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March 7, 2014

VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Room TW-A325
Washington, D.C. 20554

Attn: Satellite Division, International Bureau

Re: Updates to Special Temporary Authority Request for CODA Lab earth station in San Diego, California
File No. SES-STA-20131228-01209

Dear Ms. Dortch:

On December 23, 2013, O3b Limited ("O3b") submitted an application for Special Temporary Authority ("STA") to operate an earth station in San Diego, California, for testing and demonstration purposes only, for a 30-day period, beginning January 31, 2014. On January 24, 2014, O3b updated the STA need date to May 1, 2014.

Please find attached hereto updated information related to O3b's STA request, as described below.

- Minor corrections have been made to one of the link budgets submitted by O3b on December 23, 2013, in Annex 3 of the STA request. Specifically, the introductory chart and Table 4 have been updated. This has reduced the transmitted EIRP by 6 dB and so will not result in any increased interference.
- One part of the Form 312 Schedule B submitted by O3b on December 23, 2013, in Annex 1 of the STA request has been updated. Specifically, sections E56, E57, E58, and E59 have been updated. This relates only to the minimum elevation angle and associated azimuth angles that will be used by this earth station, where the minimum elevation angle has increased thereby reducing the possibility of interference to terrestrial services.
- Minor corrections have been made to the Transfinite report submitted by O3b on December 23, 2013, in Annex 6 of the STA request. The Transfinite report now reflects the correct 20W transmit power that is given in the Schedule B. The corrections to the Transfinite report have no impact on Transfinite's conclusion, based on its analysis, that both the short term and long term interference zones are fully contained within the U.S. borders.

Please direct any questions to the undersigned.

Sincerely,

/s/ Joslyn Read
Joslyn Read
Vice-President, Regulatory Affairs
O3b Limited
Joslyn.Read@o3bnetworks.com
202 352 5985

cc: Paul Blais (by email)

Minor correction to Annex 3 introductory chart.

The chart on the first page of Annex 3 is replaced with the following chart. Changed parameters are highlighted in **Gray bold**.

	Carrier	MODCOD	Table #
	216MHz in each direction, clear sky	8PSK/0.75 FWD QPSK/0.75 RTN	1,2
	54MHz in each direction, clear sky	16APSK/0.83 FWD **QPSK**/0.75 RTN	3,4

Minor correction to Annex 3 Table 4.

Table 4 of Annex 3 is replaced with the following table. Changed parameters are highlighted in **Gray bold**.

O3b Network Link Analysis - Tier 2 Service For San Diego, United States			
Link Budget Creator - Rev 3.2.9: February 21, 2014		**Tier 2**	**Tier 2**
Ground Parameter		**Teleport**	**Telco**
Location		Vernon (RHCP), United States	San Diego, United States
Latitude	(°)	34.2	32.7
Longitude (East)	(°)	260.7	242.8
E/S Maximum Range to SV	(km)	10445.4	9742.0
E/S Minimmum Elevation to SV	(°)	26.2	36.0
E/S Altitude	(km)	0.3	0.2
SV Beam Identifier	(#)	13	
Minutes Into Pass (Sample #15)	(Min)	6:46	
Telco Spot Beam Off-Angle	(°)	0.20	
Telco Spot Beam Diameter	(km)	67.80	
Maximum Roundtrip Latency	(msec)	134.68	
Modulation Parameters		**Forward**	**Return**
Enter Receiver	Type		DVB-S2
Modem Overhead	(%)		3.2%
Number of Carriers per Channel	(#)		1
Available Bandwidth	(Hz)		54,000,000
Channel Symbol Rate	(sps)		45,000,000
Channel Modulation Type			**QPSK**
Channel FEC Rate			0.75
Channel Spectral Efficiency	(bits/Sym)		**1.50**
Channel Throughput (100% / 100% of Full Rate)	(bps)		**65,343,428.88**
Uplink		**Forward**	**Return**
E/S Tx Channels per HPA	(#)		1
E/S Tx Carrier Frequency	(MHz)		28,280
E/S Tx HPA Power Level	(W)		20
E/S Tx OBO	(dB)		**-6.50**
E/S Tx Post-HPA Losses	(dB)		-0.28
E/S Tx Antenna Gain (7.3 m / 1.2 m)	(dB)		46.3
E/S Tx EIRP Per Channel	(dBW)		52.56
E/S Tx Radome & Pointing Loss	(dB)		-1.00
E/S Tx RF Link Availability	(%)		70.000
E/S Tx Atmospheric Losses	(dB)		-0.59
E/S Tx Spreading Loss	(dB)		-150.77
Satellite		**Forward**	**Return**
SV Number of Channels per HPA	(#)		5
SV Rx G/T	(dB/K)		4.43
SV Rx Power Per Tier	(dBW)		-145.84
SV Rx Flux Density Per Tier	(dBW/m^2)		-99.79
SV Tx OBO (ALC / ALC)	(dB)		-5.80
SV Tx Post-TWTA Losses	(dB)		-1.50
SV Tx Antenna Gain	(dBi)		31.80
SV Tx EIRP Per Channel/Carrier	(dBW)		35.64
SV Tx Pointing Loss	(dB)		0.00
Downlink		**Forward**	**Return**
E/S Rx Carrier Frequency	(MHz)		18,480
E/S Rx Spreading Loss	(dB)		-151.37
E/S Rx RF Link Availability	(%)		75.000
E/S Rx Atmospheric Losses	(dB)		-0.84
E/S Rx Pointing Loss	(dB)		-0.50
E/S Rx Antenna Gain (1.2 m / 7.3 m)	(dBi)		62.04
E/S Rx Effective G/T	(dB/K)		38.68
E/S Rx Power Per Channel	(dBW)		-101.82
E/S Rx Flux Density Per Channel	(dBW/m^2)		-117.07
Total Link		**Forward**	**Return**
Carrier / Noise Bandwidth	(dB)		76.53
Carrier / Noise Uplink	(dB)		**6.23**
Carrier / Noise Downlink	(dB)		26.88
Carrier / Intermodulation Im (C/Im)	(dB)		23.28
(C/N) - Total Actual	(dB)		**6.05**
(C/N) - Total Required	(dB)		**5.70**
(E_b/N_o) - Total Actual	(dB)		**4.29**
(E_b/N_o) - Total Required	(dB)		**3.94**
Excess Margin	**(dB)**		**0.35**
Fade Margin	**(dB)**		**8.25**

