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LATHAM & WATKINS LLP

November 29, 2013

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Response to Request for Additional Information in Connection with Inmarsat Hawaii Inc. Letter of Intent Application
IBFS File No. SAT-LOI-20130319-00035, Call Sign S2897

Dear Ms. Dortch:

Inmarsat Hawaii Inc. ("Inmarsat Hawaii" and, together with its affiliates, "Inmarsat") hereby responds to the Commission's letter dated October 30, 2013 requesting that Inmarsat provide additional information in connection with the letter of intent application for the INMARSAT-KA 63W satellite ("Letter of Intent").

The Commission's letter requests a demonstration that the operation of INMARSAT-KA 63W would not cause harmful interference into the Amazonas-3 network. Inmarsat has reached an agreement with Hispamar Satelites, S.A. ("Hispasat"), the operator of Amazonas-3, regarding the coordination of INMARSAT-KA 63W at 62.85 W.L. with Amazonas-3 at 61 W.L., thus ensuring the technical compatibility of the two networks. Inmarsat is in the process of obtaining a letter from Hispasat confirming that the operations of the two satellite networks have been coordinated but has not been able to obtain that letter in time for this filing. Inmarsat will file that letter with the Commission as soon as it becomes available.

The Commission also requests a demonstration regarding how O3b Limited's NGSO FSS system will be protected from the operation of INMARSAT-KA 63W in the 18.8-19.3 GHz and 28.6-29.1 GHz bands. Inmarsat provides as an attachment to this submission a technical analysis with supporting calculations demonstrating the compatibility between the INMARSAT-KA 63W and O3b networks. The attachment replaces Section A.12 of the Technical Annex included in the Letter of Intent.

LATHAM & WATKINS LLP

If you have any questions regarding this submission, please feel free to contact the undersigned.

Respectfully submitted,

/s/

John P. Janka
Elizabeth R. Park

cc: Jose Albuquerque
Cassandra Thomas
Don Jansky

Attachment

A.12. Sharing with NGSO FSS in the 28.6-29.1 GHz and 18.8-19.3 GHz Bands

The 28.6-29.1 GHz uplink band is designated for NGSO FSS on a primary basis and it is designated for the GSO FSS on a secondary basis in the U.S. under FCC decisions. The 18.8-19.3 GHz downlink band is designated exclusively to NGSO FSS in the U.S. The following analysis demonstrates compatibility with NGSO FSS operations in these band segments.

The highest interference levels that could occur into NGSO networks from the INMARSAT-KA 63W network are when there is an "in-line" event. On the uplink for example, an in-line event occurs when the NGSO satellite, the GSO satellite and the interfering GSO earth station are all in a line. As the NGSO satellite continues to move within its orbit, an angle between the NGSO satellite and the GSO satellite, subtended at the GSO earth station, is created. As long as the GSO earth station does not transmit when the NGSO satellite is within a certain angle, no harmful interference to the NGSO satellite will occur. A similar situation exists on the downlink. The amount of angular separation required will be dependent on the parameters of the NGSO FSS networks and their interference criteria.

The FCC has authorized O3b Limited to operate gateway earth stations in Hawaii and Texas to access the U.K.-authorized O3b NGSO system using the 28.6-29.1 GHz and 18.8-19.3 GHz bands where NGSO systems are primary under FCC rules. Inmarsat and the O3b network operator are currently finalizing a frequency coordination agreement which would enable operations of both networks without any harmful interference to each other.

The O3b constellation will use eight satellites in a medium earth orbit with an altitude of 8062 km and an inclination of zero degrees (*i.e.*, an equatorial orbit). The satellites have steerable spot beams which are maintained on the gateway location as the satellites traverse their orbit until a minimum elevation angle is no longer met. Table A.12.1 shows the pertinent parameters of the INMARSAT-KA 63W network and the O3b system. Notably, the 63° W.L. GSO orbital location is not visible to the O3b Hawaii gateway earth station, or vice versa.

Table A.12.1. Summary of INMARSAT-KA 63W and O3b parameters.

Parameters	INMARSAT-KA 63W	O3b System
Minimum Operational Elevation Angle	10°	3°
Earth Station Uplink Input Power Density	-67 dBW/Hz	-55 dBW/Hz
Satellite Rx Antenna Gain	45.4 dBi	34.5 dBi
Satellite Rx System Noise Temp	1346 K	1000 K

Satellite Tx EIRP Density	-20 dBW/Hz	-28.32 dBW/Hz
Earth Station Rx System Noise Temperature	302 K	230 K

The INMARSAT-KA 63W gateway uplink input power density value of -67 dBW/Hz is not clear sky, but rather assumes a worst-case faded uplink condition.

