Exhibit For
SES
Port St. Lucie, Florida
GD Satcom 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 SES satellite earth station 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): 27°16’ 56” N, 80° 28’ 58” W
- Satellite Range for Earth Station: (40° W) and (121° W)
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: H,V
- Emissions: N0N, 648KG7W, 10M0G7W, 20M0G7W and 118MG7W
- Modulation: Digital
- Maximum Aggregate Uplink EIRP: 34.9 dBW for the N0N Carrier
  57.0 dBW for the 648 kHz Carriers
  68.8 dBW for the 10 MHz Carriers
  71.8 dBW for the 20 MHz Carriers
  79.6 dBW for the 118 MHz Carriers
- Transmit Antenna Characteristics
  Antenna Size: 9.0 meters in Diameter
  Antenna Type/Model: GD Satcom
  Gain: 59.9 dBi
- RF power into Antenna Flange: No Modulation (N0N)
  -25.0 dBW
  or -25.0 dBW/4 kHz (Maximum)

- RF power into Antenna Flange (Continued) — 648 kHz
  -2.9 dBW
  or -25.0 dBW/4 kHz

  10 MHz
  8.9 dBW
  or -25.0 dBW/4 kHz (Maximum)

  20 MHz
  11.9 dBW
  or –25.0 dBW/4 kHz (Maximum)

  118 MHz
  19.7 dBW
  or –25.0 dBW/4 kHz (Maximum)

Minimum Elevation Angles:
Port St. Lucie, FL. — 35.5° @ 118.2° Az. and 35.4° @ 241.8° Az

- 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.

<u>Summary of Coordination Issues</u>:

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 Port St. Lucie, Florida earth station is approximately 25 km northeast toward the Florida Oceanfront. The calculation of the power spectral density at this distance is given by:

		N0N	648 kHz	10.0 MHz	20.0 MHz	118.0 MHz
1.	Clear Sky EIRP (dBW):	34.9	57.0	68.8	71.8	79.6
2.	Carrier Bandwidth:	CW	648 kHz	10 MHz	20 MHz	118 MHz
3.	PD at antenna Input: (dBW/4 kHz)	-25.0	-25.0	-25.0	-25.0	-25.0
4.	Transmit Antenna Gain:			59.9 dBi		
5.	Antenna Gain Horizon:			FCC Reference Pattern		
6.	Antenna Elevation Angle:			35.5°		

The earth station will radiate interference toward the Port St. Lucie, Florida Coastline 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 the Coastline.

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

N0N Carriers (CW Carrier)
PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m^2).

= -25.0 dBw/4 kHz + (-10.0) dBi – 10*log[4Π*$(25000m)^2$]
= -133.9 dBW/m^2/4 kHz + Additional Path Losses (~33.1dB)
= -167.0 dBW/m^2/4 kHz

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

= -25.0 dBw/4 kHz + (-10.0) dBi – 10*log[4Π*$(25000m)^2$]
= -133.9 dBW/m^2/4 kHz + Additional Path Losses (~33.1 dB)
= -167.0 dBW/m^2/4 kHz

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

= -25.0 dBw/4 kHz + (-10.0) dBi – 10*log[4Π*$(25000m)^2$]
= -133.9 dBW/m^2/4 kHz + Additional Path Losses (~33.1 dB)
= -167.0 dBW/m^2/4 kHz

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

= -25.0 dBw/4 kHz + (-10.0) dBi – 10*log[4Π*$(25000m)^2$]
= -133.9 dBW/m^2/4 kHz + Additional Path Losses (~33.1 dB)
= -167.0 dBW/m^2/4 kHz

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

$$= -25.0 \text{ dBw/4 kHz} + (-10.0) \text{ dBi} - 10*\log[4\Pi*(25000\text{m})^2]$$
$$= -133.9 \text{ dBW/m}^2\text{/4 kHz} + \text{Additional Path Losses } (\sim 33.1 \text{ dB})$$
$$= -167.0 \text{ dBW/m}^2\text{/4 kHz}$$

Our calculations show additional path loss of approximately 33.1 dB including absorption loss and earth diffraction loss for the actual path profiles from the proposed earth station to the nearest shoreline. Please note these losses include close-in local buildings in the direction of the shoreline.

The calculated PFD including additional path losses to the closest shoreline location is –167.0 dBW/m^2/4 kHz for all carriers. This meets the –167 dBW/m^2/4 kHz interference criteria of R&O 96-377. Therefore, there should be no interference to the US Navy RADAR from the Port Saint Lucie 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 SES earth station in Port St. Lucie, Florida 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 SES earth station in Port St. Lucie, Florida.

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 antenna will have an EIRP less than 71 dBW/6 MHz for all carriers in this band. The highest equivalent EIRP per 6 MHz segment will be 68.4 dBW/6 MHz for the 20 MHz carrier. All other proposed carriers will have an equivalent EIRP per 6 MHz segment lower than 68.4 dBW/6 MHz. There should not be any interference to the TDRSS space-to-space link for any of the carriers proposed at Port St. Lucie in this 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 Port St. Lucie facility and the US Navy and NASA systems space-to-earth link and NASA systems space-to-space link (13772.0 to 13778.0 MHz) will be permitted for all proposed carriers.