Minor correction to Annex 1 Form 312 Schedule B.

Sections E56, E57, E58, and E59 are updated. Changed parameters are highlighted in **Gray bold**.

FREQUENCY COORDINATION

E28. Antenna Id	E51. Satellite Orbit Type	E52/53. Frequency Limits(MHz)	E54/55. Range of Satellite Arc E/W Limit	E56. Earth Station Azimuth Angle Eastern Limit	E57. Antenna Elevation Angle Eastern Limit	E58. Earth Station Azimuth Angle Western Limit	E59. Antenna Elevation Angle Western Limit	E60. Maximum EIRP Density toward the Horizon(dBW/4kHz)
Orbit 1.2	Non-Geostationary	18300 - 18600	NON-GEO	**129**	**20**	**223**	**25**	--
Orbit 1.2	Non-Geostationary	18800 - 19300	NON-GEO	**129**	**20**	**223**	**25**	--
Orbit 1.2	Non-Geostationary	28100 - 28400	NON-GEO	**129**	**20**	**223**	**25**	-39.8
Orbit 1.2	Non-Geostationary	28600 - 29100	NON-GEO	**129**	**20**	**223**	**25**	-39.8

Minor correction to Annex 6 Transfinite Report.

The updated Transfinite report is on the following pages.

Technical Note
O3b San Diego Gateway Coordination

Date: Revised 5th March 2014

1 Document Scope

This describes analysis undertaken by Transfinite Systems Ltd for O3b to generate a coordination contour for an Earth Station (ES) of O3b's non-GSO network in San Diego.

In addition more detailed interference zones were generated using terrain data and interference criteria from Recommendation ITU-R SF.1006.

Finally a Monte Carlo analysis was undertaken to identify the scope to use that methodology to convolve ES antenna pointing and propagation statistics.

2 Scenario Parameters

2.1 Earth Station Parameters Used

The ES parameters were taken from:

1. Email of 25th November 2013 with location and height parameters
2. Box files shared on 25th November 2013 with antenna gain patterns
3. FCC application emailed on 21st November 2013

2.2 O3b ES Location

From reference 1:

Latitude:	32° 40' 54.3" N
Longitude:	117° 7' 0.1" W
Antenna height:	12.5m above ground level
Ground height :	5.33m above sea level
Total antenna height	17.83m above sea level

Table 1: O3b ES Location

2.3 O3b ES Antenna Gain Pattern

From reference 2 the ES antenna gain pattern has been measured at 29.1 GHz and is shown in the figure below:

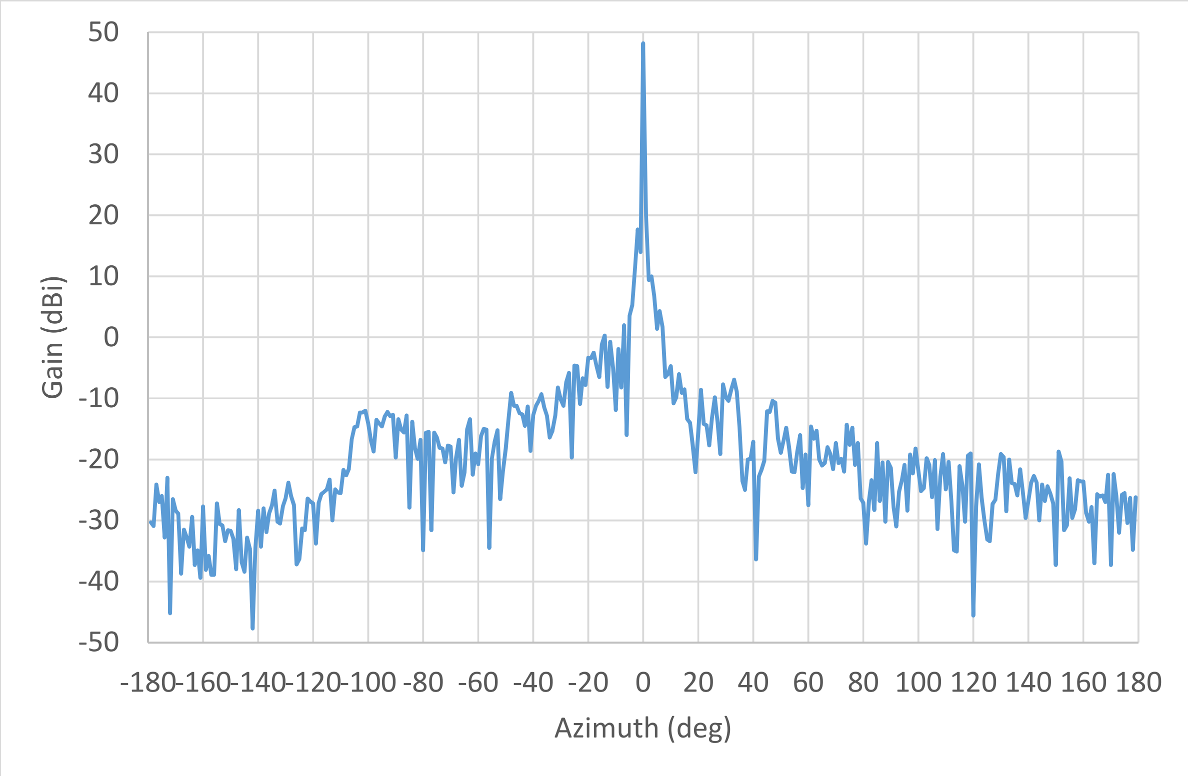

Figure 1: ES Antenna Gain Pattern Slice

The peak gain in the measured data file was 48.2 dBi and the minimum operating elevation angle was taken as 20º.

For generation of the Appendix 7 coordination contour the following simplified assumptions were made:

Gain pattern:	ITU-R Rec. S.580-6
Peak gain:	48 dBi
Beamwidth:	0.6°

Table 2: O3b ES Simplified Antenna Pattern for Appendix 7 Calculations

It is assumed the measurement missed the very narrow beam’s peak gain and hence the highest gain value in the table was 0.3 dB below the specified peak gain. However this wouldn’t impact the analysis as the minimum elevation angle constraint implies that gain values below 20 degrees off-axis would not be used.

2.4 O3b Transmit Link

From References 1, 2 and 3:

Transmit frequency:	29.1 GHz
Transmit power:	13 dBW
Reference bandwidth:	216 MHz

Table 3: O3b ES Transmit Link Parameters

2.5 O3B Constellation

The following parameters were used for the O3b non-GSO satellite constellation:

Type and service:	Non-GSO FSS
Orbit inclination:	0°
Orbit height:	8,062 km

Table 4: O3b Constellation

2.6 Appendix 7 Parameters

The values for transmit ES are shown in the table below from RR Appendix 7:

TABLE 7c (Rev.WRC-12)