O3b Hawaii gateway earth station

The minimum elevation angle for service to O3b's Hawaiian gateway is stated as being 3 degrees. From this we can determine the eastern-most location of an O3b satellite, just before it can no longer communicate with the Hawaiian gateway, as being at 99.67° W.L. This orbital location provides the smallest angular separation with respect to the INMARSAT-KA 63W network. Any location of an O3b satellite further west will necessarily create a larger angular separation with respect to the INMARSAT-KA 63W network.

For the purpose of interference analysis, the INMARSAT-KA 63W gateway antenna is assumed to be located at the most southern part of the US West Coast area where the smallest angular separation occurs. Based on the assumed INMARSAT-KA 63W gateway antenna location, and with the O3b satellite assumed to be at a static 99.67° W.L. location, the angular separation (off-axis angle) subtended at the INMARSAT-KA 63W gateway can be determined.

In addition, the calculations take into account the fact that the O3b satellites communicating with the Hawaiian gateway provide at least 20 dB of satellite antenna discrimination towards the INMARSAT-KA 63W gateway antenna location in both uplink and downlink directions.

Table A.12.2a shows the predicted interference degradations to the O3b system due to operation of the INMARSAT-KA 63W network and vice versa. The results show that the O3b system is adequately protected. The calculated ΔT/T values in all cases are extremely small, demonstrating the technical compatibility of the INMARSAT-KA 63W satellite network with the operation of O3b's Hawaii gateway.

Table A.12.2a. Worst case interference calculations between INMARSAT-KA 63W and O3b (Hawaii).

Victim network		*O3b (Hawaii)*	*INMARSAT-KA 63W*
Interfering network		INMARSAT-KA 63W	O3b (Hawaii)
Victim E/S Latitude	degree	21.67	32.88
Victim E/S Longitude	degree	-158.03	-116.81
Uplink			
Frequency band	GHz	28.85	NOT VISIBLE
Interfering E/S uplink p.s.d.	dBW/Hz	-67	
Angular separation between interfering E/S and victim satellite	degree	**31.3**	
Interfering E/S off-axis Tx gain	dB	-8.39	
Slant range (interfering path)	km	**10214**	
Free space path loss (Interfering path)	dB	201.83	
Atmospheric losses	dB	1.2	
Victim satellite receive antenna gain	dBi	34.5	
Victim satellite's antenna discrimination towards interfering E/S	dB	20	
Victim satellite Rx noise temperature	km	1000	
No	dBW/Hz	-198.6	
Io	dBW/Hz	-263.9	
Io/No	dB	-65.3	
dT/T	%	0.000029	
Downlink			
Frequency band	GHz	NOT VISIBLE	19.05
Interfering satellte downlink EIRP density	dBW/Hz		-28.32
Slant range (interfering path)	km		**10214**
Free space path loss (Interfering path)	dB		198.22
Atmospheric losses	dB		1
Angular separation between interfering satellite and victim E/S	degree		**31.3**
Interfering satellite's antenna dicrimination towards victim E/S	dB		20
Victim E/S off-axis Rx gain	dB		-8.39
Victim E/S system noise temperature	km		302
No	dBW/Hz		-203.8
Io	dBW/Hz		-255.9
Io/No	dB		-52.1
dT/T	%		0.000612

O3b Texas gateway earth station

For the purpose of indentifying the worst case interference scenario, two scenarios based on two example locations of the INMARSAT-KA 63W gateway antenna are used in the interference analysis. The first one is co-located with the O3b Texas gateway where there is no satellite antenna discrimination. The second one is at the most southern part of Texas where the smallest angular separation occurs.

Based on the above INMARSAT-KA 63W gateway antenna locations and with the O3b satellite assumed to be at a static 71.18° W.L. (for the first INMARSAT-KA 63W gateway antenna location) and 71.5° W.L. (for the second one), the angular separations (off-axis angles) subtended at the INMARSAT-KA 63W gateway can be determined.

In addition, the calculations take into account the fact that the O3b satellites communicating with the O3b Texas gateway provide at least 3 dB of satellite antenna discrimination towards the second example location of the INMARSAT-KA 63W gateway antenna in both uplink and downlink directions.

