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

In the Matter of	)	
	)	
Telesat International Limited	)	File No. _____
	)	
Petition for Declaratory Ruling to Add	)	
Telstar 19 VANTAGE, a Ku-band and Ka-band	)	
Satellite, to the Permitted Space Station List	)	

PETITION FOR DECLARATORY RULING

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PETITION FOR DECLARATORY RULING

I. INTRODUCTION AND SUMMARY

Pursuant to Section 25.137 of the Commission's rules, the *DISCO II Order*,[1] the *DISCO II Reconsideration Order*,[2] and the Commission's order extending its *DISCO II* policies to the Ka-band,[3] Telesat International Limited ("Telesat International") hereby petitions for a declaratory ruling authorizing the Telstar 19 VANTAGE ("T19V") satellite to serve the U.S. market using Ku-band and Ka-band frequencies. For reasons that are discussed below, Telesat International respectfully requests Commission action on its Petition for Declaratory Ruling by June 1, 2016.

T19V is a geostationary satellite orbit, Fixed-Satellite Service space station that will operate at 63° W.L. Telesat International requests that the Commission:

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[1] *Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, 12 FCC Rcd 24094, ¶ 29 (1997) ("*DISCO II Order*").

[2] *In re Amendment of the Commission's Regulatory Practices to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, First Order on Reconsideration, 15 FCC Rcd. 7207 (1999) ("*DISCO II Reconsideration Order*").

[3] *In the Matter of 2006 Biennial Regulatory Review – Revision of Part 25; Establishment of Permitted List Procedure for Ka-band Space Stations*, 25 FCC Rcd 1542 (2010) ("Ka-band Permitted List Order").

- add T19V to the Permitted Space Station List ("Permitted List") for operation of its conventional Ku-band frequencies in the 11.7–11.95/14.0–14.25 GHz bands;
- permit use of T19V's extended Ku-band frequencies in the 13.8–14.0 and 11.5–11.7 GHz bands to serve the U.S. market;
- add T19V to the Ka-band Permitted Space Station List ("Ka-band Permitted List") for operation of its conventional Ka-band frequencies in the 18.3–18.8, 19.7–20.2, 28.35–28.6, and 29.25–30 GHz bands[4]; and
- permit use of T19V's Ka-band frequencies in the 18.8–19.3, 27.6–28.35, and 28.6–29.1 GHz bands to serve the U.S. market.

In addition to the Ku-band and Ka-band frequencies listed above, T19V will operate within beams that do not have coverage of U.S. territory in the following frequency bands: 12.75–13.25 GHz and 11.2–11.45 GHz (frequency bands subject to the AP 30B Plan in the ITU Radio Regulations), 10.95–11.2 GHz, 11.95–12.2 GHz, 14.25–14.5 GHz, 17.8–18.3 GHz, and 27.1–27.6 GHz. Telesat International does not seek authority from the FCC to operate in any of these bands in the United States.

A construction contract for T19V was awarded to Space Systems/Loral in November 2015. Detailed design of T19V is underway. It is anticipated that T19V will be launched in the first quarter of 2018 and placed into service around mid-year 2018.

Telesat International respectfully requests Commission action on its Petition for Declaratory Ruling by June 1, 2016. This timetable will provide the lead time and

[4] Pursuant to Section 25.203(k) of the Commission's rules, 47 C.F.R. § 25.203(k), all Ka-band earth station applicants specifying T19V as a point of communication and proposing to operate in the 29.25-29.3 GHz band will have to show that they either: (a) will not cause harmful interference to any co-primary non-geostationary feeder links in the band; or (b) will operate in accordance with coordination agreements they have entered into with the operator(s) of the co-primary non-geostationary feeder links.

regulatory certainty required for making investments in gateway earth stations and proceeding with earth station design, licensing, and construction.

The Ku-band payload on T19V will supplement the Ku-band capacity on Estrela do Sul 2 (a/k/a Telstar 14R), which the Commission previously added to the Permitted List at the request of an affiliate of Telesat International.[5] T19V will be collocated with Estrela do Sul 2. An affiliate of Telesat International will control both satellites and maintain them in the same orbital box of 63° W.L. ± .05° while executing maneuvers to ensure adequate physical separation at all times. To avoid electromagnetic interference issues, the transponders on the two satellites will be carefully controlled so that they will never operate co-frequency, co-coverage.

T19V will be operated under authorizations held by affiliates of Telesat International. Telesat Brasil Capacidade de Satelites Limitada ("Telesat Brasil") will operate the Ku-band payload on T19V and the beams of the Ka-band payload that serve Brazilian territory, and Telesat (IOM) Holdings Limited ("Telesat IOM") will operate the beams of the Ka-band payload that do not serve Brazilian territory.[6]

Agencia Nacional de Telecomunicacoes (ANATEL) has granted Telesat Brasil a Satellite Exploitation Right to operate in the Ku-band at 63°W. Telesat also was the successful applicant in the Brazilian domestic process for the Ka-band Satellite

[5] *See* Telesat Brasil Capacidade de Satelites Ltda. Application for Space Station Authorization, FCC File No. SAT-PPL-20110112-00012 (granted Apr. 4, 2011).

[6] Telesat Brasil is organized under the laws of Brazil. It is 100% owned (indirectly through subsidiaries) and controlled by Telesat Canada. Telesat IOM is incorporated in the Isle of Man and is a 100% subsidiary of Telesat Canada. Telesat International is is 100% owned (indirectly through subsidiaries) and controlled by Telesat Canada. Additional details regarding Telesat International's ownership can be found in Exhibit 3.

Exploitation Right at 63°W. Telesat Brasil will operate the Ku-band payload under ITU network B-SAT I (Part II-S published in IFIC 2618/29.04.2008). Telesat Brasil will operate the beams of the Ka-band payload on T19V that serve Brazilian territory under ITU network B-SAT-1I-1 (CR/C/3230, IFIC2736/22.01.2013), and Telesat IOM will operate the beams that do not serve Brazilian territory under ITU networks IOMSAT-KA-63W (Part I-S, IFIC 2802/01.09.2015), and IOMSAT-KA-63W-R (CR/C/3359, IFIC2747/25.06.2013).[7]

Grant of Telesat International's petition for declaratory ruling is in the public interest. A grant will preserve the benefits of competition associated with using a Ku-band satellite at 63° W.L. to serve the United States and will enhance service for customers who will benefit from augmented Ku-band capacity at the location. Further, a grant will enhance competition by adding Ka-band capacity at that orbital location, thereby expanding the options available to customers in the United States.

Telesat International demonstrates herein that it is legally and technically qualified to serve the U.S. market via T19V. Telesat International is providing a Technical Exhibit and Schedule S that show compliance with the Commission's technical requirements, including appropriate protections for adjacent GSO satellites, NGSO satellite systems, LMDS stations, and government stations. It is furnishing a

[7] A company known as Mansat has an arrangement with the Isle of Man government whereby the rights to Isle of Man satellite networks are granted to Mansat. Telesat International's affiliate has a commercial agreement with Mansat for licensing of certain satellite networks filed by OFCOM on behalf of the Isle of Man government, including the ones referenced above for the Ka-band payload on T19V. Telesat International's affiliate, Skynet Satellite Corporation, previously filed a copy of this agreement with the Commission on a confidential basis. See Request for Confidential Treatment, FCC File No. SAT-LOA-20141010-00107.

Form 312 that shows compliance with the Commission's legal qualification requirements. It shows that serving the United States via T19V is presumed to enhance competition because T19V's authorizing countries are members of the World Trade Organization. And it shows that no national security, law enforcement, foreign policy, or trade concerns are implicated by its proposed use of T19V to serve the United States. Accordingly, the Commission's requirements for U.S. market access are satisfied.

II. TELSTAR 19 VANTAGE SATISFIES THE FCC'S REQUIREMENTS FOR SERVING THE UNITED STATES.

The Commission has an established framework for considering requests for non-U.S. licensed space stations to access the U.S. market. In evaluating requests for such authority, the Commission considers the effect on competition in the United States, spectrum availability, eligibility and operational requirements, and concerns related to national security, law enforcement, foreign policy, and trade.[8]

Operators seeking U.S. market access for non-U.S. licensed space stations need to provide the same information concerning legal and technical qualifications as must be provided by applicants for space station licenses issued by the FCC.[9] Section 25.114 establishes the technical and legal qualification requirements for space station applicants.

