Exhibit For
Denali 20020, LLC
Vernon Valley, New Jersey
Call Sign E160179
Vertex 6.1 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 6.1 meter Ku-band earth station licensed under Denali 20020 LLC Call Sign E160179 located in Vernon Valley, New Jersey, 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): 41° 12’ 4.6” N, 74° 31’ 39.1” W
- Satellite Location for Earth Station: 37.5 ° WL (Telstar 11N)
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: H,V
- Emissions: 21 MHz and 72 MHz
- Modulation: Digital
- Maximum Aggregate Uplink EIRP:
  80.1 dBW 21 MHz , 85.0 dBW 72 MHz Carriers
- Transmit Antenna Characteristics
  - Antenna Size: 6.1 meters in Diameter
  - Antenna Type/Model: Vertex
  - Gain: 56.9 dBi
- RF power into Antenna Flange:

  21 MHz
  23.2 dBW or -14.0 dBW/4 kHz (Maximum)

  72 MHz
  28.1 dBW or -14.0 dBW/4 kHz (Maximum

- Minimum Elevation Angles:
  Vernon Valley, NJ. 29.4 ° @ 131.2 ° Az. (Telstar 11) at 37.5 ° 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 Vernon earth station is approximately 71.6 km Southeast toward the Atlantic Coastline. The calculation of the power spectral density at this distance is given by:

		21 MHz	72 MHz
1.	Clear Sky EIRP:	80.1 dBW	85.0 dBW
2.	Carrier Bandwidth:	21 MHz	72 MHz
3.	PD at antenna Input: (dBW/4 kHz)	-14.0	-14.0
4.	Transmit Antenna Gain:	56.9 dBi	
5.	Antenna Gain Horizon:	FCC Reference Pattern	
6.	Antenna Elevation Angles:	29.4°	

The proposed earth station will radiate interference toward the coastline according to its off-axis side-lobe performance. A conservative analysis, using FCC standard reference pattern, results in off-axis antenna gains of -2.0 dBi toward the coastline.

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

21 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 + (-2.0 dBi) – 10*log[4Π*(71620m)^2]
= -124.1 dBW/m^2/4 kHz + Additional Path Losses (~75.0 dB)
= -199.1 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).

= -14.0 dBw/4 kHz + (-2.0 dBi) – 10*log[4Π*(71620m)^2]
= -124.1 dBW/m^2/4 kHz + Additional Path Losses (~75.0 dB)
= -199.1 dBW/m^2/4 kHz

Our calculations show additional path loss of approximately 75 dB including absorption loss and earth diffraction loss for the actual path profiles from the proposed earth station to the nearest shoreline.

For the 21 MHz carriers, the calculated PFD including additional path losses to the closest shoreline location is –199.1 dBW/m^2/4 kHz. This is 32.1 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 –199.1 dBW/m^2/4 kHz. This is 32.1 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 Vernon 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 Vernon, New Jersey 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 Vernon, New Jersey.

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 total EIRP for the 21 MHz carriers will be limited to 74.49 dBW, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz to meet the 71 dBW/6 MHz objective for the TDRSS space-to-space link in the 13.772 to 13.778 GHz band. The total EIRP for the 72 MHz carriers will be limited to 82.9 dBW, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz to meet the 71 dBW/6 MHz objective for the TDRSS space-to-space link in the 13.772 to 13.778 GHz band.

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 Vernon facility and the US Navy and NASA systems space-to-earth link are possible for the 21 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 limitation of uplink power for the 21 MHz and 72 MHz carriers in this portion of the band.

Exhibit For
Denali 20020, LLC
Vernon Valley, New Jersey
Call Sign E160179
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 E160179 located in Vernon Valley, New Jersey, 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): 41° 12’ 4.6” N, 74° 31’ 39.1” W
- Satellite Location for Earth Station: 37.5 ° WL (Telstar 11N)
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: H,V
- Emissions: 21 MHz and 72 MHz
- Modulation: Digital
- Maximum Aggregate Uplink EIRP:
  83.3 dBW 21 MHz , 85.0 dBW 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:

  21 MHz
  23.2 dBW or -14.0 dBW/4 kHz (Maximum)

  72 MHz
  28.5 dBW or -17.6 dBW/4 kHz (Maximum)

- Minimum Elevation Angles:
  Vernon Valley, NJ. 29.4 ° @ 131.2 ° Az. (Telstar 11) at 37.5 ° 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 Vernon earth station is approximately 71.6 km Southeast toward the Atlantic Coastline. The calculation of the power spectral density at this distance is given by:

	21 MHz	72 MHz
7. Clear Sky EIRP:	83.3 dBW	85.0 dBW
8. Carrier Bandwidth:	21 MHz	72 MHz
9. PD at antenna Input: (dBW/4 kHz)	-14.0	-17.6
10. Transmit Antenna Gain:	60.1 dBi	
11. Antenna Gain Horizon:	FCC Reference Pattern	
12. Antenna Elevation Angles:	29.4°	

The proposed earth station will radiate interference toward the coastline according to its off-axis side-lobe performance. A conservative analysis, using FCC standard reference pattern, results in off-axis antenna gains of -2.0 dBi toward the coastline.

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

21 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 + (-2.0 dBi) – 10*log[4Π*(71620m)^2]
= -124.1 dBW/m^2/4 kHz + Additional Path Losses (~75.0 dB)
= -199.1 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 + (-2.0 dBi) – 10*log[4Π*(71620m)^2]
= -124.1 dBW/m^2/4 kHz + Additional Path Losses (~75.0 dB)
= -202.7 dBW/m^2/4 kHz

Our calculations show additional path loss of approximately 75 dB including absorption loss and earth diffraction loss for the actual path profiles from the proposed earth station to the nearest shoreline.

For the 21 MHz carriers, the calculated PFD including additional path losses to the closest shoreline location is –199.1 dBW/m^2/4 kHz. This is 32.1 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 –202.7 dBW/m^2/4 kHz. This is 35.7 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 Vernon 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 Vernon, New Jersey 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 Vernon, New Jersey.

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 total EIRP for the 21 MHz carriers will be limited to 74.49 dBW, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz to meet the 71 dBW/6 MHz objective for the TDRSS space-to-space link in the 13.772 to 13.778 GHz band. The total EIRP for the 72 MHz carriers will be limited to 82.9 dBW, and the equivalent EIRP per 6 MHz segment will be 70.9 dBW/6 MHz to meet the 71 dBW/6 MHz objective for the TDRSS space-to-space link in the 13.772 to 13.778 GHz band.

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 Vernon facility and the US Navy and NASA systems space-to-earth link are possible for the 21 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 limitation of uplink power for the 21 MHz and 72 MHz carriers in this portion of the band.