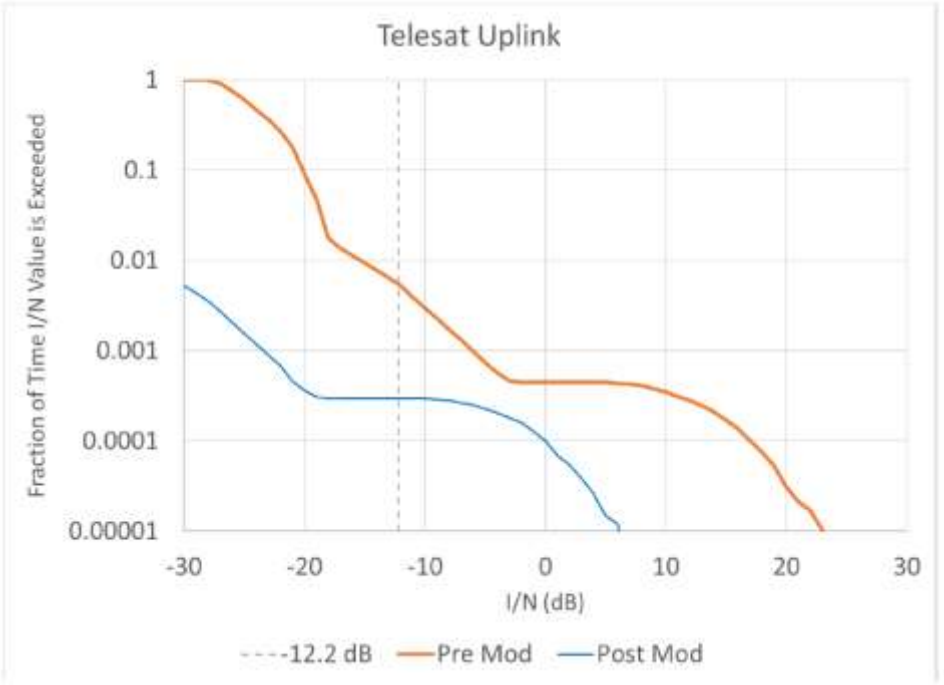
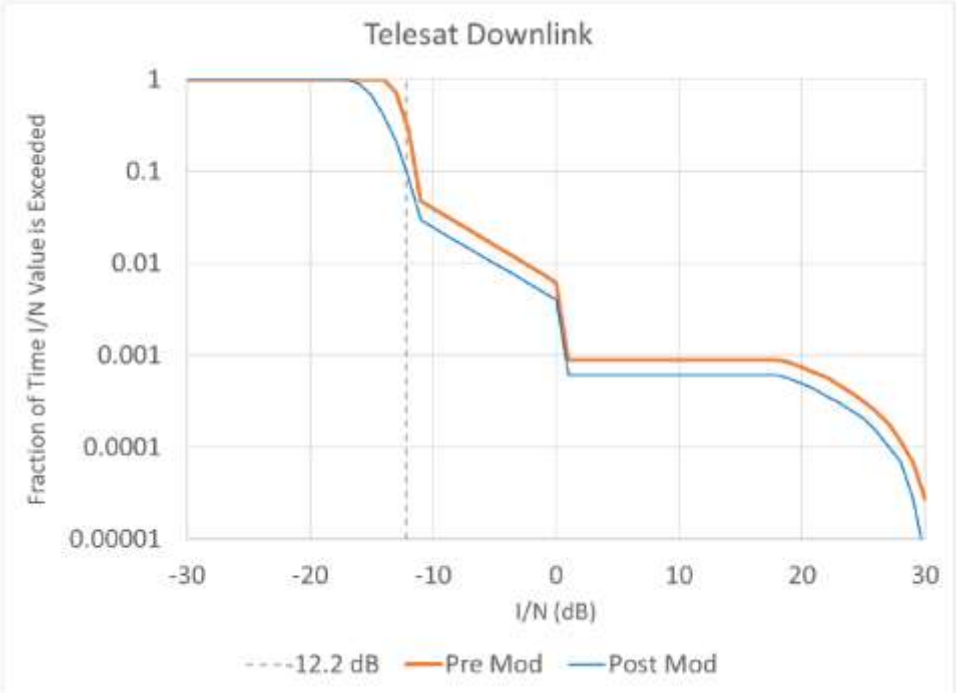