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[8] *See DISCO II Order,* 12 FCC Rcd 24094, ¶ 29 (1997), *on reconsideration,* 15 FCC Rcd 7207, ¶ 5 (1999). *See also* Section 25.137 of the Commission rules, 47 C.F.R. § 25.137.

[9] *See In the Matter of Amendment of the Commission's Space Station Licensing Rules and Policies; Mitigation of Orbital Debris,* First Report and Further Notice of Proposed Rulemaking in IB Docket No. 02-34, and First Report and Order in IB Docket No. 02-54, 18 FCC Rcd 10760, ¶ 288 (2003) *("Space Station Licensing Reform Order").* Some of the Commission's application policies for authorizing non-U.S. licensed space stations are codified in Section 25.137 of the Commission's rules, 47 C.F.R. § 25.137.

Special permitted space station list procedures apply in some bands. In the *DISCO II Reconsideration Order*, the Commission held that a non-U.S. licensed satellite may be included on the Permitted List for conventional C-band and Ku-band frequencies if the Commission finds that operation of the satellite complies with Sections 25.114 and 25.137 of the Commission's rules and raises no other public interest concerns.[10] This policy has been extended by the Commission to conventional Ka-band frequencies.[11]

The proposed operation of T19V to serve the United States satisfies all of these tests.

A. Technical Qualifications

T19V will provide significant additional capacity in both the Ku-band and the Ka-band.

The Ku-band payload encompasses frequencies in the conventional, extended and planned Ku-bands and provides spot beam and regional coverage of Brazil, spot beam coverage of the Andean region, and regional coverage of the North Atlantic Ocean Region ("NAOR") including portions of the United States. The design takes into account that T19V will be collocated with Estrela do Sul 2. The NAOR payload provides VSAT services through the use of up to four 36 MHz transponders in the

[10] *See DISCO II Reconsideration Order*, 15 FCC Rcd at 7214 ("U.S. earth stations with ALSAT licenses should be permitted to communicate with any non-U.S. satellite just as easily as they communicate with any U.S.-licensed satellite, provided that those communications do not cause harmful interference to or require protection from adjacent satellite operations, and otherwise comply with DISCO II.").
[11] *See* Ka-Band Permitted List Order, ¶¶ 12-13.

forward direction and two 72 MHz transponders in the return direction. The Ku-band gateway earth station for the NAOR beam will be located in the United States.

The Ka-band payload of T19V is planned for use in the provision of broadband internet service, video transmissions, and VSAT services including for marine and aeronautical communications. It provides high-throughput (HTS) capacity with the following service areas:

- parts of South America though 34 spot beams, with associated Ka-band gateway earth stations located in the United States, Chile and Brazil;
- parts of Northern Canada through three spot beams, with an associated Ka-band gateway in Canada;
- parts of the Caribbean region, including Puerto Rico and the U.S. southeast coast through eight spot beams, with an associated Ka-band gateway in the United States;
- parts of the NAOR, including parts of Maine, through eight spot beams with an associated Ka-band gateway in Europe.

The attached technical exhibit and the Schedule S that is filed with this petition establish that the proposed operation of T19V is consistent with the Commission's technical requirements, including its requirements for two-degree satellite spacing compatibility.

B. Legal Qualifications

The information provided in the FCC Form 312 that accompanies this petition establishes Telesat International's legal qualifications.

Telesat International highlights the following Part 25 rules that warrant special mention:

Section 25.145(e) – Prohibition Against Exclusive Arrangements

Section 25.145(e) of the Commission's rules[12] precludes the Commission from granting a Ka-band FSS space station license to any applicant if it (or its affiliates) has or acquires an exclusive right to construct or operate space segment or earth stations, or to interchange traffic, for the purpose of handling traffic to or from the United States, its territories, or possessions. Telesat International hereby confirms that it has no such exclusive right, and that it will not acquire such an exclusive right in the future.

Sections 25.137(d)(1) & 25.164(b) – Satellite Construction Milestones

Section 25.137(d)(1) of the Commission's rules[13] requires parties filing PDRs to demonstrate compliance with satellite construction, launch, and operation milestones. The milestones for GSO systems like Telesat International's are set forth in Section 25.164(a) of the Commission's rules. [14] Telesat International hereby confirms that its provision of service to the U.S. market via T19V will be subject to these requirements.

Sections 25.137(d)(4) & 25.165 – Posting of Bond

Section 25.137(d)(4) of the Commission's rules requires a bond to be posted in connection with filings involving non-U.S. licensed satellites that are not in orbit and operating.[15] The bond required for a new GSO satellite is in the amount of $3 million,[16]

[12] 47 C.F.R. § 25.145(e).
[13] 47 C.F.R. § 25.137(d)(1).
[14] 47 C.F.R. § 25.164(a).
[15] 47 C.F.R. § 25.137(d)(4).
[16] *Id.*

which typically must be posted within 30 days of FCC action providing access to the U.S. market. The party posting the bond may reduce the amount of the bond by $750,000 each time a milestone has been satisfied.[17] Telesat International hereby confirms that its provision of service to the U.S. market via T19V will be subject to these requirements.

C. Other Public Interest Factors

1. Effect on competition in the United States

The *DISCO II Order,* as implemented in Section 25.137(a) of the Commission's rules, establishes a presumption that granting applications to provide service in the United States via satellites licensed by countries that are members of the World Trade Organization ("WTO") will enhance competition and therefore is in the public interest.[18] All of the beams comprising the Ku-band and Ka-band payloads on T19V will be either operated under a Satellite Exploitation Right granted by Brazil or operated under authority of the United Kingdom, both of which are members of the WTO. Accordingly, this petition satisfies the requirements of Section 25.137, and there is a presumption that granting U.S. market entry to T19V is in the public interest.

Telesat International's petition for declaratory ruling for T19V is limited to services covered by the WTO Basic Telecommunications Agreement. It does not seek authority to use T19V to provide direct-to-home, Direct Broadcast Satellite, or Digital Audio Radio Service services in the United States.

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[17] 47 C.F.R. § 25.137(d)(4). *See also* 47 C.F.R. § 25.165(d).

[18] *See In re Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, Report and Order, 12 FCC Rcd. 24094, 24112 (1997) ("*DISCO II Order*"). *See also* Estrela do Sul 1 Order, ¶ 5.

2. Spectrum availability

The Commission considers under the "other public interest factors" element of *DISCO II* whether grant of an application would have an impact on spectrum availability.[19] In so doing, the Commission evaluates whether grant of access would create the potential for harmful interference with U.S.-licensed satellite and terrestrial systems. T19V satisfies this aspect of *DISCO II*.

T19V will operate at 63° W.L. and is compatible with other geostationary satellite orbit ("GSO") space stations from a spectrum availability perspective. The compatibility of T19V with satellites two degrees away from T19V is demonstrated in the Section A7 of the attached Technical Exhibit.

T19V also is compatible with non-geostationary satellite orbit ("NGSO") Fixed-Satellite Service ("FSS") space stations and terrestrial stations from a spectrum availability perspective. Section A9 of the attached Technical Exhibit demonstrates how T19V can share with NGSO FSS systems in the 28.6–29.1 GHz and 18.8–19.3 GHz bands, consistent with T19V's secondary status under the FCC's band plan in the 28.6–29.1 GHz band and its non-conforming status under the FCC's band plan in the 18.8–19.3 GHz band.

T19V also is compatible with the FCC's band plan for the 27.6–28.35 GHz band, which makes the band available to local multipoint distribution service ("LMDS") operations on a primary basis and GSO FSS operations on a secondary basis. As stated in Section A2 of the attached Technical Exhibit, Telesat International makes no claim for

[19] *See DISCO II Order*, ¶¶ 146-182.

protection of T19V against interference caused by LMDS operations, and earth station applications that propose to transmit to T19V in the 27.6–28.35 GHz band will include a showing addressing the need to protect LMDS stations.

Finally, operation of the Ka-band payload on T19V is compatible with U.S. government users because the operation will be coordinated. Pursuant to the requirements of the Ka-band Permitted List Order,[20] Telesat International hereby requests that the Commission initiate Footnote US334 coordination discussions with the National Telecommunications and Information Administration ("NTIA") concerning T19V's operations in the 17.8–18.3, 18.3–18.8, 18.8–19.3, and 19.7–20.2 GHz bands.

