DETAILED INTERFERENCE ANALYSIS REPORT

Transmit/Receive Earth Station

Prepared For
Harris
(FAA)
Hooper Bay, Alaska
(HPB)

(C-band)
Transmit/Receive Earth Station

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SECTION 1

INTRODUCTION

Transmit/Receive Earth Station

This report presents the results of a detailed interference analysis for a proposed C-band transmit/receive earth station location. The site was selected by Harris and is located in Hooper Bay, Alaska (HPB).

The analysis was performed for a 4.5 meter antenna. The long term interference objective at 4 GHz, was -156 dBW/1 MHz, while the 6 GHz long term interference objective was -154 dBW/4 kHz, as specified by the FCC.

The earth station was analyzed for transmission and reception of digital traffic to and from a satellite arc range of 115 to 150 degrees West Longitude. This report assumes that the satellite transponders are numbered 1 through 24, with each transponder having a 36 MHz bandwidth.

This detailed interference analysis is meant to provide an estimate of potential interference at this location, and to recommend a course of future action.

SECTION 2

REPORT CONTENTS AND PROCEDURES

Transmit/Receive Earth Station

This section describes the contents of the report for a proposed C-band transmit/receive earth station.

Section 1 describes the site location, the antenna considered, and the system parameters considered in the detailed interference analysis. The analysis was undertaken to determine the potential for microwave interference for the transmit/receive earth station at the site specified.

Initially, a computer analysis of this site was performed to determine the extent of potential interference on a line-of-sight (LOS) basis. This analysis considers the microwave environment with respect to the earth station and calculates predicted signal levels between these systems. Paths which exceed a given objective level are listed for further analysis. The objective levels present the maximum interference levels allowed between the earth station and the surrounding terrestrial microwave environment for the frequency band of interest.

To further analyze the effect of the predicted interference conflicts, terrain path profiles were prepared for the critical cases. This involves plotting the interference path on topographic maps, typically 7.5 minute series U.S.G.S. maps, to determine the terrain characteristics of the path. Once this has been accomplished, predicted over-the-horizon (O-H) losses are calculated using the techniques of the National Bureau of Standards Technical Note 101 (Revised).

These calculations give the amount of signal attenuation achieved due to terrain blockage.

Section 3 summarizes the results of the site analysis. This summary includes the number of cases that were considered, the interference cases that remain, and the proposed resolution of the interference problems.

Tables 3.1-1 and 3.2-1 list the Great Circle interference cases and the predicted O-H losses calculated on the various 6 and 4 GHz paths, respectively. If multiple analyses are considered, such as changes in satellite arc or antenna, the results are presented in Tables 3.1-1.1, 3.1-1.2, 3.2-1.1 3.2-1.2, etc.....

A brief explanation of the various columns shown in Tables 3.1-1 and 3.2-1 follows:

PATH ID: This is the predicted interference path. The first site listed is the transmitter at 4 GHz or the receiver at 6 GHz.

BAND: This shows the frequency plan of the interfering paths. The 4 GHz paths affect reception of the downlink, while the 6 GHz terrestrial facilities are affected by the uplink. Receivers in the low half of the band (5925 - 6175 MHz), are indicated by 6L.

Receivers in the high half of the band (6175 - 6425 MHz), are indicated by 6H.

DIST: This is the distance from the earth station to the terrestrial station in kilometers.

AZ: This is the azimuth bearing in degrees (taken from True North), from the earth station toward the terrestrial station.

ES DISC: This is the earth station discrimination angle in degrees, towards the involved terrestrial facility.

ES GAIN: This is the gain of the earth station in dBi, at the calculated earth station discrimination angle.

LOS LOSS REQ'D: This is the amount of loss required in dB, on a line-of-sight basis, to meet the interference objective.

O-H LOSS: This is the calculated over-the-horizon (O-H) losses in dB, between the earth station and the involved terrestrial station. The 20 percent column represents losses for the long term objective. The 0.0025 and .01 percent columns present the losses for the short term objective at 6 GHz and 4 GHz, respectively.

