EXHIBIT 4

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

In the Matter of	)	
	)	
Telesat Canada	)	File No. _____
	)	
Petition for Declaratory Ruling to Add Anik F1 to the Permitted Space Station List	)	

PETITION FOR DECLARATORY RULING

I. INTRODUCTION

Telesat Canada ("Telesat") respectfully petitions the Federal Communications Commission, pursuant to Section 25.137 of the Commission's rules and the *DISCO II Reconsideration Order*,[1] for a declaratory ruling providing U.S. market access for Telesat's Anik F1 satellite by adding it to the Permitted Space Station List ("Permitted List").

Anik F1 is currently deployed at the 107.3° WL orbital location, under Canadian authority. Telesat has requested approval from Canada's licensing authority, Innovation, Science and Economic Development Canada, to relocate Anik F1 to the 109.2°WL orbital location and to operate it in an inclined orbit. The market access approval herein requested is to allow communications with Anik F1 at the 109.2° WL orbital location.[2] At this orbital location, Anik

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[1] *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*").

[2] Anik FI was previously authorized by the Commission to be on its Permitted List at the 107.3° WL orbital location. *Telesat Canada, Petition for Declaratory Ruling for Inclusion of ANIK F1 on the Permitted Space Station List*, FCC File No. SAT-PDR-20000420-00083Order, 15 FCC Rcd 24828 (2000), and *Telesat Canada, Petition for Declaratory Ruling for Inclusion of ANIK F1 on the Permitted Space Station List*, FCC File No. SAT-PDR-20000420-00083, Order, 16 FCC Rcd 16365 (2001).

F1 will be capable of providing fixed-satellite services to the southeastern United States and countries in the Caribbean and Central America including for aero and maritime customers.

Telesat's request is limited to services covered by the WTO Basic Telecommunications Agreement; Telesat does not seek authority to provide direct-to-home, Direct Broadcast Satellite, or Digital Audio Radio Service services in the United States. The request also is limited to conventional Ku-band frequencies.

Grant of Telesat's petition for declaratory ruling is in the public interest. A grant will provide the benefits of competition associated with using a Ku-band satellite at 109.2° WL to serve the United States. Telesat demonstrates below that Anik F1 satisfies all of the requirements for U.S. market entry to be added to the Permitted List.

II. ANIK F1 SATISFIES THE REQUIREMENTS FOR ENTRY ON THE PERMITTED SPACE STATION LIST.

In the *DISCO II Reconsideration Order*, the Commission held that a non-U.S. licensed satellite may be included on the Permitted List 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.[3] Section 25.114 establishes the technical and legal qualification requirements for space station applicants. Section 25.137 sets forth entry requirements for satellites licensed outside the United States. And under the "other public interest concerns" part of the *DISCO II* standard, the Commission considers spectrum availability and evaluates whether

[3] *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.").

there are any national security, law enforcement, foreign policy, or trade concerns. The proposed operation of Anik F1 to serve the United States satisfies all of these tests.

A. Technical Qualifications

Proposed operations would be limited to a single beam with a total of 16 transponders, each with a bandwidth of 27 MHz. The uplink and downlink frequencies all fall within the standard Ku band. The uplink band 14.0-14.5 GHz is connected to the downlink band 11.7-12.2 GHz. The attached technical exhibit and the Schedule S that are filed with this petition establish that, subject to the two waiver requests that are shown in Section III below, the proposed operation of Anik F1 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's legal qualifications. Telesat notes, moreover, that it and its affiliates have been found to be legally qualified for a grant of market access and to hold Commission licenses on multiple occasions.

C. Section 25.137 Requirements

Section 25.137 of the Commission's rules identifies several factors to be considered in a request for U.S. market access through non-U.S. licensed space stations. Telesat highlights the following provisions of Section 25.137 of the Commission's rules that are relevant to this application:

Section 25. 137(a)(Effect on competition in the United States)

Section 25.137(a) of the Commission's rules[4] requires those requesting U.S. market access for a non-U.S.-licensed space station to demonstrate either that: (1) U.S.-licensed satellites have effective competitive opportunities to provide analogous services in the country in which the space station is licensed and all countries in which communications with the U.S. earth station will originate or terminate, or (2) the licensing jurisdiction is a World Trade Organization ("WTO") member country.[5] Telesat satisfies this requirement. Anik F1 will be operated in the United States under authority from Canada (ITU designation: CANSAT-64), which is a WTO member.

Section 25.137(b)(information that would be required for license application)

Section 25.137 (b) of the Commission's rules[6] requires those requesting U.S. market access for a non-U.S.-licensed space station to provide information of the kind that is specified in Section 25.114 of the Commission's rules to be filed by an applicant for a space station license, including a completed Schedule S. All required information is provided in this petition, the attached technical exhibit, and the completed FCC Form 312 and Schedule S that is filed with this petition.

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[4] 47 C.F.R. § 25.137(a).

[5] This rule implements the portion of the *DISCO II Order* establishing a presumption that granting applications to provide service in the United States via satellites licensed by WTO members will enhance competition and therefore is in the public interest. See *Amendment of the Commission's Regulatory Policy to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Service in the United States*, 12 FCC Rcd 24094, ¶ 29 (1997) ("*DISCO II Order*").