Figure A2-2

"Telesat Downlink Comparison for Typical User Terminal Antennas"



In fact, although the CDF curves included in those figures are related to a dynamic interference analysis, the reliability of those plots can be assessed by comparing the maximum I/N values of the "Pre-Mod[25]" CDF curves (ca. 30 dB and ca. 22 dB for the downlink and uplink case, respectively) with a static analysis modelling the worst-case scenario of a perfect in-line event between a Viasat interfering earth station, a Telesat victim satellite and a Viasat satellite (for Scenario 2) and a Viasat interfering satellite, a Telesat satellite and a Telesat victim earth station (for Scenario 4). It should be noted

[25] Since it is not clear whether the same PFD and EIRP mask data would be applicable to the Viasat system after the proposed modification, Telesat did not carry out the same test for the "Post-Mod" CDF curves.

that computing the I/N value at the input of the victim Telesat satellite or earth station receiver in such worst-case geometry is an effective way to check for the accuracy and consistency of Viasat I/N CDF plots because, if the "worst-case" I/N ratios computed in a static analysis do not match the maximum I/N values represented in Figures A2-1 and A2-2 above, then either (i) the simulations Viasat used to generate those plots do not consider enough samples to provide for statistically significant results or (ii) the underlying assumptions are wrong. Since the CDF plots in Figures A2-1 and A2-2 above cover events that occur for as little as 0.00001% of the time, a feature which leads to believe that the granularity of the simulation is fine enough to capture *quasi-in-line* events (*i.e.*, almost a worst-case geometry), then case (ii) (*i.e.*, that the underlying assumptions are wrong) is most likely should a static analysis provide for I/N values different from the maximum values represented by the CDF plots. Tables A2-1 and A2-2 below summarize the results obtained when modelling these scenarios by considering the values included in the PFD and EIRP masks that Viasat attached to the amendment of its original application; it can be seen that they are not compatible with the maximum I/N values of the "Pre-Mod" CDF curves illustrated in Figures A2-1 and A2-2 above. Due to this important discrepancy, as a minimum, the Commission should require Viasat to explain its analysis.

Tables A2-1a and A2-1b – Static analysis of Scenario 2 (Uplink, Viasat as Interferer)

Case 1: 27500-28600 MHz

Parameter	Value	Unit	Value	Unit	Value	Unit
Centre frequency			28050	MHz		
Min. slant range			1000	km		
Min. FSL[26]			181.4	dB		
Telesat beam G/T	13.2	dB/K	2.5	dB/K	-17.0	dB/K
Viasat 30cm e/s						
Max. EIRP sd[27]			-20.8	dB(W/Hz)		
Max. I/N	**39.6**	**dB**	**28.9**	**dB**	**9.4**	**dB**
Viasat 60cm e/s						
Max. EIRP sd			-19.8	dB(W/Hz)		
Max. I/N	**40.6**	**dB**	**29.9**	**dB**	**10.4**	**dB**
Viasat 7m e/s						
Max. EIRP sd			1.2	dB(W/Hz)		
Max. I/N	**61.6**	**dB**	**50.9**	**dB**	**31.4**	**dB**
Maximum "Pre-Mod" I/N in Figure A2-1			**22.0 dB**			

[26] Free-Space Loss.

[27] The EIRP spectral density values for the earth stations of the Viasat system before modification have been extracted by the masks provided by selecting a latitude of 40 deg N.