3. National security, law enforcement, foreign policy, and trade issues

The Commission also considers under the "other public interest factors" element of *DISCO II* whether grant of an application would implicate national security, law enforcement, foreign policy, or trade concerns.[21] The Commission has found in similar circumstances involving affiliates of Telesat International that using non-U.S. licensed satellites to serve the United States raises no national security, law enforcement, foreign policy, or trade concerns. The Commission made this finding, for example, in authorizing the Estrela do Sul 2 satellite with which T19V will be collocated.[22] These

[20] Ka-band Permitted List Order, ¶14.
[21] *See DISCO II Order,* ¶¶ 146-182.
[22] *See Telesat Brasil Capacidade de Satelites Ltda. Application for Space Station Authorization*, FCC File No. SAT-PPL-20110112-00012 (granted Apr. 4, 2011). *See also Telesat Canada Petition for Declaratory Ruling for Inclusion of ANIK F3 on the Permitted Space Station List,* FCC File No. SAT-PPL-20060516-00061 (granted Jan. 18, 2007); *Loral Orion Services, Inc., Order,* 15 FCC Rcd. 12419 (IB 2000); *Orion Satellite Corp., Order and Authorization,* 10 FCC Rcd. 12307 (IB 1995).

findings apply with equal force to Telesat International's proposal to use T19V to serve the United States from 63° W.L.

4. Waiver requests

Telesat International respectfully requests waivers of the U.S. Table of Allocations[23] and the Ka-Band Plan[24] to allow Telesat International to operate T19V in the 18.8-19.3 GHz band on a non-conforming basis. As shown in the attached Technical Statement (Section A9), Telesat International's operations on a non-conforming basis would not create the potential for harmful interference to primary NGSO FSS stations in the band. There is good cause, therefore, for a waiver.

[23] 47 C.F.R. § 2.106.

[24] The Ka-Band Plan is a combination of the 18 GHz band plan established in IB Docket No. 98-172 , including *In the Matter of Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, 15 FCC Rcd 13430, ¶ 28 (2000) and related decisions, and the 28 GHz band plan established in CC Docket No. 92-297, including *In the Matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, 11 FCC Rcd 19005, ¶ 42 (1996) and related decisions.

CONCLUSION

In view of the foregoing, grant of Telesat International's Petition for a Declaratory Ruling is in the public interest, and it is respectfully requested that the Commission grant the petition expeditiously.

Respectfully submitted,

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Attachment A

Technical Exhibit for "Telstar 19 VANTAGE" Satellite at 63° West Longitude

A1. Introduction

This document is the technical attachment to the application of Telesat International Limited ("Telesat") with regard to the *Telstar 19 VANTAGE* satellite ("T19V") at the 63° west longitude (WL) geostationary orbital location. The technical information for the proposed system, as required by paragraph (d) of Section §25.114[1] of the FCC rules, is provided in this document. The information specified in paragraph (c) of that section has been provided in Schedule S and is not repeated in this document.

A2. §25.114(d)(1): General Description of the Overall System

The T19V satellite network will consist of a geostationary satellite at 63° WL and associated earth station facilities. The T19V satellite will provide a range of fixed-satellite services (FSS) to the United States and various countries in the Americas, the North Atlantic Ocean Region, and Europe. Services to Alaska and Hawaii cannot be provided because these areas are not visible from the satellite geostationary orbital location of 63° WL. The services provided by T19V will include VSAT services, point-to-point communication links, and video transmissions for cable head-ends. This satellite uses a combination of wide regional beams and spot beams.

The frequency bands of T19V satellite are summarized in Table 1. The last column of Table 1 shows whether or not FCC authorization is being sought for each segment of the frequency bands on T19V. Specifically, the downlink frequency bands 10.95-11.2, 11.2-11.45, 11.95-12.2, 17.8-18.3, and the uplink frequency bands 12.75-13.25, 14.25-14.5, and 27.1-27.6 do not have coverage over U.S. and FCC authorization is not being sought for them.

Table 1: Frequency bands of T19V

Lower Frequency Limit (GHz)	Upper Frequency Limit (GHz)	Downlink/Uplink	Seeking FCC Authorization for US Market
10.95	11.2	Downlink	No
11.2	11.45	Downlink	No
11.5	11.95	Downlink	Yes

[1] 47 C.F.R. §25.114

11.95	12.2	Downlink	No
12.75	13.25	Uplink	No
13.8	14.25	Uplink	Yes
14.25	14.5	Uplink	No
17.8	18.3	Downlink	No
18.3	19.3	Downlink	Yes
19.7	20.2	Downlink	Yes
27.1	27.6	Uplink	No
27.6	29.1	Uplink	Yes
29.25	30.0	Uplink	Yes

The downlink band 11.5–11.7 GHz will be used in the United States only for (i) international links, i.e., service between the United States and other countries, and (ii) transmission to earth stations on vessels (ESV), vehicle-mounted earth stations (VMES), and earth stations aboard aircrafts (ESAA) consistent with footnote NG52 of the U.S. Table of Frequency Allocations.[2]

T19V will use the bands 18.8 – 19.3 GHz (space-to-Earth) and 28.6 – 29.1 GHz (Earth-to-space) for gateway links. The analysis in Section A9 of this application demonstrates compatibility with NGSO FSS operations in these band segments.

Under the FCC's band plan, in the United States the 28.6 – 29.1 GHz band is available to the NGSO FSS on a primary basis and to the GSO FSS on a secondary basis. Stations operating in a secondary service cannot cause harmful interference to, and cannot seek interference protection from, stations of a primary service. As discussed in greater detail in Section A9, Telesat's T19V operations in the United States in this band will be consistent with these obligations of a secondary user.

The frequency band 27.6 – 28.35 GHz is allocated to the local multipoint distribution service ("LMDS") on a primary basis. GSO FSS operations are allocated on a secondary basis in the same band and, therefore, no waiver of the Ka-Band Plan is required for Telesat to operate in those frequencies.[3] A secondary GSO user in the Ka-band must not cause harmful interference to primary operations, nor can it claim protection from interference caused by primary operations. Telesat's proposed use of the 27.6-28.35 GHz band satisfies this standard. As a secondary GSO user in the 27.6-28.35 GHz frequency band, Telesat makes no claim for protection from interference caused by LMDS operations. Moreover, earth station applications that propose to transmit to T19V in the 27.6-28.35 GHz band will include a showing addressing the need to protect LMDS stations.

[2] 47 C.F.R. §2.106

[3] *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, 12 FCC Rcd 22310, ¶ 42 (1997) ("GSO and NGSO FSS systems have equal status as secondary users in this band segment").

Under the FCC's band plan, the 18.8 – 19.3 GHz band is available in the United States on a primary basis only to the NGSO FSS. Telesat seeks a waiver to allow its T19V GSO network to operate in the 18.8 – 19.3 GHz NGSO band. As demonstrated in Section A9, Telesat will operate on a non-harmful interference basis to NGSO and will not cause harmful interference to, nor seek protection from, NGSO operations in this band.

As requested in §25.114(d)(1) an explanation of how the uplink frequency bands are connected to the downlink frequency bands is as follows: the uplink frequency band 13.8-14 GHz is connected to the downlink band 11.5-11.7, the uplink band 14-14.25 GHz is connected to the downlink bands 11.7-11.95 GHz, the uplink band 12.75-13.25 GHz is connected to the downlink band 11.95-12.2 GHz, the uplink band 14.25-14.5 GHz is connected to the downlink bands 10.95-11.2, 11.2-11.45, and 11.95-12.2 GHz, the uplink band 27.1-29.1GHz is connected to the downlink bands 17.8-19.3 and 19.7-20.2 GHz, the uplink band 29.5-30 GHz is connected to the downlink bands 17.8-18.8 and 19.7-20.2 GHz, the uplink band 27.85-28.35 GHz is connected to the downlink band 19.7-20.2 GHz, the uplink band 29.25-30 GHz is connected to the downlink band 17.8-18.55 GHz. The strapping information has been provided in the Schedule S, which provides further details of how the uplink frequency bands are connected to the downlink frequency bands as well as the corresponding beams and the geographical coverage.

The polarization used for the Ku-band communication signals is linear and the polarization for the Ka-band signals is circular. Frequency reuse will be exploited through the use of orthogonal polarization and geographical isolation of the beams. All transponders will contain step attenuators which can be adjusted remotely by ground commands.