[6] 47 C.F.R. § 25.137(b)

25.137(c)(Consideration before later-filed applications)

Section 25.137(c) of the Commission's rules[7] allows a petition requesting U.S. market access for a non-U.S.-licensed satellite system to be considered before later-filed applications of other U.S. satellite system operators, among other reasons, if the non-U.S.-licensed satellite system has been submitted for coordination to the International Telecommunication Union (the "ITU"). That is here the case. Anik F1 will operate under the CANSAT-64 satellite network, which has been notified at the ITU.

25.137(d)(1) (Milestones)

Section 25.137(d)(1) of the Commission's rules[8] requires those requesting U.S. market access to demonstrate compliance with satellite launch and operation milestones. The milestones for GSO systems like Anik F1 are set forth in Section 25.164(a) of the Commission's rules.[9] Anik F1 has already been launched and placed into operation, but not yet at the orbital location herein specified for market access, 109.2° WL. Telesat anticipates that Anik F1 will be in operation at that orbital location, and that the milestone requirements therefore will have been satisfied, prior to Commission action on this petition. Telesat acknowledges, however, that the provision of service to the U.S. market via Anik F1 will be subject to the Commission's milestone requirements in the event the satellite is not in service at the time of a grant.

[7] 47 C.F.R. § 25.137(c).

[8] 47 C.F.R. § 25.137(d)(1).

[9] 47 C.F.R. § 25.164(a).

Section 25.137(d)(4) (Posting of Bond)

Section 25.137(d)(4) of the Commission's rules[10] requires a bond to be posted in connection with filings involving non-U.S. licensed satellites that are not in orbit and operating at their assigned orbital location. As stated above, Anik F1 has been launched and placed into operation and it is anticipated Anik F1 will be in operation at the orbital location for which U.S. access rights are herein requested prior to Commission action on this petition. Telesat acknowledges, however, that the provision of service to the U.S. market via Anik F1 will be subject to the bond requirement in the event the satellite is not in service at the assigned orbital location at the time of a grant.

D Other Public Interest Factors

1. Effect on competition in the United States

This factor is addressed above with respect to satisfaction of Section 25.137(a) of the Commission's rules.

2. Spectrum availability

The Commission considers under the "other public interest factors" element of *DISCO II* whether access to the U.S. market would have an impact on spectrum availability.[11] 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.

Anik F1 satisfies this aspect of *DISCO II*. Anik F1 will operate at 109.2° WL and is compatible with other geostationary satellite orbit ("GSO") space stations from a spectrum

[10] 47 C.F.R. § 25.137(d)(4).

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

availability perspective. The compatibility of Anik F1 with satellites as close as two degrees away is demonstrated in the attached technical exhibit.

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.[12] The Commission has found in similar circumstances involving Telesat or its affiliates 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 Telesat's non-geostationary satellite orbit system and for the Telstar 19 VANTAGE satellite.[13] These findings apply with equal force to Telesat's request to add Anik F1 as a point of communication.

III. WAIVER REQUESTS

In connection with Telesat's proposed operation of Anik F1 at 109.2° WL, it requests waiver of: (i) Section 25.210(j) of the Commission's rules,[14] which ordinarily would require a station keeping tolerance of ± 0.05°; and (ii) Section 25.210(f) of the Commission's rules,[15]

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

[13] *Telesat International Limited Petition for Declaratory Ruling to Add Telstar 19 VANTAGE, a Ku-band and Ka-band Satellite, to the Permitted Station List*, FCC File No. SAT-PPL-20160225-00020 (granted Aug. 31, 2016). *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); *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation*, FCC File No. SAT-PDR-20161115-00108, Order and Declaratory Ruling, 32 FCC Rcd 9663 (2017); *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, FCC File No. SAT-PDR-20170301-00023, Order, 33 FCC Rcd 11469 (2018).

[14] 47 CFR §25.210(j).

[15] 47 CFR §25.210(f).

which requires full frequency reuse. Good cause for each of these waivers is demonstrated in the discussion below.

A. Station Keeping Waiver Request

Telesat requests a waiver permitting it to operate Anik F1 at 109.2° WL with a station keeping tolerance of ± 0.10°. Telesat can maintain a safe flight profile using this station keeping tolerance, which will lengthen the time during which Telesat is able to provide service via Anik F1.

Section 25.210(j) requires satellite operators to maintain station keeping within ± 0.05° of their assigned orbital longitude in the east/west direction, unless specifically authorized by the Commission to operate with a different longitudinal tolerance. On multiple occasions, the Commission has permitted an increased station keeping tolerance based on a finding that doing so would not adversely affect the operations of other spacecraft and would have benefits such as conserving fuel for future operations.[16] These grants have been subject to a condition that authority to operate with the larger tolerance must terminate in the event a satellite is launched into a location such that its station keeping volume would overlap a satellite's ± 0.10 degree station keeping volume, but would not overlap a ±0.05° degree station keeping volume, unless the satellite operator has successfully coordinated its physical operations with those of the other spacecraft. Telesat has no objection to a similar condition.