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Fixed-satellite	Fixed-satellite [2]	Fixed-satellite [3]	Space research	Earth exploration-satellite, space research	Fixed-satellite, mobile-satellite, radionavigation-satellite	Fixed-satellite [2]
Frequency bands (GHz)		24.65-25.25 27.0-29.5	28.6-29.1	29.1-29.5	34.2-34.7	40.0-40.5	42.5-47 47.2-50.2 50.4-51.4	47.2-50.2
Receiving terrestrial service designations		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile	Fixed, mobile, radionavigation	Fixed, mobile
Method to be used		§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2
Modulation at terrestrial station [1]		N	N	N		N	N	N
Terrestrial station interference parameters and criteria	p_0 (%)	0.005	0.005	0.005		0.005	0.005	0.001
	n	1	2	1		1	1	1
	p (%)	0.005	0.0025	0.005		0.005	0.005	0.001
	N_L (dB)	0	0	0		0	0	0
	M_s (dB)	25	25	25		25	25	25
	W (dB)	0	0	0		0	0	0
Terrestrial station parameters	G_x (dBi) [4]	50	50	50		42	42	46
	T_e (K)	2 000	2 000	2 000		2 600	2 600	2 000
Reference bandwidth	B (Hz)	10^6	10^6	10^6		10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	–111	–111	–111		–110	–110	–111

Figure 2: Extract from Appendix 7 for Transmit ESs

Footnotes:

2. Non-geostationary satellites in the fixed-satellite service.

3 Appendix 7 Coordination Contour

The Visualyse Coordinate tool can be used to generate ES coordination contours according to the algorithm in ITU-R RR Appendix 7. The algorithm ensures that the contour is never less than around 100 km in radius, as shown in the figure below:

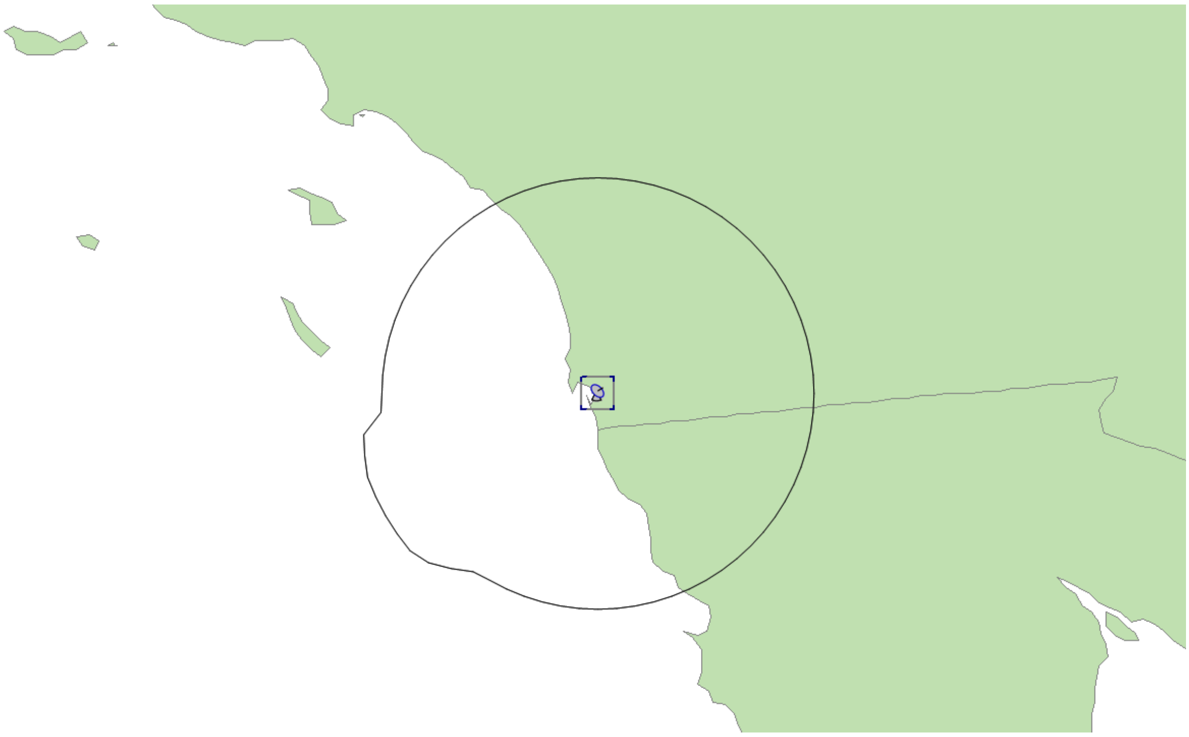

Figure 3: **Transmit Coordination Contour**

With the ES less than 20 km inside the US and a minimum contour size of 100 km, the coordination contour can be expected to cross the border into Mexico.

4 Recommendation ITU-R SF.1006 Interference Zone

4.1 Sharing Criteria

The approach in Appendix 7 is to use an agreed set of parameters in the Radio Regulations that can only be changed at World Radiocommunication Conferences. These are by nature conservative as they are used as coordination triggers and in detailed coordination actual parameters would be used.

