

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

Application of	)	
	)	
<b>Ligado Networks Subsidiary LLC</b>	)	File No. SAT-AMD-_____
	)	Call Sign AMSC-1
For Modification of License to Operate	)	
MSAT-2 at 107.5°WL	)	

**AMENDMENT TO APPLICATION FOR MODIFICATION**

Ligado Networks Subsidiary LLC (“Ligado”) is licensed to operate a Mobile Satellite Service (“MSS”) satellite, MSAT-2 (call sign AMSC-1), at the 106.5° WL orbital location.<sup>1</sup> Ligado is filing this amendment to its pending fleet management application to instead request that the Commission modify the license for MSAT-2 to permit relocation of the satellite to the nominal orbital position of 107.3°WL for actual operation at 107.5° WL +/-0.1 degrees.<sup>2</sup>

As discussed below and in the attached Technical Exhibit, Ligado has coordinated the relocation of MSAT-2 with affected satellite operators, the relocation of the satellite will not

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<sup>1</sup> Memorandum Opinion, Order and Authorization, 4 FCC Rcd 6041 (1989); remanded by *Aeronautical Radio, Inc. v. FCC*, 928 F.2d 428 (D.C. Cir. 1991); Final Decision on Remand, 7 FCC Rcd 266 (1992); *aff’d*, *Aeronautical Radio, Inc. v. FCC*, 983 F.2d 275 (D.C. Cir. 1993); see also AMSC Subsidiary Corporation, Memorandum Opinion and Order, 8 FCC Rcd 4040 (1993); FCC File No. SAT-MOD-20180912-00070 (granted Nov. 29, 2018) (“2018 Relocation Modification”) (authority to move MSAT-2 to current location); FCC File No. SAT-MOD-20201201-00138 (granted Feb. 17, 2021) (extending MSAT-2 operations through Dec. 31, 2022).

<sup>2</sup> Ligado has already filed an application for Special Temporary Authority to drift MSAT-2 to the new location. *See* FCC File No. SAT-STA-20210406-00046 (filed Apr. 6, 2021). The details of that application are incorporated by reference. As noted below, because both MSAT-2’s current and intended locations are orbital locations under Canadian authority, Ligado has separately asked for authorization from Innovation, Science & Economic Development Canada (“ISED”) to relocate MSAT-2 and operate at the new location. Ligado will file the ISED authorization as soon as it is received.

cause harmful interference to other satellite operators, and the proposed license modification complies with the Commission's technical rules. Moreover, the station-keeping volume of MSAT-2 at the proposed new location will not overlap the station-keeping volume of any other satellite. A Schedule S attachment reflecting technical changes associated with the relocation of the satellite is provided with this application. As required by the Commission's rules,<sup>3</sup> Ligado hereby certifies that all other information related to MSAT-2's licensed operations and not addressed in this application has not changed.

For all of these reasons, Ligado submits that the Commission should grant this application for the relocation of MSAT-2.

### **Required Information for Application**

As provided under 47 C.F.R. §25.117(d)(1), Ligado files the following information required under 47 C.F.R. §25.114 that would change as a result of the application being granted. Information required under §25.114(c) has been provided with Schedule S. Information required under §25.114(d) and a request for authorization under §25.210(j) are provided below.

#### **§25.114(c)(5)(iii) and (iv), §25.210(j): East-west and north-south station-keeping range**

MSAT-2 has adopted an increasingly inclined orbit, which will continue to increase for several years after relocation to the new orbital location. Accordingly, to provide necessary flexibility for expected operations for the next five years and to extend MSAT-2 remaining fuel life, Ligado has indicated on Schedule S that the north-south station-keeping range should continue to be  $\pm 13.5^\circ$ , and, pursuant to §25.201(j), requests that the Commission authorize an east-west station-keeping range to  $\pm 0.1^\circ$ , as was previously authorized for MSAT-2's current

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<sup>3</sup>See 47 C.F.R. § 25.117(d)(1).

location.<sup>4</sup>

As noted above, these ranges will not result in any overlap with any neighboring satellites. The nearest existing satellites to the new orbital location will be Telesat's Anik-F1R and Anik G-1 satellites located at 107.3° WL. These satellites maintain station-keeping ranges of  $\pm 0.05^\circ$  each, so neither of them will overlap with MSAT-2's planned location at 107.5° WL and station-keeping range of  $\pm 0.1^\circ$ . Ligado has also reviewed planned satellites and determined that there will be no overlap with the nearest planned satellites. Ligado acknowledges and agrees that if a new satellite were to be placed in a location that could result in an overlap, Ligado will coordinate with the new satellite to establish an acceptable station-keeping range between 0.05 and 0.1 degrees.