Telesat's proposal is consistent with these precedents. If Anik F1 operates with a ± 0.10° tolerance, it will come no closer than 0.75° to its nearest neighbors, EchoStar 10 (110.0° WL)

[16] *See, e.g., SES Americom, Inc. Application for Modification of Satcom SN-4 Fixed Satellite Space Station License,* 20 FCC Rcd 11542, 11545 (Sat. Div. 2005).

and DirecTV 5(110.1° WL).[17] Telesat provides orbital data to the CSpOC and the Space Data Association to maintain space situational awareness and receives close approach warnings from the CSpOC when warranted.

Furthermore, grant of Telesat's waiver request is in the public interest as it will allow Anik F1 to operate longer and more efficiently. Authorizing the proposed station keeping area will enable Telesat to maximize spacecraft life and fuel, thereby extending the time during which service can be provided. Moreover, given that Anik F1 will be operating at 109.2° WL in an inclined orbit, the additional proposed east-west movement will be small relative to the north-south daily motion and will not impact services that utilize tracking antenna systems.

B. Frequency Reuse Waiver Request

Anik F1 remains in good health with full redundancy of all critical subsystems required for inclined orbit operations. The satellite has 32 Ku-band transponders, 16 in each polarization; however, as a result of degraded solar array capability it is anticipated the satellite only will be capable of operating up to 16 transponders. Moreover, to avoid interference between Anik F1 at 109.2° WL and Anik G1 at 107.3° WL., it may prove necessary to operate with a single polarization on the uplink and the opposite polarization on the downlink. In anticipation of that possible limitation, Telesat seeks a waiver of the full frequency reuse requirement set forth in Section 25.210(f).

Operation of Anik F1 in this manner will advance the public interest by making service available from 109.2° WL that would not otherwise be provided. Further, Telesat is evaluating the prospects for locating a replacement satellite at that orbital location, and providing service

[17] The closest separation will occur when Anik F1 and EchoStar 10 are simultaneously at the closet edges of their respective station keeping boxes.

via Anik F1 in the interim could serve as a bridge to the replacement. Accordingly, there is good cause for a waiver, if needed, of Section 25.210(f).

IV. CONCLUSION

In view of the foregoing, grant of Telesat's petition is in the public interest, and it is respectfully requested that the Commission grant the petition and associated waiver requests expeditiously.

Respectfully submitted,
TELESAT CANADA

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Attachment A

Technical Exhibit for "Anik F1" Satellite at 109.2°WL

A1. Introduction

This document is the technical attachment to the Petition for Declaratory Ruling of Telesat Canada ("Telesat") to operate the *Anik F1 satellite* ("F1") at the 109.2° west longitude (WL) geostationary orbital location. The technical information 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 is provided in Schedule S.

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

F1 is licensed by Canada and is currently deployed at the 107.3° WL orbital location.[2] Telesat has requested approval from Canada's licensing authority, Innovation, Science and Economic Development (ISED) Canada to relocate F1 to the 109.2°WL orbital location and to operate it in an inclined orbit. The F1 satellite network as a whole will consist of the geostationary satellite at 109.2° WL and associated earth station facilities. At the new orbital location, F1 will be capable of providing fixed-satellite services (FSS) to the southeastern United States and countries in the Caribbean and Central America for aero and maritime customers. Coverage is provided by a single beam as shown in Figure 1.

A total of up to 16 transponders, each with bandwidth 27 MHz, will be implemented using the beam in Figure 1. The uplink and downlink frequencies all fall within the standard Ku band. As requested in §25.114(d)(1), the uplink

[1] 47 C.F.R. §25.114

[2] FCC File No. SAT-PDR-20000420-00083

band 14.0-14.5 GHz is connected to the downlink band 11.7-12.2 GHz. Telesat seeks FCC authority to operate F1 in these uplink and downlink frequency bands in conjunction with earth stations licensed by the FCC.

There are a total of 32 transponders on F1, with 16 in each polarization. Only a subset of, at most, 16 of the transponders will be active at any time. Since the active transponders may vary, Schedule S includes the technical details for all 32. It may be necessary to operate with a single polarization on the uplink and the opposite polarization on the downlink to avoid interference between Anik F1 at 109.2° WL and Anik G1 at 107.3° WL. All transponders have step attenuators that can be adjusted remotely by ground commands. 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[3]. The TT&C frequencies and polarization plan are provided in Schedule S. Primary F1 TT&C operations will be performed from the following location in Canada:

