Exhibit For
Denali 20020, LLC
Brewster, Washington
Call Sign E960222
Vertex 9 Meter Earth Station

Compliance with FCC Report & Order (FCC96-377) for the 13.75 - 14.0 GHz Band
Analysis and Calculations

1. Background

This Exhibit is presented to demonstrate the extent to which the proposed modifications to the 9 meter Ku-band earth station licensed under Denali 20020 LLC Call Sign E960222 located in Brewster, Washington, is in compliance with FCC REPORT & ORDER 96-377. The potential interference from the earth station to US Navy shipboard radiolocation operations (RADAR) and the NASA space research activities in the 13.75 - 14.0 GHz band is addressed in this exhibit. The parameters for the earth station are:

Table 1. Earth Station Characteristics

- Coordinates (NAD83): 48° 08' 50.5" N, 119° 41' 33.2" W
- Satellite Location for Earth Station: 139° WL (**E139WA**)
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: H,V
- Emissions: 2.4 MHz
  36 MHz
  72 MHz
- Modulation: Digital
- Maximum Aggregate Uplink EIRP: 73.9 dBW for the 2.4 MHz Carriers
  85.0 dBW for the 36 MHz Carriers
  85.0 dBW for the 72 MHz Carriers
- Transmit Antenna Characteristics
  Antenna Size: 9 meters in Diameter
  Antenna Type/Model: Vertex
  Gain: 60.1 dBi
- RF power into Antenna Flange: 2.4 MHz
  13.8 dBW
  or -14.0 dBW/4 kHz (Maximum)

36 MHz
24.9 dBW
or -14.6 dBW/4 kHz (Maximum)

72.0 MHz
24.9 dBW
or -17.6 dBW/4 kHz (Maximum)

- Minimum Elevation Angles:
  Brewster, WA 31.6 ° @ 205.2° Az. (**E139WA**) at 139.0° WL

- Side Lobe Antenna Gain: 32 - 25*log(θ)

Because the above uplink spectrum is shared with the Federal Government, coordination in this band requires resolution data pertaining to potential interference between the earth station and both Navy Department and NASA systems. Potential interference from the earth station could impact with the Navy and/or NASA systems in two areas. These areas are noted in FCC Report and Order 96-377 dated September 1996, and consist of (1) Radiolocation and radio navigation, (2) Data Relay Satellites.

Summary of Coordination Issues:

1) Potential Impact to Government Radiolocation (Shipboard Radar)
2) Potential Impact to NASA Data Relay Satellite Systems (TDRSS)

2. Potential Impact to Government Radiolocation (Shipboard Radar)

Radiolocation operations (RADAR) may occur anywhere in the 13.4 - 14 GHz frequency band aboard ocean going United States Navy ships. The Federal Communication Commission (FCC) order 96-377 allocates the top 250 MHz of this 600 MHz band to the Fixed Satellite Service (FSS) on a co-primary basis with the radiolocation operations and provides for an interference protection level of -167 dBW/m^2/4 kHz.

The closest distance to the shoreline from the Brewster earth station is approximately 206 km Southwest toward Puget Sound. The calculation of the power spectral density at this distance is given by:

	2.4 MHz	**36 MHz**	**72.0 MHz**
1. Clear Sky EIRP:	73.9 dBW	85.0 dBW	85.0 dBW
2. Carrier Bandwidth:	2.4MHz	36 MHz	72.0 MHz
3. PD at antenna Input: (dBW/4 kHz)	-14.0	-14.6	-17.6
4. Transmit Antenna Gain:	60.1 dBi		
5. Antenna Gain Horizon:		FCC Reference Pattern	
6. Antenna Elevation Angles:		31.6°	

The proposed earth station will radiate interference toward the Puget Sound according to its off-axis side-lobe performance. A conservative analysis, using FCC standard reference pattern, results in off-axis antenna gains of -10.0 dBi toward Puget Sound.

The signal density at the shoreline, through free space is:

2.4 MHz Carriers
PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m^2).

= -14.0 dBw/4 kHz + (-10.0 dBi) – 10*log[4Π*(206000m)^2]
= -141.3 dBW/m^2/4 kHz + Additional Path Losses (~98.0 dB)
= -239.3 dBW/m^2/4 kHz

36 MHz Carriers
PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m^2).

= -14.6 dBw/4 kHz + (-10.0 dBi) – 10*log[4Π*(206000m)^2]
= -141.9 dBW/m^2/4 kHz + Additional Path Losses (~98.0 dB)
= -239.9 dBW/m^2/4 kHz

72 MHz Carriers
PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m^2).

= -17.6 dBw/4 kHz + (-10.0 dBi) – 10*log[4Π*(206000m)^2]
= -144.9 dBW/m^2/4 kHz + Additional Path Losses (~98.0 dB)
= -242.9 dBW/m^2/4 kHz

Our calculations show additional path loss of approximately 98 dB including absorption loss and earth diffraction loss for the actual path profiles from the proposed earth station to the nearest shoreline.

For the **2.4 MHz** carriers, the calculated PFD including additional path losses to the closest shoreline location is –239.3 dBW/m^2/4 kHz. This is 72.3 dB below the –167 dBW/m2/4 kHz interference criteria of R&O 96-377. For the **36 MHz** carriers, the calculated PFD including additional path losses to the closest shoreline location is –239.9 dBW/m^2/4 kHz. This is 72.9 dB below the –167 dBW/m2/4 kHz interference criteria of R&O 96-377. For the **72 MHz** carriers, the calculated PFD including additional path losses to the closest shoreline location is –242.9 dBW/m^2/4 kHz. This is 75.9 dB below the –167 dBW/m2/4 kHz interference criteria of R&O 96-377.

Therefore, for all emissions, there should be no interference to the US Navy RADAR from the Brewster earth station due to the distance and the terrain blockage between the site and the shore.

3. Potential Impact to NASA's Data Relay Satellite System (TDRSS)

The geographic location of the Denali 20020 LLC earth station in Brewster, Washington is outside the 390 km radius coordination contour surrounding NASA's White Sands, New Mexico ground station complex. Therefore, the TDRSS space-to-earth link will not be impacted by the Denali 20020 LLC earth station in Brewster, Washington.

The TDRSS space-to-space link in the 13.772 to 13.778 GHz band is assumed to be protected if an earth station produces an EIRP less than 71 dBW/6 MHz in this band. The 9 meter earth station dish will have an EIRP less than 71 dBW/6 MHz in this band for all three of the emissions. The total EIRP for the 2.4 MHz carriers will be limited to 71.3 dBW for transmissions that cross the 13.772 to 13.778 GHz spectrum, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz. The total EIRP for the 36 MHz carriers will be limited to 76.9 dBW for transmissions that cross the 13.772 to 13.778 GHz spectrum, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz. The total EIRP for the 72 MHz emissions, will be limited to 80.87 dBW for transmissions that cross the 13.772 to 13.778 GHz spectrum. The equivalent EIRP per 6 MHz segment will be 68.87 dBW/6 MHz for the 72 MHz emissions.

4. Coordination Issue Result Summary and Conclusions

The results of the analysis and calculations performed in this exhibit indicate that compatible operations between the earth station at the Brewster facility and the US Navy and NASA systems space-to-earth link are possible for the 2.4 MHz, 36 MHz and 72 MHz carriers. Operations in NASA systems space-to-space link (13772.0 to 13778.0 MHz) will also be permitted based on the reduced EIRP across that spectrum.