REVISED MARGIN: This is the difference between the LOS margin and the predicted O-H losses achieved due to terrain blockage. Sufficient attenuation is calculated for the paths which show the word "CLEAR" in the revised margin. Cases showing a positive revised margin will require additional losses to meet the interference objective.

The information listed at the bottom of the table reflects the antennas, satellite arc, and interference objectives considered for the proposed site.

Section 4 presents conclusions and recommendations. It gives an overall description of the microwave environment and suggests a future course of action.

Table 5.1-1 contains the operational parameters for the proposed earth station. Tables 5.1-2 provides azimuth and elevation data for the geostationary arc, and identifies the locations of particular satellites within that arc.

Figure 5.1-1 indicates the location of the site analyzed. This location should be verified. **If it is not the desired site, Comsearch should be notified immediately so that the precise location can be analyzed.**

Section 6 presents the Great Circle interference cases. This provides a listing of the utilized channels and type of traffic loading for each path.

SECTION 3

SUMMARY AND RESULTS

The detailed interference analysis for the proposed earth station site to be located in Hooper Bay (HPB), Alaska revealed that two potential interference conflicts exist.

Transmit Band 5925 - 6425 MHz

A summary of these cases follows:

Path	Distance (Km)	Azimuth (Degrees)	Line-of-Sight Margin (dB)	Revised Margin 20% (dB)
Chevak - Hooper Bay	29.6	87.6	13.6	13.6
Hooper Bay - Chevak	1.8	54.9	2.7	2.7

Additional blockage will need to be identified in the direction of the remaining 6 GHz cases, or frequency offsets will need to be implemented to avoid conflict with the receive frequencies of these facilities.

Table 6.1-1 provides a summary of the remaining interference conflicts to the 6 GHz transmit band and their coordinated receive frequencies.

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Based on the results of the detailed interference analysis, two potential interference conflicts exist to the 6 GHz transmit band that could not be cleared with terrain path profiles.

Both of these cases are with a terrestrial path operated by United2, LLC, the receivers are at Chevak (13.6 dB margin) and Hooper Bay (2.7 dB margin). The predicted margins are based on an earth station maximum EIRP per carrier of 33.0 dBW/4 kHz. A reduction in the maximum EIRP per carrier to 30.0 dBW/4 kHz would resolve the case into the United2, LLC Hooper Bay receiver and just leave the case in Chevak that operates on receive frequencies of 6404.79 and 6256.54 MHz.

The available spectrum if limited around the Chevak receive frequencies would be 5925 – 6240, 6273 – 6388, 6421 - 6425 MHz.

4.2 Recommendations

It is recommended that Harris/FAA review the operating parameters of the proposed earth station antenna and determine whether the above referenced transmit band restrictions are acceptable. In the event that they are not, it is recommended that on-site RFI measurements and path surveys be completed in an attempt to resolve the cases identified in this report.