The satellite TT&C operations will be performed from the three locations as listed below. The primary TT&C station is the first one in the list below (i.e., the one in Brazil):

1) Telesat Brasil Teleport,
   Rua Deputado Cristovan Chiaradia, 540.
   Buritis
   Bairro Buritis, MG.
   CEP 30575-815, Brazil
   Phone: +55-31-3508-7006

2) 1305 Industrial Park Road, Mt. Jackson,
   VA 22842, USA
   Phone: 540-477-5520

3) 133438 Allan Park Road, West Grey Township, Allan Park,
   ON N4N 3B8, Canada
   Phone: 519-371-7490

The TT&C frequencies and polarization plan are provided in the Schedule S.

Satellite transmission on each transponder can be individually turned on and off by ground telecommand signals, enabling cessation of emissions from the satellite, as required by §25.207[4] of the Commission's rules.

Analysis of the satellite antenna gain contours and the peak EIRP density verified that the PFD limits of §25.208[5] and §25.138[6] , as well as the PFD limits of the ITU Radio Regulations, are met in all the operating frequency bands.

A3. Space station antenna gain contours

The co-pol and cross-pol antenna gain contours for the beams of the T19V satellite have been provided in the GIMS database "GIMS_DB_T19V.mdb", which is submitted separately. The Ka-band beams of the T19V satellite consist of a large number of identical fixed spot beams. Therefore, for the Ka spot beams, as indicated by §25.114(c)(4)(vii)[7] only the predicted antenna gain contours for one transmit beam and one receive beam have been provided the in the GIMS database. In file "GIMS_DB_T19V.mdb", the downlink Ka spot beam is called 1TX and the uplink Ka spot beam is called 1RX. Figure 1 is an area map showing all of the Ka spot beams depicted on the surface of the earth (as per option (A) in §25.114(c)(4)(vii)). The smaller circles in Figure 1 show the location of the gateways (but as mentioned above all the Ka spot beams are identical). Table 2 shows how the beam numbers or names in this picture are related to the beam IDs in the Schedule S.

[4] 47 C.F.R. §25.207
[5] 47 C.F.R. §25.208
[6] 47 C.F.R. §25.138
[7] 47 C.F.R. §25.114(c)(4)(vii)

Figure 1: Ka-band spot beams of the T19V satellite

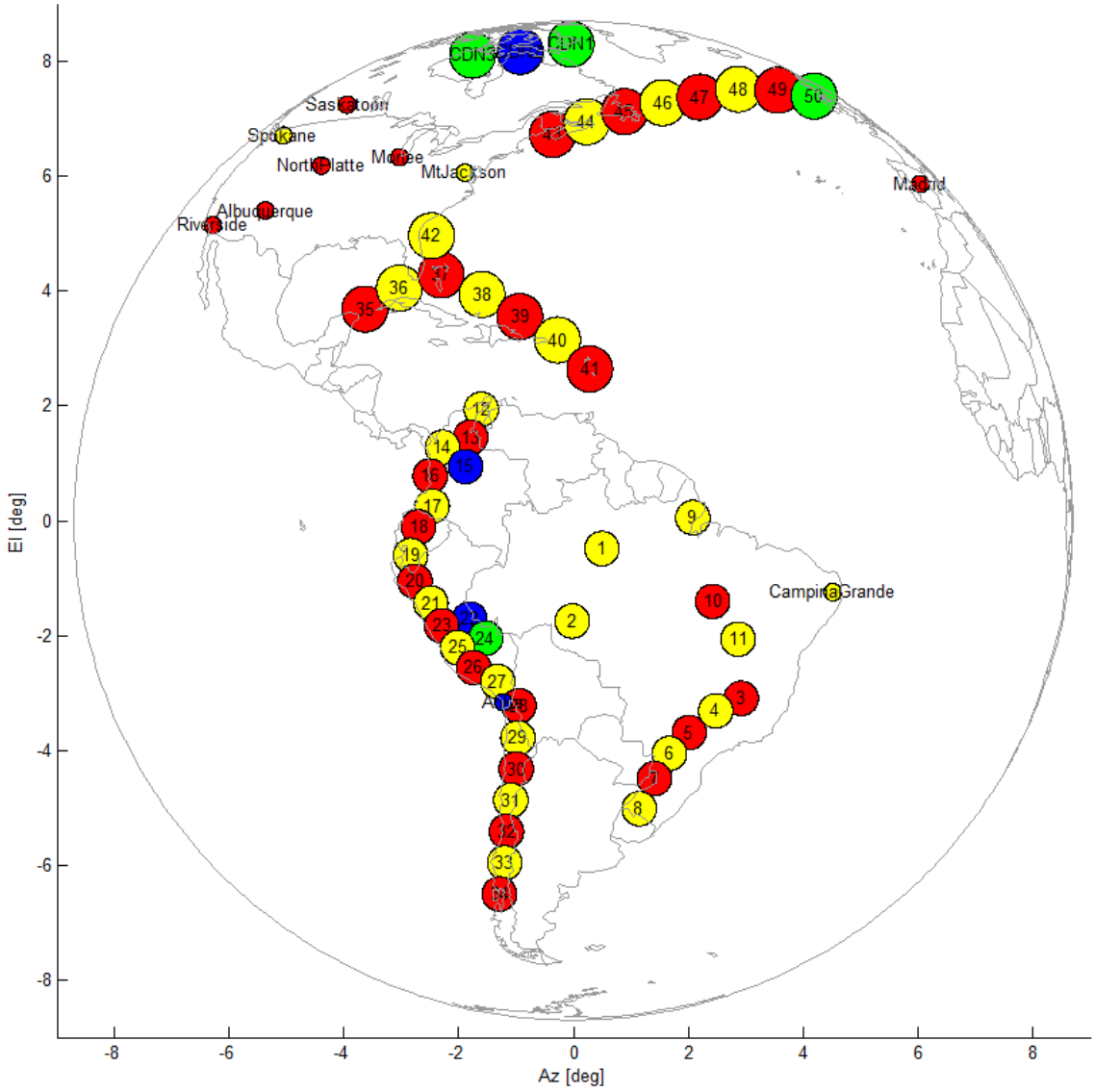

Table 2: Explanation of how each Ka spot beam number or name in Figure 1 is related to the corresponding beam ID in the Schedule S

Spot beam number or name in Figure 1	The associated DOWNLINK beam ID in Schedule S	The associated UPLINK beam ID in Schedule S	Notes
1	1TX	1RX	
2	2TX	2RX	
3	3TX	3RX	
4	4TX	4RX	
5	5TX	5RX	
6	6TX	6RX	

7	7TX	7RX	
8	8TX	8RX	
9	9TX	9RX	
10	10TX	10RX	
11	11TX	11RX	
12	12TX	12RX	
13	13TX	13RX	
14	14TX	14RX	
15	15TX	15RX	
16	16TX	16RX	
17	17TX	17RX	
18	18TX	18RX	
19	19TX	19RX	
20	20TX	20RX	
21	21TX	21RX	
22	22TX	22RX	
23	23TX	23RX	
24	24TX	24RX	
25	25TX	25RX	
26	26TX	26RX	
27	27TX	27RX	
28	28TX	28RX	
29	29TX	29RX	
30	30TX	30RX	
31	31TX	31RX	
32	32TX	32RX	
33	33TX	33RX	
34	34TX	34RX	
35	35TX	35RX	
36	36TX	36RX	
37	37TX	37RX	
38	38TX	38RX	
39	39TX	39RX	
40	40TX	40RX	
41	41TX	41RX	
42	42TX	42RX	
43	43TX	43RX	
44	44TX	44RX	
45	45TX	45RX	
46	46TX	46RX	
47	47TX	47RX	
48	48TX	48RX	
49	49TX	49RX	
50	50TX	50RX	
A	ATX	ARX	Gateway in Chile

Campina Grande	CAMTX	CAMRX	Gateway in Brazil
Madrid	MADTX	MADRX	Gateway in Spain
Mt Jackson	MTJTX	MTJRX	Gateway in USA
Monee	MONTX	MONRX	Gateway in USA
North Platte	NORTX	NORRX	Gateway in USA
Spokane	SPOTX	SPORX	Gateway in USA
Albuquerque	ALBTX	ALBRX	Gateway in USA
Riverside	RIVTX	RIVRX	Gateway in USA
Saskatoon	SASTX	SASRX	Gateway in Canada
CDN1	CDN1T	CDN1R	
CDN2	CDN2T	CDN2R	The blue spot beam in Canada between CDN1 and CDN3 spots in Figure 1
CDN3	CDN3T	CDN3R	

A4. §25.114(d)(6): Public interest considerations in support of grant

As stated in the legal narrative portion of this application, the T19V satellite will operate at 63° WL and will be co-located with the Telstar 14R satellite (also known as Estrela do Sul 2). Telstar 14R operates only in the Ku band whereas T19V will operate in the Ku and Ka bands (as described in the previous section and in the Schedule S). The Telstar 14R satellite network currently provides services to the United States and several other countries. The T19V satellite network will address the demand for additional capacity in both Ku and Ka bands, and will provide more options to consumers in the United States who will benefit from more competitive rates and a greater diversity of possible services. Grant of this application will therefore be in the public interest.