**§25.114(d)(1): Overall description of system facilities, operations and services and explanation of how uplink frequency bands would be connected to downlink frequency bands**

MSAT-2 is currently deployed at 106.5° WL, an orbital location under Canadian authority to which MSAT-2 was moved in 2018 pursuant to the Commission consenting to relocation of MSAT-2 to that location.<sup>5</sup> By this application, Ligado seeks permission to move MSAT-2 to the physical 107.5° WL position, which was occupied by MSAT-1 until November, 2020, when MSAT-1 was placed in a disposal orbit and decommissioned. MSAT-1's nominal orbital location was 107.3° WL, but it operated at 107.5° WL to avoid overlap with Telesat's Anik satellites noted above, and MSAT-2 would similarly operate at 107.5° WL. As 107.3° WL is an orbital location under Canadian authority, Ligado filed an application on March 26, 2021 with ISED to establish telemetry, tracking and command ("TT&C") communications with

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<sup>4</sup> See 2018 Relocation Modification.

<sup>5</sup> *Id.*

MSAT-2 and will soon file a further application to operate the satellite's service and feeder links from the nominal 107.3° WL. Pursuant to existing interagency procedures as authorized by the ITU and as previously used by the FCC and ISED for MSAT-2's 2018 move, Ligado requests that the Commission indicate to ISED that it consents to relocating MSAT-2 to the nominal 107.3°WL position and to the actual operation of MSAT-2 at 107.5° WL.<sup>6</sup>

As MSAT-2 and MSAT-1 were built to the same design specifications, MSAT-2's operating characteristics and interference envelope are identical to those of MSAT-1. Thus, as further described below, relocation of MSAT-2 to the location previously occupied by MSAT-1 will not result in any interference environment that has not already been coordinated with other operators.

MSAT-2 does not provide service to customers given that it acts as a backup satellite to SkyTerra-1 for providing mobile satellite service (MSS) throughout North America, and Ligado plans to continue using MSAT-2 as a backup satellite at the new location. The relocation will thus not result in interruption of service for any customers.

In all other respects – use of frequencies for service links, feeder links and TT&C, connection of downlink and uplink frequency bands, operation with authorized earth station and mobile earth terminals, and all relevant technical parameters – MSAT-2 will operate in the new orbital location in exactly the same way as it has operated in its current orbital location.

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<sup>6</sup>See ITU, Radiocommunication Bureau, *WRC-12 decisions included in the Minutes of Plenary meeting relating to space services procedures*, Circular Letter CR/333 (2012) at 2 (citing (§3.12 Doc. CMR12/554); *see also* ITU, Radiocommunication Bureau, *Decisions of past WRCs concerning the application of the Radio Regulations*, Circular Letter CR/380 (2015) at 3 (same); *see, e.g.*, 2018 Relocation Modification; FCC File No. SAT-MOD-200160513-00050 (granted Aug. 18, 2016) (grant of authority to Skynet Satellite Corporation to operate satellite in Canadian orbital location).

**§25.114(d)(6): Public interest considerations in support of the grant**

Grant of the application is in the public interest because the relocation of the satellite, without interference or harm to other operators, will facilitate Ligado's continued efficient management of its satellites and orbital locations, and will also preserve the availability of backup service at an orbital location that Ligado has operated from for many years, thus helping to ensure continuity of service to its customers.

**§25.114(d)(7): Information specified in §25.140(a) regarding authorized co-frequency GSO space stations less than two degrees from 107.5° WL**

MSAT-2 will use feeder links in the Ku-band frequencies defined in Appendix 30B of the ITU Radio Regulations, TT&C operations in the standard Fixed Satellite Service Ku-band frequencies (12/14 GHz) and service frequencies in the L-band.

Ligado has determined that no other satellites will conduct co-frequency operations in MSAT-2's Ku-band feeder links or L-band service frequencies within 2 degrees of 107.5° WL.

With regard to other satellites that are co-frequency with MSAT-2's TT&C operations in the standard FSS Ku-band (12/14 GHz), as an initial matter MSAT-2's operating characteristics and interference envelope are identical to those of MSAT-1,<sup>7</sup> which operated in that location for five years without causing any harmful interference to other operators. Moreover, this location has already been coordinated with other operators assuming use by an MSAT-class satellite. Thus, placement of MSAT-2 will not create any new interference risk that has not already been discussed and resolved by the relevant operators.

Two other satellites share the standard FSS Ku-band (12/14 GHz) less than two degrees

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<sup>7</sup> MSAT-2 does differ slightly from MSAT-1 in one respect: MSAT-2 uses 11.7005 GHz as a backup TT&C frequency, while MSAT-1 used 11.70275 GHz as a backup.

from 107.5° WL: Anik-F1R at 107.3° WL, and Anik-G1 at 107.3° WL.<sup>8</sup> The Anik satellites are controlled by Telesat, the same entity that Ligado has contracted with to control MSAT-2, and their TT&C operations have been and will continue to be coordinated with Ligado.