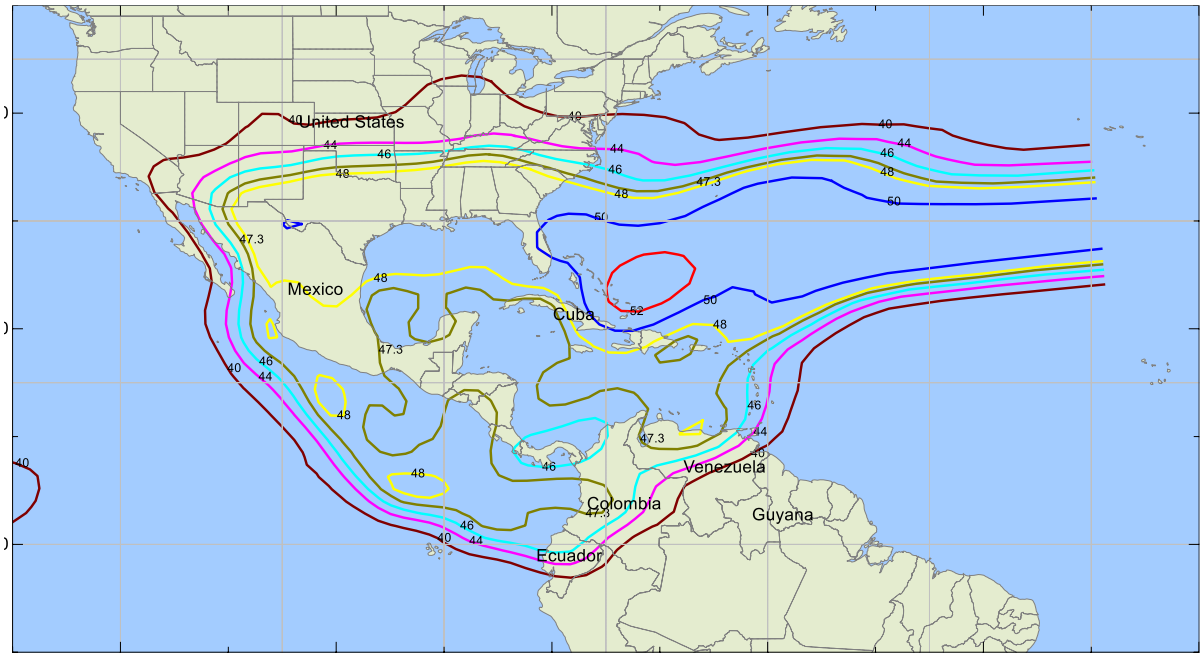
133438 Allan Park Road, Allan Park, ON, N4N 3B8, Canada
Phone: 1-519-371-7490

Backup F1 TT&C operations will be performed from the following location in the USA:

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

[3] 47 C.F.R. §25.207

Figure 1: Anik F1 Coverage at 109.2ºWL



Telesat plans to operate F1 in an inclined orbit at the 109.2°WL orbital location. The initial inclination will be 0°, with a rate of change of 0.9° per year. The expected end-of-life of the satellite, accounting for inclined orbit operation and the maneuvers specified under §25.283 of the Commission's rules, is up to three years from the date of this application.

A3. Space station antenna gain contours

The co-pol and cross-pol antenna gain contours for F1 have been provided in the GIMS database "GIMS_DB_F1.mdb", which is submitted with the Schedule S. The gain values of the contours in the GIMS database are relative to the peak gain. The peak gain values and polarization information is shown in Table 1.

Table 1: Peak antenna gain values

Uplink/ Downlink	Co-pol Antenna Peak Gain (dBi)	Cross-pol Antenna Peak Gain (dBi)	Polarization[4]
Downlink	32.1	1.1	H/V
Uplink	31.9	0.9	H/V

A4. Description of the types of services to be provided, areas served, transmission characteristics, performance objectives, link noise budget, typical earth station parameters, and modulation parameters

F1 can provide fixed-satellite services (FSS) to the southeastern United States and countries in the Caribbean and Central America. The services to be provided include customers in the aero and maritime market. Typical digital modulation and emission schemes that will be used, along with their performance objectives, are listed in Table 2.

Table 2: Typical modulation/emission schemes and the corresponding performance objectives

Modulation	FEC Rate	Emission Designator	Assigned BW (kHz)	Total C/(N+I) Objective (dB)
16APSK	8/9	22M5D7W	27000	13.6
QPSK	2/3	22M5G7W	27000	3.3
8PSK	6/7	1M00G1W	1200	12.3
BPSK (Spreading Factor 4)	2/3	1M12G1W	1250	-4.2

[4] It may be necessary to operate with a single polarization on the uplink and the opposite polarization on the downlink to avoid interference between Anik F1 at 109.2° WL and Anik G1 at 107.3° WL.

For maritime and aero services, a typical gateway earth station antenna diameter will be 7.0 m. A typical marine terminal antenna diameter will be 2.2 m. For aero service, a typical terminal will be a flat panel array with rectangular dimensions of 81 by 20 cm with performance approximately equivalent to a parabolic antenna with a diameter of 70 cm. The earth station antennas will meet the antenna performance requirements specified in §25.209[5] of the Commission's rules, and the uplink transmit power will comply with the requirements of §25.204. [6]

Typical link budgets and overall performance analysis, including the analysis of the effects of each contributing noise and interference source, are provided in Tables 3 and 4.