A5. Link noise budgets

Typical link budgets and overall performance analysis, including the analysis of the effects of each contributing noise and interference source, are provided in Table 3, Table 4, and Table 5. Table 3 shows typical link budgets in extended Ku band, Table 4 shows typical link budgets in standard Ku band, and Table 5 shows typical link budgets in Ka band.

Table 3: Typical link budgets in extended Ku band

TX ES Location	**Mt. Jackson, VA (38.7N,78.6W)**	**Lisbon, Portugal (38.7N,9.1W)**
RX ES Location	**Lisbon, Portugal (38.7N,9.1W)**	**Mt. Jackson, VA (38.7N,78.6W)**
Emission BW [kHz]	10000	10000
Modulation type	16APSK	16APSK
Information (bit) rate [kbps]	35556	35556
FEC Rate	0.889	0.889
Uplink Frequency [GHz]	13.852	13.892
Uplink ES antenna diameter [m]	4.5	4.5
Uplink ES antenna gain [dBi]	54.4	54.4
Uplink Antenna feed flange power [dBW]	15	15
Uplink ES to Satellite Distance [km]	37597	39633
Uplink Free-Space Loss [dB]	206.8	207.3
Satellite RX antenna gain towards the TX ES [dBi]	30.8	30.9
Satellite Rx system noise temperature [K]	478.6	478.6
Uplink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	1.6	1.6
Uplink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	89.4	89.4
Uplink Thermal C/N [dB]	22.9	22.6
Uplink C/I (ASI) [dB]	29.9	29.9
Uplink C/I (Xpol) [dB]	30	30
Uplink C/I (IM) [dB]	30	30
Uplink C/(N+I) [dB]	20.9	20.7
Downlink Frequency (GHz)	11.552	11.592
Satellite TX antenna gain towards the RX ES [dBi]	29.4	30.8
Downlink Antenna feed flange power [dBW]	7.6	7.6
Downlink ES to Satellite Distance [km]	39633	37597
Downlink Free-Space Loss [dB]	205.7	205.2
RX ES antenna diameter [m]	4.5	4.5
RX ES antenna gain [dBi]	52.8	52.9
RX ES system noise temperature [K]	200	200
Downlink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	0.95	0.95
Downlink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	57.0	57.0
Downlink Thermal C/N [dB]	17.8	19.6
Downlink C/I (ASI) [dB]	28.3	28.3
Downlink C/I (Xpol) [dB]	30	30
Downlink C/I (IM) [dB]	30	30
Downlink C/(N+I) [dB]	17.0	18.4
Overall Link C/(N+I) [dB]	15.5	16.4

Required C/(N+I) [dB]	14.7	14.7
Margin [dB]	0.8	1.7

Table 4: Typical link budgets in standard Ku band

TX ES Location	**Mt. Jackson, VA (38.7N,78.6W)**	**Lisbon, Portugal (38.7N,9.1W)**
RX ES Location	**Lisbon, Portugal (38.7N,9.1W)**	**Mt. Jackson, VA (38.7N,78.6W)**
Emission BW [kHz]	10000	10000
Modulation type	QPSK	8PSK
Information (bit) rate [kbps]	17778	20000
FEC Rate	0.889	0.667
Uplink Frequency [GHz]	14.126	14.206
Uplink ES antenna diameter [m]	4.5	1.2
Uplink ES antenna gain [dBi]	54.6	43.2
Uplink Antenna feed flange power [dBW]	15	15
Uplink ES to Satellite Distance [km]	37597	39633
Uplink Free-Space Loss [dB]	206.9	207.5
Satellite RX antenna gain towards the TX ES [dBi]	30.8	30.9
Satellite Rx system noise temperature [K]	478.6	478.6
Uplink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	1.6	1.6
Uplink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	89.4	89.4
Uplink Thermal C/N [dB]	22.9	11.1
Uplink C/I (ASI) [dB]	30.1	18.7
Uplink C/I (Xpol) [dB]	30	30
Uplink C/I (IM) [dB]	30	30
Uplink C/(N+I) [dB]	20.9	10.3
Downlink Frequency (GHz)	11.826	11.906
Satellite TX antenna gain towards the RX ES [dBi]	29.4	30.8
Downlink Antenna feed flange power [dBW]	9.6	5.4
Downlink ES to Satellite Distance [km]	39633	37597
Downlink Free-Space Loss [dB]	205.9	205.5
RX ES antenna diameter [m]	1.2	4.5
RX ES antenna gain [dBi]	41.6	53.1
RX ES system noise temperature [K]	200	200
Downlink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	0.95	0.95
Downlink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	57.0	57.0
Downlink Thermal C/N [dB]	8.3	17.4
Downlink C/I (ASI) [dB]	17.1	28.6

Downlink C/I (Xpol) [dB]	30	30
Downlink C/I (IM) [dB]	30	30
Downlink C/(N+I) [dB]	7.7	16.6
Overall Link C/(N+I) [dB]	7.5	9.4
Required C/(N+I) [dB]	7.0	7.9
Margin [dB]	0.5	1.5

Table 5: Typical link budgets in Ka band

TX ES Location	**Mt. Jackson, VA (38.7N,78.6W)**	**Jacksonville, FL (30.3N,81.7W)**
RX ES Location	**Jacksonville, FL (30.3N,81.7W)**	**Mt. Jackson, VA (38.7N,78.6W)**
Emission BW [kHz]	10000	10000
Modulation type	QPSK	8PSK
Information (bit) rate [kbps]	13333	20000
FEC Rate	0.667	0.667
Uplink Frequency [GHz]	27.725	29.5625
Uplink ES antenna diameter [m]	4.5	0.6
Uplink ES antenna gain [dBi]	60.5	43.5
Uplink Antenna feed flange power [dBW]	10	12
Uplink ES to Satellite Distance [km]	37597	37124
Uplink Free-Space Loss [dB]	212.8	213.2
Satellite RX antenna gain towards the TX ES [dBi]	51.1	47.1
Satellite Rx system noise temperature [K]	871.0	871.0
Uplink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	6.2	7.9
Uplink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	220.4	243.0
Uplink Thermal C/N [dB]	30.8	9.6
Uplink C/I (ASI) [dB]	36.0	19.0
Uplink C/I (Xpol) [dB]	30	30
Uplink C/I (IM) [dB]	30	30
Uplink C/(N+I) [dB]	25.1	9.1
Downlink Frequency (GHz)	18.675	19.7625
Satellite TX antenna gain towards the RX ES [dBi]	45.1	49.1
Downlink Antenna feed flange power [dBW]	1.0	1.0
Downlink ES to Satellite Distance [km]	37124	37597
Downlink Free-Space Loss [dB]	209.3	209.9
RX ES antenna diameter [m]	0.6	4.5
RX ES antenna gain [dBi]	39.5	57.5
RX ES system noise temperature [K]	200	200
Downlink Atten. due to Rain, Cloud, and Atmospheric Gases [dB]	3.8	3

Downlink Noise Temp. Increase due to Rain, Cloud, and Atmospheric Gases [K]	169.1	144.7
Downlink Thermal C/N [dB]	5.5	28.0
Downlink C/I (ASI) [dB]	15.0	33.0
Downlink C/I (Xpol) [dB]	30	30
Downlink C/I (IM) [dB]	30	30
Downlink C/(N+I) [dB]	5.0	23.9
Overall Link C/(N+I) [dB]	4.9	8.9
Required C/(N+I) [dB]	3.9	7.9
Margin [dB]	1.0	1.0

A7. §25.114(d)(7): Information specified in §25.140(a) (Interference analysis and the compatibility of the proposed system with respect to authorized space stations within two degrees of T19V)

In this section the information specified in §25.140(a)[8] is presented (as required by §25.114(d)(7)).