**§25.114(d)(14): Information relevant to mitigation of orbital debris**

Ligado's orbital debris mitigation statement requires no modification as a result of the move and remains the same as has already been reviewed and authorized by the Commission.<sup>9</sup> With regard to post-mission disposal information required under 47 C.F.R. §25.114(d)(14)(iv), Ligado notes that after relocation MSAT-2 will reserve approximately 9.5 kg of propellant for final orbit raising maneuvers. Thus, Ligado will continue to be capable of disposing of MSAT-2 by moving it to a minimum altitude of 300 km above the GSO orbit at the end of its operational life.

**Specific Issues Related to Schedule S**

*Orbital Longitude*

As specified in Form 312 and this narrative, this application is for authorization to operate at 107.5° WL. The Schedule S online system, however, only shows orbital longitude as rounded integers, and as such the system will only show MSAT-2's orbital longitude as "107". This answer should be read, however, as 107.5.

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<sup>8</sup> At the time of the move authorized by the 2018 Relocation Modification, Anik-F1 was also located at 107.3° WL, but has since been moved to 109.2° WL. Please also note that Echostar-17 at 107.1° WL, but that satellite operates entirely in the Ka-band so an interference analysis is not required.

<sup>9</sup> See Application, FCC File No. SES-MFS-20070530-00731, at Technical Appendix 32-36 (filed May 30, 2007), *granted Comtech Mobile Data Corporation*, 7 FCC Rcd 5283 (2009); *see also* FCC File No. SAT-MOD-20100412-00075 (granted Nov. 8, 2010) (granting modification to statement and waiving 47 C.F.R. §25.283(c)).

### *Polarization Switchable*

For each beam, Schedule S asks whether the polarization for the beam is switchable. The online system does not, however, allow the insertion of a Yes or No answer to this question. The answer for all of MSAT-2's receiving and transmitting beams is "No."

### *Maximum Power Flux Density*

The Schedule S online system did not allow for provision of Maximum Power Flux Density values for transmitting beams KUaE, KUbE, OMNE or OMNa. These values are as follows:

#### KUaE

<b>BW:</b>	<b>0°-5° (dbW/m<sup>2</sup>/BW)</b>	<b>5°-10° (dbW/m<sup>2</sup>/BW)</b>	<b>10°-15° (dbW/m<sup>2</sup>/BW)</b>	<b>15°-20° (dbW/m<sup>2</sup>/BW)</b>	<b>20°-25° (dbW/m<sup>2</sup>/BW)</b>	<b>25°-90° (dbW/m<sup>2</sup>/BW)</b>
<b>Hz</b>	-159.6	-159.4	-159.3	-159.2	-159.1	-159.1

#### KUbE

<b>BW:</b>	<b>0°-5° (dbW/m<sup>2</sup>/BW)</b>	<b>5°-10° (dbW/m<sup>2</sup>/BW)</b>	<b>10°-15° (dbW/m<sup>2</sup>/BW)</b>	<b>15°-20° (dbW/m<sup>2</sup>/BW)</b>	<b>20°-25° (dbW/m<sup>2</sup>/BW)</b>	<b>25°-90° (dbW/m<sup>2</sup>/BW)</b>
<b>Hz</b>	-159.6	-159.4	-159.3	-159.2	-159.1	-159.1

#### OMNE

<b>BW:</b>	<b>0°-5° (dbW/m<sup>2</sup>/BW)</b>	<b>5°-10° (dbW/m<sup>2</sup>/BW)</b>	<b>10°-15° (dbW/m<sup>2</sup>/BW)</b>	<b>15°-20° (dbW/m<sup>2</sup>/BW)</b>	<b>20°-25° (dbW/m<sup>2</sup>/BW)</b>	<b>25°-90° (dbW/m<sup>2</sup>/BW)</b>
<b>Hz</b>	-209.0	-209.0	-209.0	-209.0	-209.0	-209.0

#### OMNa

<b>BW:</b>	<b>0°-5° (dbW/m<sup>2</sup>/BW)</b>	<b>5°-10° (dbW/m<sup>2</sup>/BW)</b>	<b>10°-15° (dbW/m<sup>2</sup>/BW)</b>	<b>15°-20° (dbW/m<sup>2</sup>/BW)</b>	<b>20°-25° (dbW/m<sup>2</sup>/BW)</b>	<b>25°-90° (dbW/m<sup>2</sup>/BW)</b>
<b>Hz</b>	-209.0	-209.0	-209.0	-209.0	-209.0	-209.0

### *Certifications*

The Schedule S online system allowed for the input of answers to all certification, but does not display answers for two of them. Those certifications with Ligado's answers are as follows:

- Are the applicable power-flux-density limits of 25.208 met, and is the appropriate technical showing provided within the application? Answer: N/A

- If the application is for a 17/24 GHz BSS space station, will it be operated at an offset location with full power and interference protection in accordance with 25.262(b)?