[5] 47 C.F.R. §25.209

[6] 47 C.F.R. §25.204

Table 3: Typical Maritime Link budgets

	Forward Link	Return Link
Uplink parameters		
Transmitting earth station site	Atlanta/U.S.A.	New Orleans/U.S.A.
Latitude (°N)	33.80	29.96
Longitude (°E)	275.65	269.90
Earth station to satellite distance (km)	37581.8	37117.6
Elevation angle (degrees)	42.7	49.5
Uplink Frequency (MHz)	14411.25	14411.25
Antenna diameter (m)	7	2.2
Antenna efficiency (%)	60.0%	65.7%
Antenna gain (dBi)	58.3	48.6
Earth station antenna pattern	ITU-R S.580-6	ITU-R S.580-6
Carrier input back-off (dB)	2.5	19.5
Uplink EIRP per carrier (dBW)	76.8	56.6
Transponder SFD from direction of Tx ES(dBW/m^2)	-83.8	-87.0
Antenna uplink pointing loss (dB)	0.3	0.5
Free-Space Loss (dB)	207.1	207.0
Uplink Propagation Loss Margin (dB)	0.3	0.3
Other losses (dB)	0	0
Carrier parameters		
Maximum clear sky throughput (Mbps)	75.43	2.57
Coding rate	0.84	0.86
Type of modulation	16APSK	8PSK
Carrier Symbol Rate (Msps)	22.5	1.0
Bandwidth roll-off factor	1.2	1.2
Occupied bandwidth per carrier (MHz)	27	1.2
Number of carriers per beam	1	22
Number of carriers per traveling-wave tube amplifier	1	22
Required Eb/No (dB)	8.3	8.2
Satellite parameters		
Maximum Satellite G/T (dB/K)	8.0	8.0
Satellite G/T towards transmitting earth station (dB/K)	4.3	4.0
Bandwidth per beam (MHz)	27	27
Bandwidth per traveling-wave tube amplifier (MHz)	27	27
Transponder input back-off (dB)	2.5	6.0
Transponder output back-off (dB)	1.5	4.0
Transponder operational mode	FGM	FGM
Saturated EIRP per transponder at beam peak (dBW)	53.4	53.4
Saturated EIRP per transponder toward the Rx ES (dBW)	48.9	49.4
Satellite EIRP toward receiving earth station (dBW)	47.4	45.4

Table 3 Cont'd

Downlink parameters		
Receiving earth station site	New Orleans/U.S.A.	Atlanta/U.S.A.
Latitude (°N)	29.96	33.80
Longitude (°E)	269.90	275.65
Slant range to the satellite (km)	37117.6	37581.8
Elevation angle (degrees)	49.5	42.7
Downlink frequency (MHz)	12111.25	12111.25
Antenna diameter (m)	2.2	7
Antenna efficiency (%)	65.7%	60.0%
Antenna gain (dBi)	47.1	56.8
Earth station antenna pattern	ITU-R S.580-6	ITU-R S.580-6
Carrier output back-off (dB)	1.5	17.5
Carrier downlink EIRP toward receiving earth station (dBW)	47.3	31.8
PFD Limit per Article 21.16 (dBW/m^2/MHz)	N/A	N/A
Carrier PFD per reference BW at the Rx Es (dBW/m^2/MHz)	-128.6	-130.7
Carrier PFD at the Rx ES (dBW/m^2)	-115.1	-130.7
Antenna noise temperature (K)	46	50
LNA/LNB noise temperature (K)	90	70
System noise temperature (K)	149.6	128.1
Receive earth station G/T (dB/K)	25.3	35.7
Antenna downlink pointing loss (dB)	0.5	0.3
Free-Space Loss (dB)	205.5	205.6
Downlink feeder loss (dB)	0.2	0.1
Downlink Propagation Loss Margin (dB)	0.2	0.2
Other losses (dB)	0	0
Interference summary		
Adjacent Satellite Interference C/I (dB)		
Uplink	32.6	22.6
Downlink	24.2	34.7
Co-Channel Interference C/I (dB)	0	0
Uplink	30	30
Downlink	30	30
Transponder HPA Intermodulation C/I (dB)	125.0	18.5
Adjacent Carrier Interference C/I (dB)	35.0	32.5
Transmitting earth station HPA Intermodulation C/I (dB)	38.5	31.5
Link Budget summary		
Uplink thermal C/N (dB)	28.4	21.4
Downlink thermal C/N (dB)	21.3	29.8
Overall link C/(N+I) (dB)	18.0	15.0
Required C/(N+1) (dB)	13.6	12.3
Link Margin (dB)	4.5	2.7
Spectrum efficiency (bps/Hz)	2.79	2.14