§25.140(a) requests the demonstration of the compatibility of the proposed space system with any authorized space stations located within two degrees along the GSO arc. This demonstration is provided in this section.

Currently, the FCC database indicates the following satellites within two degrees of 63° WL with frequency bands that overlap with the T19V operating frequency bands:

- Telstar 14R (Estrela do Sul 2) at 63°W in Ku band
- Star One C1 at 65°W in Ku band
- Amazonas 2 at 61°W in Ku band
- Amazonas 3 at 61°W in Ku and Ka bands

Telstar 14R (Estrela do Sul 2) is owned and operated by a Telesat affiliate, and the design and operation of T19V will preclude interference from Telstar 14R to T19V or from T19V to Telstar 14R.[9] From the list above it can be seen that in Ku band there are adjacent satellites to T19V both at +2 degrees and at -2 degrees. In Ka band, there is currently only a satellite at +2 degrees away. However, to account for potential future satellites, in the

[8] 47 C.F.R. §25.140(a)

[9] An affiliate of Telesat will control both satellites and maintain them in the same orbital box of 63° W.L. ± .05° while executing maneuvers to ensure adequate physical separation at all times. To avoid electromagnetic interference issues, the transponders on the two satellites will be carefully controlled so that they will never operate co-frequency, co-coverage.

analysis below Ka band satellites both at +2 degrees and at -2 degrees away have been considered for the adjacent satellite interference (ASI) calculations.

An analysis was performed to calculate the adjacent satellite interference (ASI). The results are summarized in Tables 6 to 11. Table 6 shows the uplink carrier to interference ratio (C/I) due to ASI in extended Ku-band and Table 7 shows the downlink C/I due to ASI in extended Ku-band. Table 8 shows the uplink carrier to interference ratio (C/I) due to ASI in standard Ku-band and Table 9 shows the downlink C/I due to ASI in standard Ku-band. Table 10 shows the uplink carrier to interference ratio (C/I) due to ASI in Ka-band and Table 11 shows the downlink C/I due to ASI in Ka-band. The details of the ASI calculations have been presented in Annex 1.

The ASI values presented in Tables 6 to 11 have been used in the link budget calculations of Table 3, Table 4, and Table 5. From Table 3, Table 4, and Table 5 it can be seen that the required carrier to noise plus interference ratios C/(N+I) are met. This shows that the T19V satellite network can perform efficiently with the ASI received from its adjacent satellites +/-2 degrees away. Similarly, considering that the T19V satellite network complies with all FCC Section 25 rules, including the off-axis uplink EIRP limits of §25.218 and §25.138 as well as downlink power flux density limits of §25.208 and §25.138, and that the adjacent satellites are at +2 and -2 degrees away (and not closer than 2 degrees away), it can be expected that the ASI from T19V into those adjacent satellites is at an acceptable level, too. The operation of the Telstar 14R satellite (also known as Estrela do Sul 2), with which T19V will be collocated at 63°W, has been coordinated in Ku band with the operators of Star One C1, Amazonas 2, and Amazonas 3.. In addition, Telesat is in the process of completing the frequency coordination of T19V in the Ka band with the operator of Amazonas 3. The operation of T19V will comply with the resulting coordination agreement.

Table 6: Uplink aggregate ASI from adjacent satellites at ±2 degrees away in extended Ku band

TX Earth Station Antenna Diameter (m)	uplink C/I due to ASI (dB)
4.5	29.9

Table 7: Downlink aggregate ASI from adjacent satellites at ±2 degrees away in extended Ku band

RX earth Station Antenna Diameter (m)	downlink C/I due to ASI (dB)
4.5	28.3

Table 8: Uplink aggregate ASI from adjacent satellites at ±2 degrees away in standard Ku band

TX Earth Station Antenna Diameter (m)	uplink C/I due to ASI (dB)
4.5	30.1
1.2	18.7

Table 9: Downlink aggregate ASI from adjacent satellites at ±2 degrees away in standard Ku band

RX earth Station Antenna Diameter (m)	downlink C/I due to ASI (dB)
4.5	28.6
1.2	17.1

Table 10: Uplink aggregate ASI from adjacent satellites at ±2 degrees away in Ka band

TX Earth Station Antenna Diameter (m)	uplink C/I due to ASI (dB)
4.5	36
0.6	19

Table 11: Downlink aggregate ASI from adjacent satellites at ±2 degrees away in Ka band

RX earth Station Antenna Diameter (m)	downlink C/I due to ASI (dB)
4.5	33
0.6	15

A8. §25.114(d)(14): Description of the design and operational strategies that will be used to mitigate orbital debris

§25.114(d)(14)(i), Debris Release Assessment. The T19V satellite is designed so that during its normal operation it will release no debris. The spacecraft hardware of T19V is designed so that individual faults will not cause the loss of the entire spacecraft. All critical components (e.g., computers and control devices) are built within the structure and shielded from external influences. Items that are not built within the spacecraft nor shielded (e.g., antennas) are able to withstand impact. The spacecraft can be controlled through both the normal payload antennas and wide angle antennas. The likelihood of both being damaged during a small body collision is minimal. The wide angle antennas on this spacecraft are open waveguides that point towards the earth (there is one set on each side of the spacecraft and either set could be used to successfully de-orbit the spacecraft). These wide angle antennas would continue to operate even if struck and bent.

§25.114(d)(14)(ii), Accidental Explosion Assessment. Telesat has reviewed failure modes for all equipment to assess the possibility of an accidental explosion onboard the

spacecraft. In order to ensure that the spacecraft does not explode on orbit, Telesat takes specific precautions. All batteries and fuel tanks are monitored for pressure or temperature variations. Alarms in the Satellite Control Center inform controllers of any variations. Additionally, long-term trending analysis is performed to monitor for any unexpected trends.

The batteries are operated utilizing the manufacturer's automatic recharging scheme. Doing so ensures that charging terminates normally without building up additional heat and pressure. As this process occurs wholly within the spacecraft, it also affords protection from command link failures (on the ground).

In order to ensure that the spacecraft has no explosive risk after it is successfully de-orbited, all stored energy sources onboard the spacecraft will be removed by venting the remaining propellant and venting the remaining helium pressurant. All propulsion lines and latch valves will be vented and left open. All battery chargers will be turned off and batteries will be left in a permanent discharge state. These steps will ensure that no buildup of energy can occur and therefore eliminate the risk of explosion in the years after the spacecraft is de-orbited.

§25.114(d)(14)(iii), Assessment Regarding Collision with Larger Debris and Other Space Stations. The T19V satellite will be operating at the 63°W orbital location. Currently Telesat operates the Telstar 14R satellite (also known as "Estrela do Sul 2") at 63°W. The Telstar 14R satellite has been operating at this orbital location since 2011 and Telesat has continuously monitored and minimized the probability of the space station becoming a source of debris due to collisions with large debris or other space stations. Telesat will use this same approach for T19V to minimize the probability of collisions with large debris.

Telesat will control Telstar 14R and T19V within the same orbital 'box' of 63°W±0.05°. Satellite maneuvers will be carefully managed to ensure that a safe flight profile is maintained at all times and that the risk of a physical collision is negligible. Telesat has operated co-located satellites at several orbital locations, using a variety of strategies, for periods ranging from days to many years, and has developed considerable expertise in the safe operation of co-located satellites. For example, Telesat currently operates three co-located satellites (Anik F1, Anik F1R, and Anik G1) under Industry Canada license at 107.3W.

In order to protect against collision with other orbiting objects, Telesat has a contract with MIT/Lincoln Labs to provide notification and high-precision orbits for drifter objects when close approaches with our operational satellites are projected. Processing of the notifications is fully automated to ensure efficient response should avoidance maneuver(s) be required to eliminate any threat of collision with a drifter object. For nearby operational satellites Telesat coordinates with operators directly and/or by providing ephemerides to the Space Data Center and the Joint Space Operations Center (JSpOC). The JSpOC also provides notifications to Telesat for any object they see approaching a Telesat satellite.