Given that the methodology in Appendix 7 is conservative there are three mechanisms that can be used to reduce the size of the coordination contour:

1. Remove the requirement for a minimum distance of 100 km

2. Use actual or at least more realistic parameters including sharing criteria and ES antenna gain pattern
3. Include the effect of terrain

This approach can be undertaken by using the thresholds in:

- Rec. SF. 1006: Determination of the interference potential between earth stations of the fixed-satellite service and stations in the fixed service

In addition it is worth reviewing typical usages of the band and equipment types.

4.2 Recommendation ITU-R SF. 1006

This recommendation provides a methodology and table of parameters to calculate sharing criteria, and in general the values are similar to those in Appendix 7, as shown in the table below:

Parameters	From SF.1006	From App.7
Frequency band	29 GHz	29 GHz
Interferer	FSS	FSS
Victim	FS	FS
p1 (%)	20	n/a
p2 (%)	0.005	0.005
n2	1	2
B (Hz)	1.00E+06	1.00E+06
J (dB)	0	n/a
W (dB)	0	0
Tr (K)	3200	2000
Ms (dB)	25	25
Nl (db)	0	0

Table 5: Rec. SF.1006 vs. Appendix 7 Parameters

SF.1006 gives long term thresholds as well as short term ones, plus there is also a difference in the receive temperature for the FS.

The following interference thresholds were used:

Threshold	Short term	Long term
p (%)	0.005	20
I (dBW)	-108.6	-133.5

Table 6: Interference Thresholds from SF.1006

4.3 FS Antenna Sizes

The primary use of these bands is for mobile backhaul where a significant factor is to keep costs low. This means that operators are unlikely to use antennas larger than 30cm, which corresponds to peak gains of 37 dBi at 29 GHz.

4.4 Terrain Database

The ASTER2 database was used. This has a horizontal resolution of 30m between pixels and is a surface database so it includes some of the effects of buildings. However its resolution means it is unable to identify specific buildings and cannot in this case be considered to include local clutter around the ES.

The figure below shows the ASTER2 terrain / surface details around San Diego:

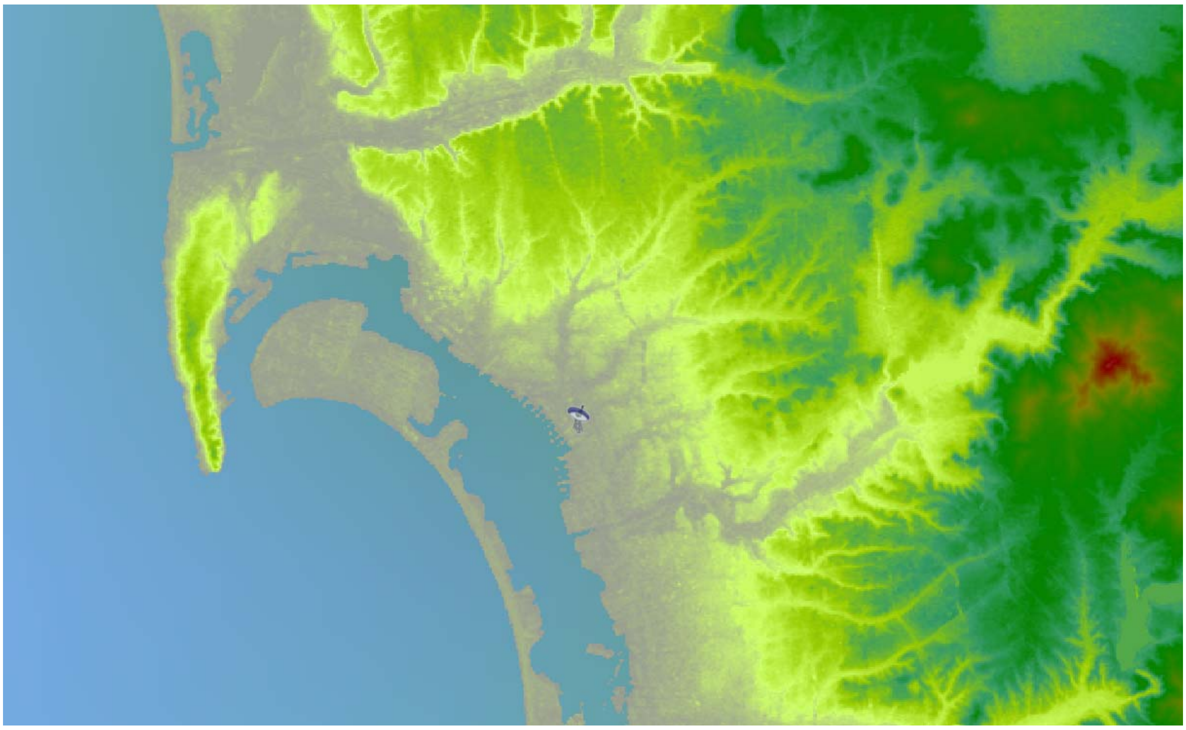

Figure 4: **ASTER2 Surface Data**

This surface data is freely available from the following web site:

http://earthexplorer.usgs.gov/

Data is provided subject to terms and conditions available on this web site which includes:

- When presenting or publishing ASTER GDEM data, users are required to include a citation stating, "ASTER GDEM is a product of METI and NASA."
- The data are provided "as is" and neither NASA nor METI/ERSDAC will be responsible for any damages resulting from use of the data.

4.5 O3b Horizon Gain

Another factor to consider is how the O3b ES gain towards the horizon varies as the constellation moves.

It was noted that this pattern was not symmetric around the zero degrees azimuth line and hence an average pattern was created assuming symmetry around the zero degree azimuth as shown in the figure below:

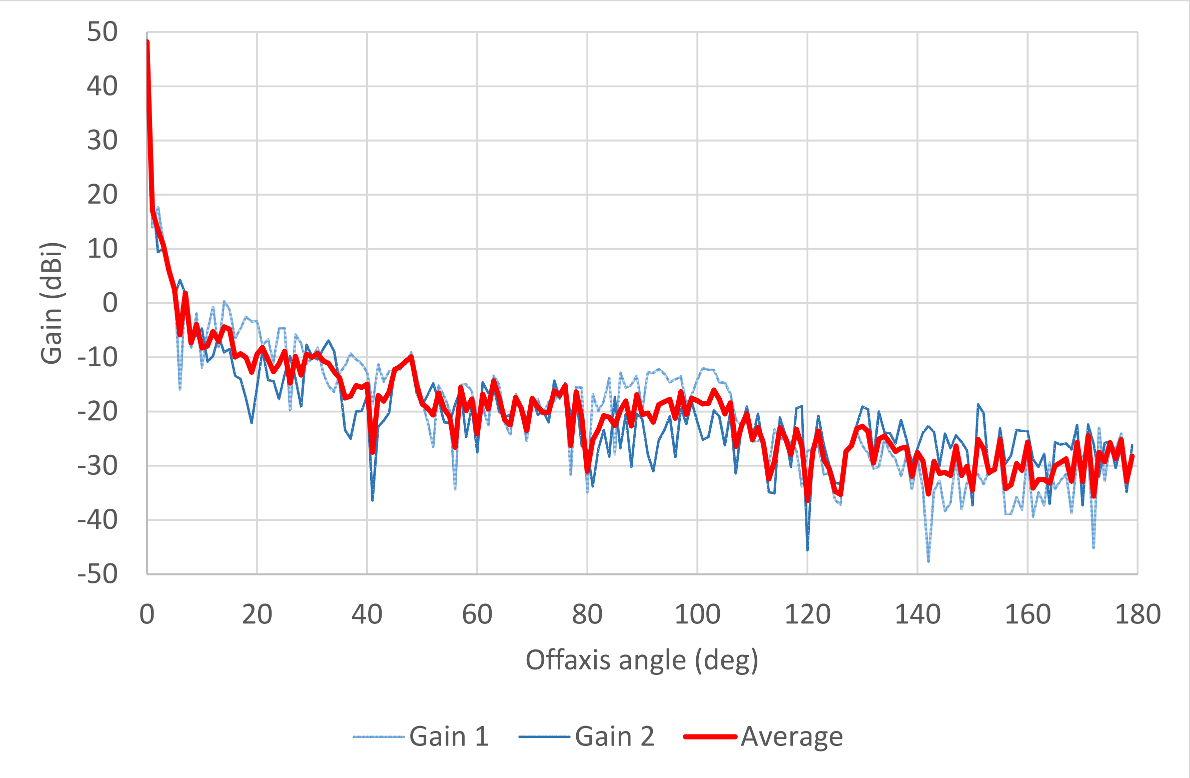

Figure 5: ES Antenna Gain Pattern Symmetric Pattern

This symmetric pattern was used in a simulation to work out the peak gain towards the horizon for the O3b constellation with minimum elevation angle of 20° as shown in the figure below:

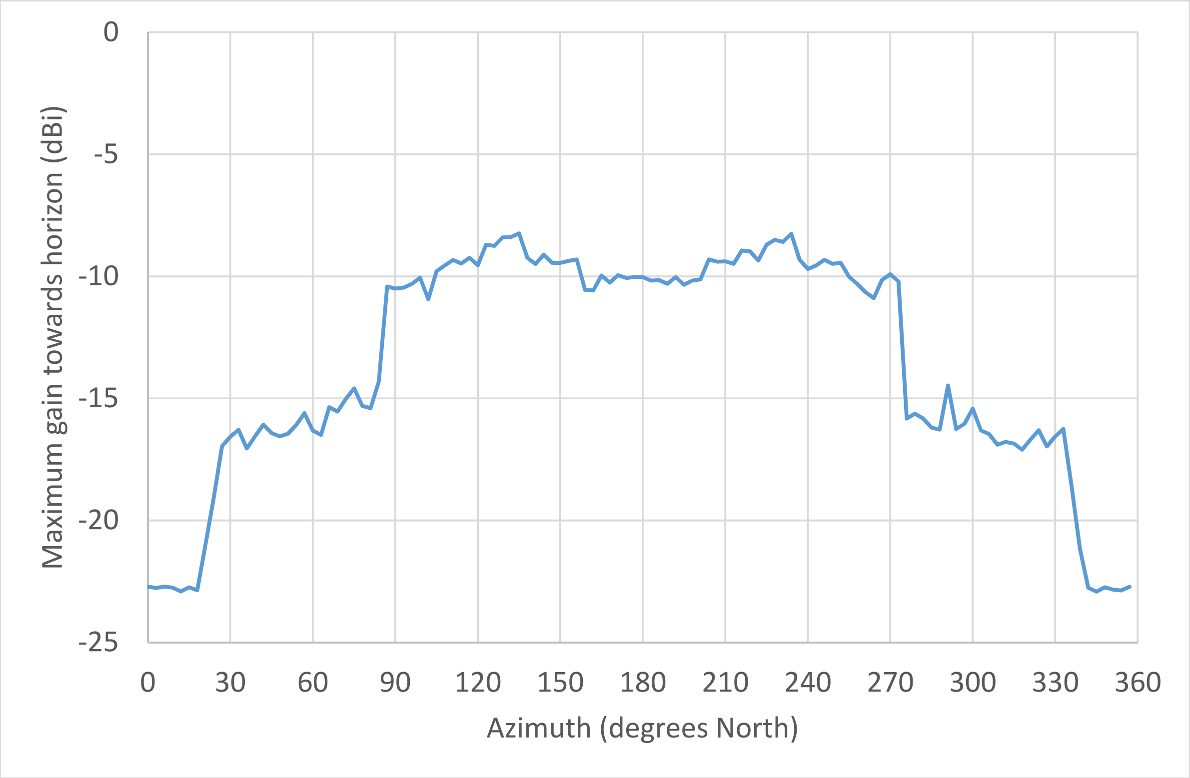

Figure 6: Horizon Gain for O3b

4.6 Mitigation Methods

A number of mitigation methods could be used to reduce the impact of the O3b ES on FS links in adjacent countries including:

- Include use of the auxiliary contours. As described by Appendix 7, it is unlikely that there will be the worst case geometrical alignment in which the FS antenna is pointing directly at the ES, there is likely to be some antenna gain discrimination. A value of 5 dB is typically used in these cases
- Include the FS antenna feed loss: a value of 1 dB would be typical for systems in this band.

4.7 Short Term and Long Term Interference Zones

From the parameters in the previous section the following areas where the short and long term interference thresholds are exceeded were generated and then displayed in Google Earth:

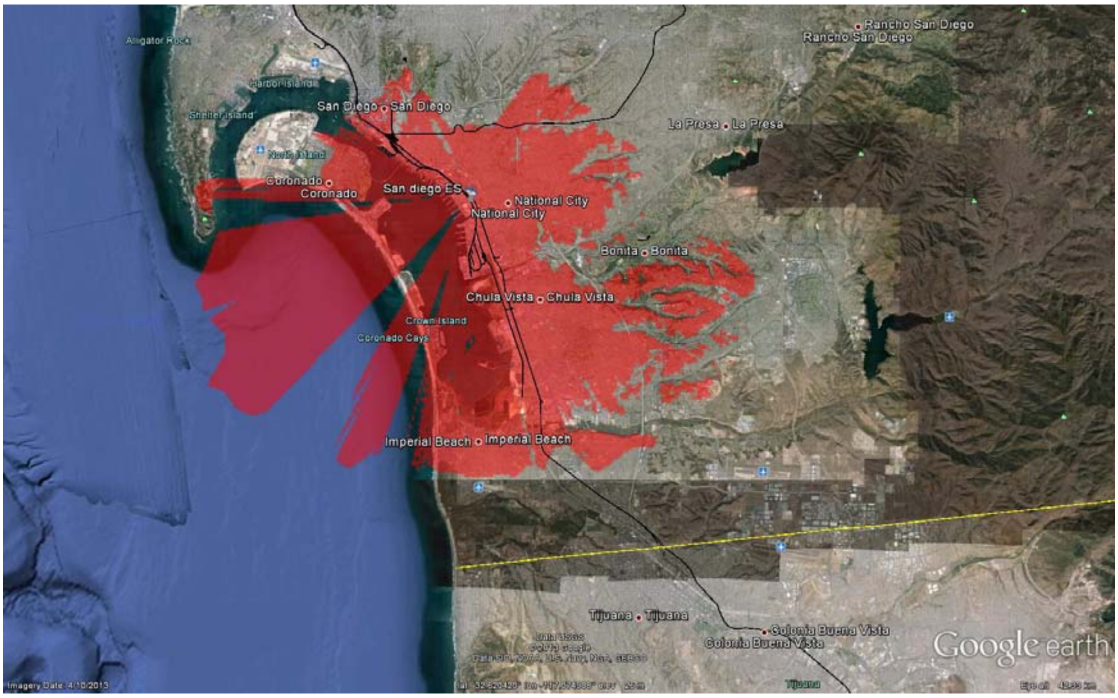

Figure 7: O3b Long Term Interference Zone

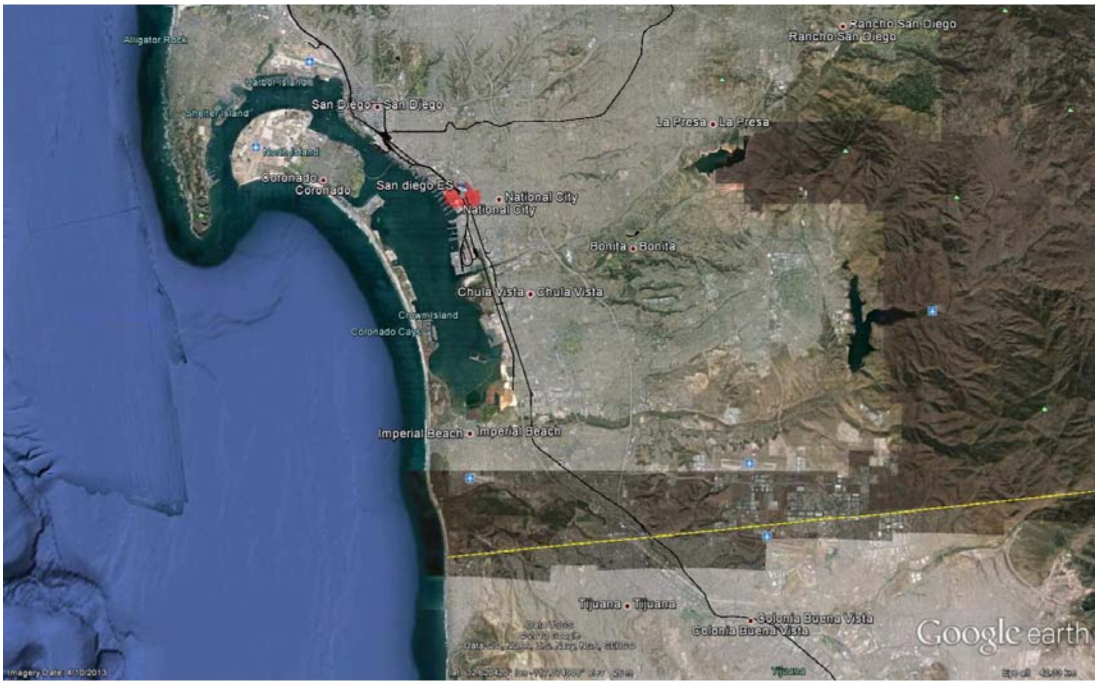

Figure 8: O3b Short Term Interference Zone

4.8 Comments

It was noted that the interference zones were significantly smaller than those generated assuming Appendix 7. This was because:

- The O3b transmit power is relatively low, resulting in an interference zone significantly less than the minimum 100 km contour in Appendix 7.
- The assumed FS antenna peak gain in Appendix 7 of 50 dBi was considered larger than would be typically used in this band
- The measured antenna gain pattern had lower far off-axis sidelobes than those assumed in Rec. ITU-R S.580-6

Taking into consideration the above, it was noted that both the short term and long term interference zones are fully contained within the U.S. borders.