Answer: N/A

\* \* \*

Ligado respectfully requests that modification as amended by this filing be granted, allowing Ligado to relocate MSAT-2 to the nominal 107.3°WL orbital position for continued operation at 107.5° WL +/-0.1 degrees.

Respectfully submitted,

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April 12, 2021



## Technical Exhibit

### Feeder Link PFD Compliance Demonstration

The ITU maintains GSO satellite downlink PFD limits across the entire 10.7-11.7 GHz frequency band. *See* Article 21, Table S21-4, ITU Radio Regulation (2016). The Commission's rules specify identical PFD limits for GSO satellites operating in the 10.95-11.2 GHz and 11.45-11.7 GHz bands (47 C.F.R. § 25.114(c)(8)), but do not specify any PFD limits for GSO satellites operating in the 10.7-10.95 GHz or 11.2-11.45 GHz bands.

Table A-1 provides the power density for the feeder downlinks for the MSAT-2 carriers. Table A-2 calculates PFD on the ground based on the maximum density calculated in Table A-1 and compares it with the limits, showing positive margin in each case.

**Table A-1: Feeder Link (Return) EIRP Density (10.7 – 11.7 GHz)**

Carrier	EIRP (dBW)	BW (kHz)	EIRP Density (dBW/4 kHz)
CW	2.7	6	0.9
GC-S	2.7	6	0.9
QPSK-V	3.7	6	1.9
Maximum EIRP Density =			1.9

**Table A-2: Feeder Link (Return) PFD Compliance (10.7 – 11.7 GHz)**

Elevation Angle (degrees)	Slant (km)	Path Spreading Loss (dB-m <sup>2</sup> )	MSAT-2 Maximum Power Flux Density (dB(W/m <sup>2</sup> /4 kHz))	Maximum PFD Limit (dB(W/m <sup>2</sup> /4 kHz))	Margin (dB)
0	41,680	-163.4	-161.5	-150	11.5
5	41,128	-163.3	-161.4	-150	11.4
25	39,072	-162.8	-160.9	-140	20.9
90	35,787	-162.1	-160.1	-140	20.1

## **Two-Degree Interference Analysis**

The MSAT-2 feeder links operate in the Ku-band frequencies defined in Appendix 30B of the ITU Radio Regulations, and the MSAT-2 Telemetry, Tracking, and Command (“TT&C”) operations are in the standard Fixed Satellite Service (“FSS”) Ku-band frequencies (12/14 GHz). The respective interference analyses are provided below. The MSAT-2 service links operate in the L-band frequencies for which a two-degree analysis is not required.<sup>1</sup> Additionally, Ligado has coordinated the L-band operations of MSAT-1, which is identical to MSAT-2, with Inmarsat, Telecomm de Mexico (TdM), Russia (RSCC) and Ligado (Canada) Inc., the only potentially affected North American L-band satellite operators.

### *Interference Analysis for the Appendix 30B Ku-Band Carriers*

In the Appendix 30B plan,<sup>2</sup> following the retirement of MSAT-1, there are no active satellites within 2 degrees of 107.5° WL.

### *Interference Analysis for the FSS Ku-Band Carriers*

In the standard FSS Ku band (12/14 GHz), the other satellites sharing this band within 2 degrees of 107.5° WL are Anik-F1R at 107.3° WL and Anik-G1 at 107.3° WL. The two satellites at the nominal 107.3° WL position are controlled by Telesat as is the MSAT-2 satellite. Telesat is able to coordinate the TT&C of these three satellites so that they will not interfere with each other.

## **Conclusion**

Accordingly, based on the analysis provided above, operation of MSAT-2 at 107.5° WL complies with the Commission’s technical rules.

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<sup>1</sup> See 47 C.F.R. § 25.150(b); see also Letter to Lon Levin from Bob Nelson, File No. SAT- AMD-20031118-00335 (April 23, 2004).

<sup>2</sup> International Telecommunications Union Radio Regulations 2016, Appendix 30B, Article 10.

### **Technical Certification**

I, Maqbool Aliani, Chief Technology Officer for Ligado Networks Subsidiary LLC,  
certify under penalty of perjury that:

I am the technically qualified person with overall responsibility for preparation of the technical information contained in this application. I am familiar with the requirements of Part 25 of the Commission's rules, and the information contained in the application is true and correct to the best of my knowledge and belief.

/s/ Maqbool Aliani  
Maqbool Aliani

Dated: April 12, 2021