To further limit future potential for collision, Telesat will continue to monitor new satellite launches to ensure that future satellites do not present a danger to T19V. If a new satellite is located in the vicinity of T19V, Telesat will coordinate station keeping activities with the satellite operator to avoid any risk of collision.

§25.114(d)(14)(iv), Post-Mission Disposal Plans. At the end of life, the T19V satellite will be removed from its geostationary orbit at 63°W longitude and boosted to an orbit with a perigee altitude no less than 275 km above the geostationary orbit of 35786 km. This altitude is determined by using the FCC-recommended equation in §25.283(a) regarding end-of-life satellite disposal. The corresponding calculations for the T19V satellite are presented below:

Minimum De-orbit Altitude= 36021 km + (1000×CR×A/m)
Where:
CR = solar pressure radiation coefficient of the spacecraft = 1.24
A/m = area to mass ratio, in square meters per kilogram, of the spacecraft = 0.032
Resulting in:
Minimum De-orbit Altitude = 36021 km + (1000×1.24×0.032)
= 36061 km
(i.e. 275 km above the geostationary orbit of 35786 km)

The propellant needed to achieve the minimum de-orbit altitude is based on the delta-V required. Based on an estimated end-of-life mass of 3031 kg, and the delta-V required, approximately 12 kg of propellant will be reserved to ensure minimum de-orbit altitude is obtained. Any remaining propellant will be consumed by further raising the orbit until combustion is no longer possible. The remaining species of propellant, either Oxidizer (N204) or Fuel (MMH), will be vented, placing the propulsion system on the spacecraft in "safe" mode.

Propellant tracking is accomplished using a bookkeeping method as per industry standard. Using this method, the ground control station tracks the number of jet seconds utilized for station keeping, momentum control and other attitude control events. The amount of fuel used is determined from the number of jet seconds. This process is calibrated using data collected from thruster tests conducted on the ground and is found to be accurate to within a few months of life on the spacecraft.

Propellant Gauging System (PGS) tests can be performed throughout the operational life. This test uses heaters and heat transfer curves to determine the actual fuel still aboard the spacecraft. As the amount of fuel in the tanks decreases, the accuracy of the test results increases. Therefore, operationally, the PGS tests will be performed as the satellite approaches its end of propellant life in order to verify bookkeeping results.

A9. Sharing with NGSO FSS in the 28.6 – 29.1 GHz and 18.8 – 19.3 GHz Bands

Under the FCC's band plan, in the United States the 28.6 – 29.1 GHz band is available to the NGSO FSS on a primary basis and to the GSO FSS on a secondary basis. Stations operating in a secondary service cannot cause harmful interference to, nor seek interference protection from, stations of a primary service. Telesat's T19V operations in the United States in this band will be consistent with the obligations of a secondary user.

Under the FCC's band plan, in the United States the 18.8 – 19.3 GHz band is available on a primary basis only to the NGSO FSS. Telesat seeks a waiver to allow its T19V GSO network to operate in the 18.8 – 19.3 GHz band. Telesat will not cause harmful interference to, nor seek protection from, NGSO operations in this band. The analysis in this section demonstrates compatibility with NGSO FSS operations in these band segments.

The FCC has granted[10] O3b Limited ("O3b") access to the U.S. market. The grant covers O3b's constellation of 12 satellites that operate under the authority of the United Kingdom in the 18.8 - 19.3 GHz (space-to-Earth) and 28.6 – 29.1 GHz (Earth-to-space) on a primary basis. Interference analysis provided herein demonstrates that the T19V and O3b networks can operate without causing harmful interference to each other.

Currently, other than the O3B constellation there is no FCC-licensed NGSO space station that is authorized to operate in the 28.6 – 29.1 GHz and 18.8 – 19.3 GHz bands.

An interference analysis is presented below to show that the T19V and O3b networks can operate without causing harmful interference to each other. The Ka-band spot beams of T19V were presented earlier in this document in Figure 1. Among the spot beams shown in Figure 1, the only ones that operate in the bands 28.6-29.1 GHz and 18.8-19.3 GHz are listed in Table 12.[11]

Table 12: Ka-band spot beams that operate in the bands 28.6-29.1 and 18.8-19.3 GHz

Ka spot beam name in Figure 1	Uplink frequency band overlaps with the band 28.6-29.1 GHz (Yes or No)	Downlink frequency band overlaps with the band 18.8-19.3 GHz (Yes or No)
Saskatoon	Yes	Yes
CDN1	Yes	Yes
CDN2	Yes	Yes
CDN3	Yes	Yes
Campina Grande	Yes	Yes
Spokane	Yes	Yes
Riverside	Yes	Yes
A	Yes	Yes
2	Yes	Yes

[10] See File Nos. SAT-LOI-20141029-0018 and SAT-AMD-20150115-00004
[11] The detailed channel plan is presented in the Schedule S and is not repeated in this document

3	Yes	Yes
5	Yes	Yes
7	Yes	Yes
10	Yes	Yes

In the analysis presented below, the interference calculation is performed for each of the spot beams of Table 12. In order to consider the worst case scenario, it is assumed that both the T19V earth station and the O3b earth station are co-located and they are both at the boresight point in each of the spot beams of Table 12.

The O3b constellation consists of 12 satellites in a medium earth orbit with an altitude of 8062 km and an inclination of zero degrees (an equatorial orbit). The satellites use steerable gateway spot beams which are oriented towards the gateways as the satellite traverses its orbit until the angle of arrival at the gateway falls below a minimum. Table 13 shows the relevant parameters of the T19V network and the O3b system.

Table 13: Summary of T19V and O3b Parameters

Satellite Network	T19V	O3b
Earth Station Uplink Input Power Density (dBW/Hz)	-57	-55
Satellite Rx Peak Antenna Gain (dBi)	51.1	34.5
Satellite Rx System Noise Temperature (K)	870	1000
Satellite Peak Downlink EIRP Density (dBW/Hz)	-16.4	-28.32
Earth Station Rx System Noise Temperature (K)	200	230

In order to evaluate the interference impact of T19V to O3b and the interference impact of O3b to T19V, it was necessary to determine the smallest angular separation between the T19V satellite and any of the satellites of the O3b constellation from the earth station location. A series of calculations was performed to calculate the separation angle for each of the spot beams listed in Table 12. As mentioned earlier, in order to consider the worst case scenario, it was assumed that both the T19V earth station and the O3b earth station were co-located and they were both at the boresight point in each of the spot beams of Table 12. The separation angles as well as the slant range values (earth station to satellite distance) are summarized in Table 14.

Table 14: Worst-case separation angles and slant ranges

Ka spot beam name in Figure 1	Earth station latitude [° N]	Earth station longitude [° W]	Angular separation (viewed from earth station) [deg]	Earth station to O3B satellite distance [km]	Earth station to T19V satellite distance [km]
Saskatoon	52.1	106.7	18.1	11663.8	39736
CDN1	63.5	70	18.0	12923.0	39742
CDN2	64.75	81	17.9	13062.2	39993
CDN3	66	100	17.8	13201.2	40534
Campina Grande	-7.2	35.9	4.3	8151.6	36652
Spokane	47.66	117.4	17.8	11186.2	40090
Riverside	33.9	117.4	15.7	9813.6	39474
A	-18.5	70.3	10.4	8632.2	36226
2	-9.9	63.1	5.9	8230.3	35897
3	-18.2	45.2	10.2	8614.6	36494
5	-21.6	50.5	11.7	8827.8	36469
7	-27.2	53.3	13.8	9239.3	36695
10	-8	49	4.8	8172.4	36078

For each of the spot beams listed in Table 12 and Table 14, the interference potential from T19V satellite network to the O3b satellite network and from the O3b satellite network to the T19V satellite network was calculated. The details of these calculations for one of the spot beams (the Saskatoon spot beam) are shown in Table 15. From Table 15 it can be seen that the operation of the Saskatoon beam in the bands 28.6-29.1 GHz and 18.8-19.3 GHz will have a negligible impact on the O3b satellite network. Similarly, it can be seen that the impact of O3b on the operation of the Saskatoon beam is negligible. Specifically from Table 15 it can be seen that the calculated $\Delta T/T$ values are far below 6%.