Table 4: Typical Aero Link Budgets

	Forward Link	Return Link
Uplink parameters		
Transmitting earth station site	Atlanta/U.S.A.	New Orleans/U.S.A.
Latitude (°N)	33.80	29.96
Longitude (°E)	275.65	269.90
Earth station to satellite distance (km)	37581.8	37117.6
Elevation angle (degrees)	42.7	49.5
Uplink Frequency (MHz)	14411.25	14411.25
Antenna diameter (m)	7	0.72
Antenna efficiency (%)	60.0%	6.4%
Antenna gain (dBi)	58.3	28.8
Earth station antenna pattern	ITU-R S.580-6	Complies with 47 CFR 25.209
Carrier input back-off (dB)	1.7	32.9
Uplink EIRP per carrier (dBW)	76.8	42.0
Transponder SFD from direction of Tx ES(dBW/m^2)	-84.6	-88.1
Antenna uplink pointing loss (dB)	0.3	0.3
Free-Space Loss (dB)	207.1	207.0
Uplink Propagation Loss Margin (dB)	0.3	0.3
Other losses (dB)	0	0
Carrier parameters		
Maximum clear sky throughput (Mbps)	28.28	0.67
Coding rate	0.63	0.67
Type of modulation	QPSK	BPSK
Carrier Symbol Rate (Msps)	22.50	1.00
Bandwidth roll-off factor	1.20	1.25
Occupied bandwidth per carrier (MHz)	27	5
Number of carriers per beam	1	5
Number of carriers per traveling-wave tube amplifier	1	5
Required Eb/No (dB)	2.3	3.6
Satellite parameters	0	0
Maximum Satellite G/T (dB/K)	8.0	.0
Satellite G/T towards transmitting earth station (dB/K)	4.3	4.0
Bandwidth per beam (MHz)	27	27
Bandwidth per traveling-wave tube amplifier (MHz)	27	27
Transponder input back-off (dB)	1.7	6.0
Transponder output back-off (dB)	0.5	4.0
Transponder operational mode	FGM	FGM
Saturated EIRP per transponder at beam peak (dBW)	53.4	53.4
Saturated EIRP per transponder toward the Rx ES (dBW)	48.9	49.4
Satellite EIRP toward receiving earth station (dBW)	48.4	45.4

Table 4 Cont'd

Downlink parameters		
Receiving earth station site	New Orleans/U.S.A.	Atlanta/U.S.A.
Latitude (°N)	29.96	33.80
Longitude (°E)	269.90	275.65
Slant range to the satellite (km)	37117.6	37581.8
Elevation angle (degrees)	49.5	42.7
Downlink frequency (MHz)	12111.25	12111.25
Antenna diameter (m)	0.72	7
Antenna efficiency (%)	70.0%	60.0%
Antenna gain (dBi)	37.7	56.8
Earth station antenna pattern	Complies with 47 CFR 25.209	ITU-R S.580-6
Carrier output back-off (dB)	0.5	30.9
Carrier downlink EIRP toward receiving earth station (dBW)	48.3	18.4
PFD Limit per Article 21.16 (dBW/m2/MHz)	N/A	N/A
Carrier PFD per reference BW at the Rx Es (dBW/m2/MHz)	-127.6	-144.1
Carrier PFD at the Rx ES (dBW/m2)	-114.1	-144.1
Antenna noise temperature (K)	327	50
LNA/LNB noise temperature (K)	30	70
System noise temperature (K)	359.8	128.1
Receive earth station G/T (dB/K)	12.1	35.7
Antenna downlink pointing loss (dB)	0.3	0.3
Free-Space Loss (dB)	205.5	205.6
Downlink feeder loss (dB)	0	0.1
Downlink Propagation Loss Margin (dB)	0.2	0.2
Other losses (dB)	0	0
Interference summary		
Adjacent Satellite Interference C/I (dB)		
Uplink	32.6	5.6
Downlink	7.1	34.7
Co-Channel Interference C/I (dB)	0	0
Uplink	30	30
Downlink	30	30
Transponder HPA Intermodulation C/I (dB)	126.0	13.1
Adjacent Carrier Interference C/I (dB)	36.0	103.1
Transmitting earth station HPA Intermodulation C/I (dB)	38.5	11.1
Link Budget summary		
Uplink thermal C/N (dB)	28.4	7.0
Downlink thermal C/N (dB)	9.4	16.4
Overall link C/(N+I) (dB)	5.0	2.0
Required C/(N+1) (dB)	3.3	-4.2
Link Margin (dB)	1.7	6.2
Spectrum efficiency (bps/Hz)	1.1	0.1

A5. Power flux density compliance

F1's antenna gain contours are provided in a GIMS database file that is submitted with the Schedule S, and the peak EIRP levels are provided in Schedule S. Since F1 operates only in standard-Ku band, there are no applicable FCC limits in §25.208[7] or §25.138[8] or in the ITU Radio Regulations.

A6. §25.114(d)

F1 operations at 109.2° WL will provide new capacity to support aero and maritime services in the Unites States, the Caribbean, and Central America. Customers will benefit from rate competition and a greater diversity of possible services. Grant of this application will therefore be in the public interest.

A7. §25.114(d)(7): Information specified in §25.140(a) (Interference analysis and the compatibility of the proposed system two degrees from any authorized space station)

In this section the information specified in §25.140(a)[9] is presented (as required by §25.114(d)(7)): the demonstration of the compatibility of the proposed space station within two degrees of any authorized space station.

There are currently three geostationary satellites within two degrees of 109.2° WL with frequency bands that overlap those of F1. Two are collocated at 107.3° WL: Anik F1R and Anik G1. In addition, Anik F2 is located at 111.1° WL. All four of these satellites are owned and operated by Telesat.

[7] 47 C.F.R. §25.208

[8] 47 C.F.R. §25.138

[9] 47 C.F.R. §25.140(a)

In this analysis, earth station (ES) antenna diameters of 2.2 m and 0.7 m (user terminals) and 7.0 m (gateways) are considered for the F1 satellite network and the adjacent satellites. Table 5 shows the uplink carrier to interference ratios (C/I) due to ASI and Table 6 shows the downlink C/I due to ASI. The details of the ASI calculations have been presented in Annex 1.