Case 2: 29500-30000 MHz

Parameter	Value	Unit	Value	Unit	Value	Unit
Centre frequency	29750	MHz				
Min. slant range	1000	km				
Min. FSL[28]	181.9	dB				
Telesat beam G/T	13.2	dB/K	2.5	dB/K	-17.0	dB/K
Viasat 30cm e/s						
Max. EIRP sd	-20.3	dB(W/Hz)				
Max. I/N	**39.6**	**dB**	**28.9**	**dB**	**9.4**	**dB**
Viasat 60cm e/s						
Max. EIRP sd	-19.4	dB(W/Hz)				
Max. I/N	**40.5**	**dB**	**29.8**	**dB**	**10.3**	**dB**
Viasat 7m e/s						
Max. EIRP sd	1.6	dB(W/Hz)				
Max. I/N	**61.5**	**dB**	**50.8**	**dB**	**31.3**	**dB**
Maximum "Pre-Mod" I/N in Figure A2-1	**22.0 dB**					

[28] Free-Space Loss.

Table A2-2a and A2-2b – Static analysis of Scenario 4 (Downlink, Viasat as Interferer)

Case 1: 17800-18600 MHz

Parameter	Value	Unit
Centre frequency	18200	MHz
Maximum PFD[29]	-131.3	dB(W/m2/40 kHz)
	-177.3	dB(W/m2/Hz)
Implied EIRP sd at nadir	-28.0	dB(W/Hz)
Telesat e/s equivalent noise temperature[30]	200	K
Telesat e/s equivalent noise power sd	-205.6	dB(W/Hz)
Telesat 1.0m e/s		
Maximum antenna gain[19]	43.5	dBi
Maximum interference at the input of the e/s receiver	-180.5	dB(W/Hz)
Maximum I/N	**25.1**	**dB**
Telesat 3.5m e/s		
Maximum antenna gain[19]	55.1	dBi
Maximum interference at the input of the e/s receiver	-168.9	dB(W/Hz)
Maximum I/N	**36.7**	**dB**
Maximum "Pre-Mod" I/N in Figure A2-2	**30.0**	**dB**

[29] Viasat Amendment, "mask_id_1".

[30] Telesat Canada, Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation, Call Sign S2976, IBFS File No. SAT-PDR-20161115-00108, Appendix A Technical Exhibit, Table 11 at 28.

Case 2: 19700-20200 MHz[31]

Parameter	Value	Unit
Centre frequency	19950	MHz
Maximum PFD[32]	-146.3	dB(W/m2/40 kHz)
	-192.4	dB(W/m2/Hz)
Implied EIRP sd at nadir	-43.0	dB(W/Hz)
Telesat e/s equivalent noise temperature[33]	200	K
Telesat e/s equivalent noise power sd	-205.6	dB(W/Hz)
Telesat 1.0m e/s		
Maximum antenna gain[22]	43.5	dBi
Maximum interference at the input of the e/s receiver	-196.0	dB(W/Hz)
Maximum I/N	**9.3**	**dB**
Telesat 3.5m e/s		
Maximum antenna gain[22]	55.1	dBi
Maximum interference at the input of the e/s receiver	-185.0	dB(W/Hz)
Maximum I/N	**20.9**	**dB**
Maximum "Pre-Mod" I/N in Figure A2-2	**30.0**	**dB**

[31] This test cannot be carried out in the 18.8-19.3 GHz and 28.6-29.1 GHz bands where no EPFD limits applies and for which Viasat did not provide any PFD/EIRP mask data. Therefore, it is impossible to determine how to model the transmitters of the Viasat system operating in compliance with "operational EPFD spectral densities" in this band.

[32] Viasat Amendment, "mask_id_2".

[33] *Supra* at note 30.

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 Petition, 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 Petition and that it is complete and accurate to the best of my knowledge and belief.

/s/ Mario Neri
Mario Neri, M.Eng., M.Fin.
Director, International Coordination
Telesat International Ltd.

August 31, 2020

CERTIFICATE OF SERVICE

I hereby certify that on this 31st day of August, 2020, a copy of the foregoing Petition to Deny or Defer Consideration was sent by US Mail to the following:

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