Table 15: Details of interference analysis for the Saskatoon spot beam

Victim network		O3b	T19V
Interfering network		T19V	O3b
Victim ES latitude	° N	52.1	52.1
Victim ES longitude	° W	106.7	106.7

Uplink			
Frequency	GHz	28.7	28.7
Interfering ES uplink power density	dBW/Hz	-57.0	-55
Angular separation between the two satellites (viewd from the interfering ES)	°	18.1	18.1
Interfering ES off-axis Tx gain	dBi	-2.4	-2.4
Slant range (interfering path)	km	11663.8	39736
Free space path loss (interfering path)	dB	202.9	213.6
Victim satellite Rx peak antenna gain	dBi	34.5	51.1
Victim satellite Rx system noise temperature	K	1000	870
N_0	dBW/Hz	-198.6	-199.2
I_0	dBW/Hz	-227.9	-219.9
I_0/N_0	dB	-29.3	-20.7
$\Delta T/T$	%	0.1	0.9
Downlink			
Frequency Band	GHz	18.9	18.9
Interfering satellite downlink EIRP density	dBW/Hz	-16.4	-28.32
Slant range (interfering path)	km	39736	11663.8
Free space path loss (interfering path)	dB	210.0	199.3
Angular separation between the two satellites (viewd from the victim ES)	°	18.1	18.1
Victim ES off-axis Rx gain	dBi	-2.4	-2.4
Victim ES RX system noise temperature	K	230	200
N_0	dBW/Hz	-205.0	-205.6
I_0	dBW/Hz	-228.8	-230.0
I_0/N_0	dB	-23.8	-24.5
$\Delta T/T$	%	0.4	0.4

The above interference analysis was performed for all of the spot beams listed in Table 12 and Table 14. The summary results ($\Delta T/T$ values) are shown in Table 16. From Table 16 it can be seen that for the beams Saskatoon, CDN1, CDN2, CDN3, Spokane, Riverside, A, 3, 5, and 7, the $\Delta T/T$ values are below 6% and thus the operation of T19V in these beams is compatible with the operation of O3b, even in the worst case scenario when both networks have earth stations co-located at the boresight of those beams. From Table 16 it can be seen that for the beams Campina Grande, 2, and 10, the worst-case $\Delta T/T$ values exceed 6%. Thus, the interference from T19V to O3b (and from O3b to T19V) has the potential to be unacceptable. It should be noted that, as shown in Table 13 and Table 15, these results are based on the peak uplink and downlink power levels and also they are based on the worst-case assumption that both networks have earth stations co-located at

the boresight of the above-mentioned spot beams. Currently Telesat is in the process of completing coordination of the T19V satellite network with the O3b satellite network. Telesat will abide by the terms of that coordination agreement. If that coordination requires Telesat to operate at reduced power levels, Telesat will comply with those requirements. Furthermore, if in the worst-case, the coordination requires Telesat to avoid operating in any of those beams Telesat will comply with that requirement.

Table 16: Summary results of interference analysis for all the spot beams operating in the bands 18.8-19.3 GHz and 28.6-29.1 GHz

Ka spot beam name in Figure 1	Victim network	Interfering network	Uplink ΔT/T [%]	Downlink ΔT/T [%]
Saskatoon	O3b	T19V	0.1	0.4
	T19V	O3b	0.9	0.4
CDN1	O3b	T19V	0.1	0.4
	T19V	O3b	0.9	0.3
CDN2	O3b	T19V	0.1	0.4
	T19V	O3b	0.9	0.3
CDN3	O3b	T19V	0.1	0.4
	T19V	O3b	0.8	0.3
Campina Grande	O3b	T19V	8.5	17.3
	T19V	O3b	35.2	25.8
Spokane	O3b	T19V	0.1	0.4
	T19V	O3b	0.9	0.4
Riverside	O3b	T19V	0.2	0.6
	T19V	O3b	1.2	0.7
A	O3b	T19V	0.9	2.0
	T19V	O3b	4.1	2.6
2	O3b	T19V	3.9	8.4
	T19V	O3b	17.1	11.8
3	O3b	T19V	0.9	2.1
	T19V	O3b	4.2	2.7
5	O3b	T19V	0.6	1.5
	T19V	O3b	3.0	1.8
7	O3b	T19V	0.4	1.0
	T19V	O3b	1.9	1.1
10	O3b	T19V	6.6	13.8
	T19V	O3b	28.1	19.9

Annex 1 to Attachment A

Details of the methodology for the calculation of C/I due to adjacent satellite interference

In this annex, the details of the methodology for the calculation of the carrier to interference ratio (C/I) due to the adjacent satellite interference (ASI) are presented and it is shown how the uplink and downlink C/I values of Tables 6-11 have been computed.

Currently, the FCC database indicates the following satellites within 2 degrees of 63° WL with frequency bands that overlap with the T19V operating frequency bands:

- Star One C1 at 65W in Ku band
- Amazonas 2 at 61W in Ku band
- Amazonas 3 at 61W in Ku and Ka bands

From the list above it can be seen that in Ku band there are adjacent satellites to T19V both at +2 degrees and at -2 degrees. In Ka band, there is currently only a satellite at +2 degrees away. However, to account for potential future satellites, in the analysis below Ka band satellites both at +2 degrees and at -2 degrees away have been considered for the adjacent satellite interference (ASI) calculations.

Table A1shows the calculation details of the uplink C/I due to ASI in standard Ku-band from an adjacent satellite 2° away from T19V. Table A2 shows the calculation of the aggregate uplink ASI in standard Ku-band from adjacent satellites at ±2° away from T19V.

The calculation for downlink C/I due to ASI in standard Ku-band from an adjacent satellite 2° away from T19V is shown in Table A3. The calculation of the aggregate downlink ASI in standard Ku-band from adjacent satellites at ±2° away from T19V is shown in Table A4.

As described above, Tables A1, A2, A3, and A4 show the methodology for the calculation of ASI in standard Ku-band. The same methodology has been used in extended Ku-band as well as Ka-band.

Table A1: Calculation of uplink C/I due to ASI in standard Ku-band from an adjacent satellite network 2° away

T19V Orbital Location	Deg WL	63	63
Adjacent Satellite Location at 2 degrees away	Deg WL	61	61
Station Keeping Tolerance	Deg	0.05	0.05
Minimum Geocentric Effective Separation	Deg	1.9	1.9
Topocentric Separation (θ)	Deg	2.0	2.0
Uplink ASI C/I Calculation			
Frequency	GHz	14.126	14.206
T19V TX Earth Station			
Antenna Diameter	m	4.5	1.2
Antenna Gain	dBi	54.6	43.2
Adjacent Satellite Network TX Earth Station			
Antenna Off-axis gain toward T19V (29-25log(θ))	dBi	21.5	21.5
C/I (Uplink ASI)	dB	33.1	21.7

Table A2: Aggregate uplink ASI in standard Ku-band from adjacent satellites +/- 2 degrees away

T19V TX Earth Station Antenna Diameter	m	4.5	1.2
Uplink C/I due to ASI from the adjacent satellite +2 degrees away	dB	33.1	21.7
Uplink C/I due to ASI from the adjacent satellite -2 degrees away	dB	33.1	21.7
Aggregate Uplink C/I due to ASI	**dB**	**30.1**	**18.7**

Table A3: Calculation of <u>downlink</u> C/I due to ASI in standard Ku-band from an adjacent satellite network 2° away

T19V Orbital Location	Deg WL	63	63
Adjacent Satellite Location at 2 degrees away	Deg WL	61	61
Station Keeping Tolerance	Deg	0.05	0.05
Minimum Geocentric Effective Separation	Deg	1.9	1.9
Topocentric Separation (θ)	Deg	2.0	2.0
Downlink ASI C/I Calculation			
Frequency	GHz	11.826	11.906
T19V RX Earth Station			
Antenna Diameter	m	1.2	4.5
Antenna Gain	dBi	41.6	53.1
Antenna Off-axis gain toward Adjacent Satellite (29-25log(θ))	dBi	21.5	21.5
C/I (Downlink ASI)	dB	20.1	31.6

Table A4: Aggregate <u>downlink</u> ASI in standard Ku-band from adjacent satellites +/- 2 degrees away

T19V RX Earth Station Antenna Diameter	m	1.2	4.5
Downlink C/I due to ASI from the adjacent satellite +2 degrees away	dB	20.1	31.6
Downlink C/I due to ASI from the adjacent satellite -2 degrees away	dB	20.1	31.6
Aggregate Downlink C/I due to ASI	**dB**	**17.1**	**28.6**

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

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