The ASI values presented in Tables 5 and 6 were used in the link budget calculations in Tables 3 and 4. Those calculations indicate that the required carrier to noise plus interference ratios C/(N+I) are met. This confirms that the F1 satellite network can perform efficiently with the presence of Anik F2 and Anik F1R/G1 – each within 1.9° of F1. Similarly, it follows that the ASI from F1 into these adjacent satellite networks will be acceptable. Furthermore, since Telesat and its affiliates own and operate all the satellites mentioned, it can self-coordinate by adjusting uplink and downlink power levels as required.

Table 5: Uplink aggregate ASI from adjacent satellites at ±1.9 degrees away

TX Earth Station Antenna Diameter (m)	**Uplink C/I due to ASI (dB)**
0.7 (equivalent)	5.6
2.2	22.6
7.0	32.6

Table 6: Downlink aggregate ASI from adjacent satellites at ±1.9 degrees away

RX earth Station Antenna Diameter (m)	**Downlink C/I due to ASI (dB)**
0.7 (equivalent)	7.1
2.2	24.2
4.6	34.7

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. F1 has been designed so that in the normal operation of the satellite no debris will be released by the spacecraft. Its hardware has been designed so that individual faults will not cause the loss of the entire spacecraft. All critical components (e.g., computers and control devices) have been built within the structure and shielded from external influences. Items that could neither be 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 has been successfully de-orbited, stored energy sources onboard the spacecraft will be removed by venting excess propellant, and all propulsion lines and latch valves will be vented and left open.

§25.114(d)(14)(iii), Assessment Regarding Collision with Larger Debris and Other Space Stations. F1 has been operating at the 107.3° WL orbital location since 2000 and Telesat has regularly monitored and minimized the probability of the space station becoming a source of debris by collisions with large debris or other space stations. Telesat will use the same approach for F1 at its new 109.2° WL orbit location to minimize the probability of collisions with large debris.

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 the drifter object. For nearby operational satellites Telesat coordinates with operators directly and/or by providing ephemerides to the Space Data Center and the Combined Space Operations Center (CSpOC). The CSpOC 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

F1. If a new satellite is located in the vicinity of F1, Telesat will coordinate station keeping activities with the satellite operator to avoid any risk of collision.

Combined, these systems constitute a best practice approach to collision avoidance.

§25.114(d)(14)(iv), Post-Mission Disposal Plans. At end-of-life, F1 will be removed from its geostationary orbit at 109.2° WL to an altitude with a perigee no less than 290.1 km above the standard geostationary orbit of 35786 km. This altitude is determined by using the FCC-recommended equation in section 25.283(a)[10] regarding end-of-life satellite disposal.

Sufficient amount of propellant will be reserved to ensure that the 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 propellant will be vented, placing the propulsion system on the spacecraft in "safe" mode.

Propellant tracking is accomplished using a bookkeeping method consistent with industry standards. 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 has been calibrated using data collected from thruster tests conducted on the ground and has been found to be accurate to within a few months of life on the spacecraft.

[10] 47 C.F.R. §25.283(a)

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.

Due to degraded solar array capability, the operation of the satellite's payload is limited to the reduced number of, at most, 16 active Ku transponders to remain within the available power. The satellite is in good health with full redundancy of all critical subsystems required for inclined orbit operations. It may be necessary to operate with a single polarization on the uplink and the opposite polarization on the downlink to avoid interference between Anik F1 at 109.2° WL and Anik G1 at 107.3° WL. Accordingly, in the Petition for Declaratory Ruling that this exhibit accompanies, Telesat is requesting a waiver of the full frequency reuse requirement of Section 25.210(f).

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 in Tables 5 and 6 were calculated.

Anik F1R and F2 provide a DTH (Direct To Home) service at Standard-Ku band exclusively to the Canada market. This service is vulnerable to ASI due to the small terminals used. Telesat has conducted analysis to ensure there is sufficient geographic separation between the nominal coverage of F1 in Figure 1 and the Canadian border, to ensure there is no impact on the DTH service.

Anik F2 also provides FSS service in the United States, and Anik G1 provides FSS service in South America. Since these areas overlap with those proposed for F1, interference analysis is necessary. The following considers 7.0 m, 2.2 m and 0.7 m (equivalent) Ku-band earth station within the F1 satellite network, and calculates uplink and downlink C/I due to ASI from the three adjacent satellites ±1.9° away from F1.

Table A1 shows the calculation details of the uplink ASI C/I due to earth stations transmitting to Anik F2, Anik F1R, and Anik G1. The on-bore uplink power densities for the antennas are the respective maximum coordinated limits.

Table A2 shows the aggregate uplink ASI due to one earth station transmitting to Anik G1, another transmitting to Anik F2, and a third to Anik F1R -- all at the same frequency.

The calculation details for downlink C/I due to ASI from Anik F2, Anik G1, and Anik F1R are shown in Table A3. The calculations of the maximum aggregate downlink ASI are shown in Table A4. Since the overlap of Anik G1 and Anik F2's coverage falls in an area where each satellite's power is significantly lower than at its beam peak, the maximum aggregate downlink ASI is an upper bound on the actual value.