Table 5.1-1

SATELLITE EARTH STATION
FREQUENCY COORDINATION DATA
11/21/2015

Company	Federal Aviation Administration		
Owner Code		FEDFAA	
Earth Station Name, State		HOOPER BAY, AK	
Latitude (DMS) (NAD83)		61 31 11.2 N	
Longitude (DMS) (NAD83)		166 8 13.7 W	
Ground Elevation AMSL (ft/m)		26.25 /	8.00
Antenna Centerline AGL (ft/m)		9.00 /	2.74
Receive Antenna Type:	FCC32	Scientific-Atlanta 8345	
4.0 GHz Gain (dBi) / Diameter (m)		43.3 /	4.5
3 dB / 15 dB Half Beamwidth		0.60 /	1.25
Transmit Antenna Type:	FCC32	Scientific-Atlanta 8345	
6.0 GHz Gain (dBi) / Diameter (m)		46.3 /	4.5
3 dB / 15 dB Half Beamwidth		0.39 /	0.81
Operating Mode		TRANSMIT AND RECEIVE	
Modulation		DIGITAL	
Emission / Receive Band (MHz)	191KG7D	233KG7D / 3700.0000 -	4200.0000
Emission / Transmit Band (MHz)	191KG7D	233KG7D / 5925.0000 -	6425.0000
Max. Available RF Power (dBW)/4 kHz)		-13.30	
(dBW)/MHz)		10.70	
Max. EIRP (dBW)/4 kHz)		33.00	
(dBW)/MHz)		57.00	
Max. Permissible Interference Power			
4.0 GHz, 20% (dBW/1 MHz)		-156.0	
4.0 GHz, 0.0100% (dBW/1 MHz)		-146.0	
6.0 GHz, 20% (dBW/4 kHz)		-154.0	
6.0 GHz, 0.0025% (dBW/4 kHz)		-131.0	
Range of Satellite Arc (Geostationary)			
Degrees Longitude		115.0 W / 150.0 W	
Azimuth Range (Min/Max)		125.3 / 161.8	
Corresponding Elevation Angles		8.8 / 19.0	
Radio Climate		B	
Rain Zone		2	
Max. Great Circle Coordination Distance (mi./km)			
4.0 GHz		442.2 / 711.7	
6.0 GHz		154.7 / 248.9	
Precipitation Scatter Contour Radius (mi./km)			
4.0 GHz		344.3 / 554.1	
6.0 GHz		62.1 / 100.0	

Note: Horizon is less than 0.2 degrees at all azimuths

Table 5.2-1

Earth Station Azimuth and Elevation Table
11/16/2015

Earth Station Name HOOPER BAY, AK
Owner Federal Aviation Administration
Latitude (DMS) (NAD83) 61 31 11.2 N
Longitude (DMS) (NAD83) 166 8 13.7 W
Ground Elevation (ft/m) 26.25 / 8.00 Amsl
Antenna Centerline (ft/m) 9.00 / 2.74 Agl
Satellite Arc Range 115.0 W
150.0 W

Satellite Longitude	Azimuth (Degrees)	Elevation (Degrees)	Satellite Name
115.0	125.3	8.8	XM 4
116.0	126.3	9.2	
116.8	127.1	9.5	SATMEX 5
117.0	127.3	9.6	
118.0	128.2	10.0	
119.0	129.2	10.4	
120.0	130.2	10.8	
121.0	131.2	11.1	GALAXY 23
121.0	131.2	11.1	ECHOSTAR 9
122.0	132.2	11.5	
123.0	133.2	11.9	GALAXY 10R
124.0	134.2	12.2	
125.0	135.2	12.6	GALAXY 14
126.0	136.2	12.9	
127.0	137.2	13.2	GALAXY 13
127.0	137.2	13.2	HORIZONS 1
128.0	138.2	13.6	
129.0	139.3	13.9	GALAXY 27
130.0	140.3	14.2	
131.0	141.3	14.5	AMC 11
132.0	142.4	14.8	
133.0	143.4	15.1	GALAXY 15
134.0	144.4	15.4	
135.0	145.5	15.7	AMC 10
136.0	146.6	16.0	
137.0	147.6	16.3	AMC 7
138.0	148.7	16.5	
139.0	149.8	16.8	AMC 8
140.0	150.8	17.0	
141.0	151.9	17.3	
142.0	153.0	17.5	
143.0	154.1	17.7	
144.0	155.2	17.9	
145.0	156.3	18.1	
146.0	157.4	18.3	
147.0	158.5	18.5	
148.0	159.6	18.7	
149.0	160.7	18.9	
150.0	161.8	19.0	