Table A.12.2b and A.12.2c below show the predicted interference degradations to the O3b system due to operation of the INMARSAT-KA 63W network and vice versa. The results show that the O3b system is adequately protected. The calculated ΔT/T values in all cases are far below 6%, demonstrating the technical compatibility of the INMARSAT-KA 63W satellite network with the operation of O3b's Texas gateway.

Table A.12.2b. Worst case interference calculations between INMARSAT-KA 63W (co-located) and O3b (Texas)

Victim network		*O3b (Texas)*	*INMARSAT-KA 63W*
Interfering network		INMARSAT-KA 63W	O3b (Texas)
Victim E/S Latitude	degree	34.7	34.7
Victim E/S Longitude	degree	-99.3	-99.3
Uplink			
Frequency band	GHz	28.85	28.85
Interfering E/S uplink p.s.d.	dBW/Hz	-67	-55
Angular separation between interfering E/S and victim satellite	degree	**14.3**	**14.3**
Interfering E/S off-axis Tx gain	dB	0.12	0.12
Slant range (interfering path)	km	**10753**	**38237**
Free space path loss (Interfering path)	dB	202.28	213.29
Atmospheric losses	dB	1.2	1.2
Victim satellite receive antenna gain	dBi	34.5	45.4
Victim satellite's antenna discrimination towards interfering E/S	dB	**0**	**0**
Victim satellite Rx noise temperature	km	1000	1346
No	dBW/Hz	-198.6	-197.3
Io	dBW/Hz	-235.9	-224.0
Io/No	dB	-37.3	-26.7
dT/T	%	0.018799	0.215367
Downlink			
Frequency band	GHz	19.05	19.05
Interfering satellite downlink EIRP density	dBW/Hz	-20	-28.32
Slant range (interfering path)	km	**38237**	**10753**
Free space path loss (Interfering path)	dB	209.69	198.67
Atmospheric losses	dB	1	1
Angular separation between interfering satellite and victim E/S	degree	**14.3**	**14.3**
Interfering satellite's antenna dicrimination towards victim E/S	dB	**0**	**0**
Victim E/S off-axis Rx gain	dB	0.12	0.12
Victim E/S system noise temperature	km	230	302
No	dBW/Hz	-205.0	-203.8
Io	dBW/Hz	-230.6	-227.9
Io/No	dB	-25.6	-24.1
dT/T	%	0.276056	0.391405

Table A.12.2c. Worst case interference calculations between INMARSAT-KA 63W (non co-located) and O3b (Texas)

Victim network		*O3b (Texas)*	*INMARSAT-KA 63W*
Interfering network		INMARSAT-KA 63W	O3b (Texas)
Victim E/S Latitude	degree	34.7	26.34
Victim E/S Longitude	degree	-99.3	-97.88
Uplink			
Frequency band	GHz	28.85	28.85
Interfering E/S uplink p.s.d.	dBW/Hz	-67	-55
Angular separation between interfering E/S and victim satellite	degree	**12.1**	**14.3**
Interfering E/S off-axis Tx gain	dB	1.93	0.12
Slant range (interfering path)	km	**10064**	**38237**
Free space path loss (Interfering path)	dB	201.70	213.29
Atmospheric losses	dB	1.2	1.2
Victim satellite receive antenna gain	dBi	34.5	45.4
Victim satellite's antenna discrimination towards interfering E/S	dB	**3**	**3**
Victim satellite Rx noise temperature	km	1000	1346
No	dBW/Hz	-198.6	-197.3
Io	dBW/Hz	-236.5	-227.0
Io/No	dB	-37.9	-29.7
dT/T	%	0.016332	0.107939
Downlink			
Frequency band	GHz	19.05	19.05
Interfering satellite downlink EIRP density	dBW/Hz	-20	-28.32
Slant range (interfering path)	km	**38237**	**10064**
Free space path loss (Interfering path)	dB	209.69	198.10
Atmospheric losses	dB	1	1
Angular separation between interfering satellite and victim E/S	degree	**14.3**	**12.1**
Interfering satellite's antenna dicrimination towards victim E/S	dB	**3**	**3**
Victim E/S off-axis Rx gain	dB	0.12	1.93
Victim E/S system noise temperature	km	230	302
No	dBW/Hz	-205.0	-203.8
Io	dBW/Hz	-233.6	-228.5
Io/No	dB	-28.6	-24.7
dT/T	%	0.138356	0.340033

Other NGSO networks

In order to demonstrate compatibility between the INMARSAT-KA 63W network and other types of NGSO networks, the parameters of the GESN and ATCONTACT NGSO networks, previously authorized by the Commission to use the 28.6-29.1 GHz and 18.8-19.3 GHz bands, have been used. Both networks were to utilize highly elliptical orbits ("HEO").