Table A1: Calculation of uplink ASI C/I due to earth stations transmitting to Anik F2, Anik F1R & Anik G1 South America at 1.9° away

Anik F1 Orbital Location	Deg WL	109.2	109.2	109.2
Anik F2 Location at 1.9 degrees away	Deg WL	111.1	111.1	111.1
Anik F1R/G1 Location at 1.9 degrees away	Deg WL	107.3	107.3	107.3
Station Keeping Tolerance	Deg	0.05	0.05	0.05
Minimum Geocentric Effective Separation	Deg	1.9	1.9	1.9
Topocentric Separation (θ)	Deg	2.1	2.1	2.1
Uplink ASI C/I Calculation				
Frequency	GHz	14.25	14.25	14.25
Anik F1 TX Earth Station				
Antenna Type		Gateway	Maritime	Aero
Antenna Diameter	m	7	2.2	0.7 (equiv.)
Antenna Gain	dBi	58.5	48.5	28.5
Location		Atlanta, GA	New Orleans, LA	New Orleans, LA
TX power Density at Antenna input Flange	dBW/Hz	-55	-55	-52
UEIRP density	dBW/Hz	3.5	-6.5	-23.5
Anik F2 TX Earth Station				
Antenna Off-axis gain toward Anik F1 (29-25log(θ))	dBi	20.9	20.9	20.9
TX power Density at Antenna input Flange	dBW/Hz	-55	-55	-55
UEIRP density toward Anik F1	dBW/Hz	-34.1	-34.1	-34.1
C/I (Uplink ASI)	dB	37.6	27.6	10.6
Anik F1R TX Earth Station				
Antenna Off-axis gain toward Anik F1 (29-25log(θ))	dBi	20.9	20.9	20.9
TX power Density at Antenna input Flange	dBW/Hz	-52	-52	-52
UEIRP density toward Anik F1	dBW/Hz	-31.1	-31.1	-31.1
C/I (Uplink ASI)	dB	34.6	24.6	7.6
Anik G1 TX Earth Station				
Antenna Off-axis gain toward Anik F1 (29-25log(θ))	dBi	20.9	20.9	20.9
TX power Density at Antenna input Flange	dBW/Hz	-52	-52	-52
Xpol UEIRP density toward Anik F1	dBW/Hz	-41.1	-41.1	-41.1
C/I (Uplink ASI)	dB	44.6	34.6	17.6

Table A2: Aggregate uplink ASI from Anik F2, Anik F1R & Anik G1

Uplink C/I due to ASI from Anik F2	dB	37.6	27.6	10.6
Uplink C/I due to ASI from Anik F1R	dB	34.6	24.6	7.6
Uplink C/I due to ASI from Anik G1	dB	44.6	34.6	17.6
Aggregate Uplink C/I due to ASI	**dB**	**32.6**	**22.6**	**5.6**

Table A3: Calculation of downlink ASI C/I for a receive earth station antenna due to ASI from Anik F2, Anik F1R and Anik G1 at 1.9° away

Anik F1 Orbital Location	Deg WL	109.2	109.2	109.2
Anik F2 Location at 1.9 degrees away	Deg WL	111.1	111.1	111.1
Anik F1R/G1 Location at 1.9 degrees away	Deg WL	107.3	107.3	107.3
Station Keeping Tolerance	Deg	0.05	0.05	0.05
Minimum Geocentric Effective Separation	Deg	1.9	1.9	1.9
Topocentric Separation (θ)	Deg	2.1	2.1	2.1
Downlink ASI C/I Calculation				
Frequency	GHz	11.95	11.95	11.95
Anik F1 Receive Earth Station				
Antenna Type		Gateway	Maritime	Aero
Antenna Diameter	m	7	2.2	0.7 (equiv)
Location		Atlanta, GA	New Orleans, LA	New Orleans, LA
Antenna Gain	dBi	57	46.9	37.4
Anik F1 DL EIRP at receive earth station location	dBW	49.3	48.76	48.76
Anik F2				
Antenna Off-axis gain toward Anik F2	dBi	20.9	20.9	28.5
Anik F2 DL EIRP at receive earth station location	dBW	46.9	46.4	46.4
C/I (Downlink ASI)	dB	38.5	28.36	11.26
Anik F1R				
Antenna Off-axis gain toward Anik F2	dBi	20.9	20.9	28.5
Anik F1R DL EIRP at receive earth station location	dBW	48.4	48.52	48.52
C/I (Downlink ASI)	dB	37	26.24	9.14
Anik G1				
Antenna Off-axis gain toward Anik F2 (29-25log(θ))	dBi	20.9	20.9	20.9
Anik G1 DL EIRP at receive earth station location	dBW	3.55	1.74	1.74
C/I (Downlink ASI)	dB	60.95	52.12	35.02

Table A4: Aggregate downlink ASI from Anik F2, Anik F1R and Anik G1

Downlink C/I due to ASI from Anik F2	dB	38.5	28.36	11.26
Downlink C/I due to ASI from Anik F1R	dB	37	26.24	9.14
Downlink Xpol C/I due to ASI from Anik G1	dB	60.95	52.12	35.02
Aggregate Downlink C/I due to ASI	**dB**	**34.7**	**24.2**	**7.1**

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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