Table 6.1-1

Great Circle Interference Conflicts
11/16/2015

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Earth Station Name     HOOPER BAY, AK
Owner                  Federal Aviation Administration
Latitude  (DMS) (NAD83)  61 31 11.2 N
Longitude (DMS) (NAD83) 166  8 13.7 W
Ground Elevation (ft/m)       26.25 /     8.00 Amsl
Antenna Centerline (ft/m)      9.00 /     2.74 Agl
Antenna Model              FCC REFERENCE 32-25LOG(THETA)
Objectives: Receive      -156.0 (dBW /1 MHz)
            Transmit     -154.0 (dBW /4 kHz)  Tx Power   -13.3 (dBW/4 kHz)
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	Terrestrial Path			Gnd Acl	Edisct Tdisct	Ges Gts	FsLoss Tant	Dist Az	Pr Tpwr Margin	Plan LL
	Latitude	Longitude	Call Sign				Loading			
	Owner									
	Freq/Pol									
1	CHEVAK	AK	HOOPER BAY AK	15.20	38.6	-7.6	137.7	29.6	-140.4	31.1HT
	61 31 48	165 34 54	WQHH679	22.86	358.1	21.5	52610A	87.6	13.6	3.3
	UNIINC: United2, LLC						2016CH	DIG	RCN: 08022718	
	6404.7900V									
	Status: L				Equipment: TEMC52		Emission: 30M0D7W			
	OH LOSS 20% / 0.0025%:			0.00 /	0.00					
2	CHEVAK	AK	HOOPER BAY AK	15.20	38.6	-7.6	137.7	29.6	-140.4	31.1HT
	61 31 48	165 34 54	WQHH679	22.86	358.1	21.5	52610A	87.6	13.6	3.3
	UNIINC: United2, LLC						2016CH	DIG	RCN: 07060126	
	6256.5400V									
	Status: L				Equipment: TEMC52		Emission: 30M0D7W			
	OH LOSS 20% / 0.0025%:			0.00 /	0.00					
3	HOOPER BAY	AK	AKCHEVAK AK	6.00	70.7	-10.0	113.2	1.8	-151.3	31.1LT
	61 31 44	166 6 36	WQHM636	13.72	145.4	-11.5	52610A	54.9	2.7	3.3
	UNIINC: United2, LLC						2016CH	DIG	RCN: 08022718	
	6152.7500V									
	Status: L				Equipment: TEMC52		Emission: 30M0D7W			
	OH LOSS 20% / 0.0025%:			0.00 /	0.00					
4	HOOPER BAY	AK	AKCHEVAK AK	6.00	70.7	-10.0	113.2	1.8	-151.3	31.1LT
	61 31 44	166 6 36	WQHM636	13.72	145.4	-11.5	52610A	54.9	2.7	3.3
	UNIINC: United2, LLC						2016CH	DIG	RCN: 07060126	
	6004.5000V									
	Status: L				Equipment: TEMC52		Emission: 30M0D7W			
	OH LOSS 20% / 0.0025%:			0.00 /	0.00					

Figure 5.1-1


Beach Access Trail
61 31 11.2n, 166 08 13.7W
© 2015 Google
Image © 2015 DigitalGlobe
Google earth
2005
Imagery Date: 7/4/2008 61°31'11.16" N 166°08'13.70" W elev 26 ft eye alt 1555 ft

Table 3.1-1
Interference Case Summary
Hooper Bay, Alaska

Case #	Path ID		Band (GHz)	Distance (km)	Azimuth (°)	ES Disc (°)	ES Gain (dBi)	LOS Loss Required (dB)	OH Loss 20% (dB)	OH Loss 0.01% (dB)	Revised 20% (dB)	Margin 0.01% (dB)
1	CHEVAK	HOOPER BAY	6.1	29.6	87.6	38.6	-7.6	13.6	0.0	0.0	13.6	CLEAR
2	CHEVAK	HOOPER BAY	6.1	29.6	87.6	38.6	-7.6	13.6	0.0	0.0	13.6	CLEAR
3	HOOPER BAY	CHEVAK	6.1	1.8	54.9	70.7	-10.0	2.7	0.0	0.0	2.7	CLEAR
4	HOOPER BAY	CHEVAK	6.1	1.8	54.9	70.7	-10.0	2.7	0.0	0.0	2.7	CLEAR

Antenna Type: 4.5 Meter
Uplink Power: -13.3 dBW/4 kHz
Satellite Arc: 115.0 W to 150.0 W
Objectives: Long Term: -154.0 dBW/4 kHz Short Term: -131.0 dBW/4 kHz