Table A.12.3 summarizes the salient parameters of the GESN and ATCONTACT HEO satellite networks for the purpose of this interference assessment. These parameters are identical to those used by Northrop Grumman and ATCONTACT to demonstrate independently that their GSO operations in the 28.6-29.1 GHz and 18.8-19.3 GHz bands were compatible with the other's proposed NGSO operations. It can be seen that the two networks' orbital and transmission parameters are identical, which allows a single interference analysis to be performed.

Table A.12.3. GESN and ATCONTACT HEO satellite characteristics.

	GESN	ATCONTACT
Orbital parameters		
• # of satellites	3	3
• # of planes	3	3
• # of satellites per plane	1	1
• Inclination	63.4°	63.4°
• Apogee	39352 km	39352 km
• Perigee	1111 km	1111 km
• Minimum Tx altitude	16000 km	16000 km
Satellite Rx gain	46.5 dBi	46.5 dBi
Satellite Rx system noise temp.	504 K	504 K
Earth station uplink input power density	-63.45 dBW/Hz	-63.45 dBW/Hz
Satellite downlink EIRP density	-18 dBW/Hz	-18 dBW/Hz
E/S Rx system noise temperature	315 K	315 K

In order to demonstrate compatibility with these two NGSO networks, a worst case, static analysis is performed. The smallest possible angle will occur when the GSO satellite, the NGSO satellite and the relevant earth station are all on the same longitude and the earth station is at a high latitude. Assuming a minimum 10° elevation angle for the GSO earth station, this sets the latitude to 71.4°N. The GESN and ATCONTACT satellites do not transmit when they are at an altitude below 16000 km, which translates to a latitude of 31.9°N. With this information, the smallest possible angular separation is then calculated to be 27.4 degrees. Both the transmitting GSO earth station (uplink calculation) and the victim NGSO earth station (downlink calculation) have been assumed to be at a latitude of 71.4°N.

Table A.12.4 shows the results of interference calculations from the INMARSAT-KA 63W network into the GESN and ATCONTACT networks and vice versa. The calculated $\Delta T/T$ values in all cases are less than 1%, indicating the technical compatibility of the INMARSAT-KA 63W satellite network with the GESN and ATCONTACT networks.

The compatibility of these networks is largely due to the fact that the two NGSO networks do not communicate with earth stations when their satellites cross the equatorial plane, thus in-line events with a GSO network do not occur.

Table A.12.4. Worst case interference calculations.

Victim network		GESN / ATCONTACT	INMARSAT-KA-63W
Interfering network		INMARSAT-KA-63W	GESN / ATCONTACT
Uplink:			
Frequency band	GHz	29	29
Interfering uplink input power density	dBW/Hz	-62.65	-63.45
Angular separation	degrees	27.4	27.4
Slant range (Interfering path)	km	21046	40586
Space loss (Interfering path)	dB	208.2	213.9
Atmospheric & scintillation losses	dB	1.2	1.2
Victim satellite receive antenna gain	dBi	46.5	39
Victim satellite Rx system noise temperature	K	504	794
No	dBW/Hz	-201.6	-199.6
Io	dBW/Hz	-232.5	-246.5
Io/No	dB	-30.9	-46.9
dT/T	%	0.08	0.002
Downlink:			
Frequency band	GHz	19	19
Interfering satellite downlink EIRP density	dBW/Hz	-19.05	-18
Slant range (Interfering path)	km	40586	21046
Space loss (Interfering path)	dB	210.2	204.5
Atmospheric & scintillation losses	dB	1	1
Angular separation	degrees	27.4	27.4
Victim Rx earth station system noise temperature	K	315	300
No	dBW/Hz	-203.6	-203.8
Io	dBW/Hz	-237.2	-230.5
Io/No	dB	-33.6	-26.7
dT/T	%	0.04	0.22

For other types of NGSO constellations that do communicate with earth stations when the satellites pass through the equatorial plane, an in-line interference event can occur. Inmarsat will coordinate with future NGSO operators in these band segments to determine the minimum angular separation required to protect any future NGSO system.

If required, Inmarsat would cease transmissions in this band from the relevant beam of the INMARSAT-KA 63W satellite and its associated earth station that is causing the in-line event, such that a minimum amount of angular separation with the NGSO network is always maintained, thereby avoiding interference in the NGSO system.