

**Exhibit For
SES Americom, LLC
Bristow, Virginia
GD SATCOM Technologies 11.0 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 Americom, LLC satellite earth station in Bristow, Virginia 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): 38° 47' 3.3" N, 77° 34' 22.6" W
- Satellite Location for Earth Station: NSS 7 (20.0° W)
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: Linear
- Emissions: 100KN0N, 1M00F8D, 500KG7W, and 77M0G7W
- Modulation: Digital
- Maximum Aggregate Uplink EIRP: 68.0 dBW for the 100 kHz Carriers
69.0 dBW for the 500 kHz Carriers
78.0 dBW for the 1 MHz Carriers
88.8 dBW for the 77 MHz Carriers
- Transmit Antenna Characteristics
 - Antenna Size: 11.0 meters in Diameter
 - Antenna Type/Model: General Dynamics SATCOM Tech.
 - Gain: 62.0 dBi
- RF power into Antenna Flange: 100 kHz
6.0 dBW
or -8.0 dBW/4 kHz (Maximum)

- RF power into Antenna Flange (Continued)
 - 500 kHz
 - 7.0 dBW
 - or -14.0 dBW/4 kHz (Maximum)

 - 1 MHz
 - 16.0 dBW or 0.0 dBW/ MHz
 - or -8.0 dBW/4 kHz (Maximum)

 - 77 MHz
 - 26.8 dBW or 18.8 dBW/ MHz
 - or -16.0 dBW/4 kHz (Maximum)

- Minimum Elevation Angle: Bristow.
 - 16.4° @ 111.7° Az. (NSS 7) at 20.0° W

- 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/m²/4 kHz.

The closest distance to the shoreline from the Bristow earth station is approximately 115.3 km Southeast toward the Chesapeake Bay. The calculation of the power spectral density at this distance is given by:

	<u>100 kHz</u>	<u>500 kHz</u>	<u>1.0 MHz</u>	<u>77.0 MHz</u>
1. Clear Sky EIRP:	68.0 dBW	69.0 dBW	78.0 dBW	88.8 dBW
2. Carrier Bandwidth:	100 kHz	500 MHz	1.0 MHz	77.0 MHz
3. PD at antenna Input: (dBW/4 kHz)	-8.0	-14.0	-8.0	-16.0
4. Transmit Antenna Gain:	62.0 dBi			
5. Antenna Gain Horizon:	FCC Reference Pattern			
6. Antenna Elevation Angles:	16.4°			

The proposed earth station will radiate interference toward the Bay according to its off-axis side-lobe performance. A conservative analysis, using FCC standard reference pattern, results in off-axis antenna gains of 6.1 dBi toward the Chesapeake Bay.

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

100 kHz Carriers

PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m²).

$$\begin{aligned}
 &= -8.0 \text{ dBw/4 kHz} + 6.1 \text{ dBi} - 10 \cdot \log[4\pi \cdot (115300\text{m})^2] \\
 &= -114.1 \text{ dBW/m}^2/4 \text{ kHz} + \text{Additional Path Losses } (\sim 53.8 \text{ dB}) \\
 &= -167.9 \text{ dBW/m}^2/4 \text{ kHz}
 \end{aligned}$$

500 kHz Carriers

PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m²).

$$\begin{aligned}
 &= -14.0 \text{ dBw/4 kHz} + 6.1 \text{ dBi} - 10 \cdot \log[4\pi \cdot (115300\text{m})^2] \\
 &= -120.1 \text{ dBW/m}^2/4 \text{ kHz} + \text{Additional Path Losses } (\sim 53.8 \text{ dB}) \\
 &= -173.9 \text{ dBW/m}^2/4 \text{ kHz}
 \end{aligned}$$

1 MHz Carriers

PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m²).

$$\begin{aligned}
 &= -8.0 \text{ dBw/4 kHz} + 6.1 \text{ dBi} - 10 \cdot \log[4\pi \cdot (115300\text{m})^2] \\
 &= -114.1 \text{ dBW/m}^2/4 \text{ kHz} + \text{Additional Path Losses } (\sim 53.8 \text{ dB}) \\
 &= -167.9 \text{ dBW/m}^2/4 \text{ kHz}
 \end{aligned}$$

77 MHz Carriers

PFD = Antenna Feed Power density (dBW/4 kHz) + Antenna Off-Axis Gain (dBi) – Spread Loss (dBw-m²).

$$\begin{aligned} &= -16.0 \text{ dBw/4 kHz} + 6.1 \text{ dBi} - 10 \cdot \log[4\pi \cdot (115300\text{m})^2] \\ &= -122.1 \text{ dBW/m}^2/4 \text{ kHz} + \text{Additional Path Losses } (\sim 53.8 \text{ dB}) \\ &= -175.9 \text{ dBW/m}^2/4 \text{ kHz} \end{aligned}$$

Our calculations show additional path loss of approximately 53.8 dB including absorption loss and earth diffraction loss for the actual path profiles from the proposed earth station to the nearest shoreline.

The worst case calculated PFD including additional path losses to the closest shoreline location is $-167.9 \text{ dBW/m}^2/4 \text{ kHz}$ for the 100 kHz and 1 MHz carriers, $-173.9 \text{ dBW/m}^2/4 \text{ kHz}$ for the 500 kHz carriers and $-175.9 \text{ dBW/m}^2/4 \text{ kHz}$ for the 77 MHz carriers. This is 0.9 dB (100 kHz and 1 MHz carriers), 6.9 dB (500 kHz carriers) and 8.9 dB (77 MHz carriers) below the $-167 \text{ dBW/m}^2/4 \text{ kHz}$ interference criteria of R&O 96-377. Therefore, there should be no interference to the US Navy RADAR from the Bristow 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 Americom earth station in Bristow, Virginia 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 Americom earth station in Bristow, Virginia.

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 11.0 meter earth station antenna will have an EIRP less than 71 dBW/6 MHz for the 100 kHz and 500 kHz carriers in this band. The total EIRP for the 100 kHz, carriers is 68.0 dBW and the total EIRP for the 500 kHz, carriers is 69.0 dBW. The equivalent EIRP per 6 MHz segment will remain at 68.0 dBW/6 MHz, and 69.0 dBW/6 MHz. Therefore, there should not be interference to the TDRSS space-to-space link for the 100 kHz and 500 kHz carriers. For the 1.0 MHz and 77 MHz carriers, total EIRPs of 78.0 dBW (1 MHz), and 88.8 dBW (77 MHz), equate to an EIRP per 6 MHz of 77.8 dBW/6 MHz) and 76.0 dBW/6 MHz, respectively. These levels are above the 71.0 dBW/6 MHz threshold, and there will be interference to the TDRSS space-to-space link. Therefore, transmit operations from 13770 to 13780 MHz will not be permitted for these two emissions.

4. Coordination Issue Result Summary and Conclusions

The results of the analysis and calculations performed in this exhibit indicate that compatible operation between the earth station at the Bristow facility and the US Navy and NASA systems space-to-earth link are possible for the 100 and 500 kHz carriers. Operations in NASA systems space-to-space link (13772.0 to 13778.0 MHz) will also be permitted.

For the 1 MHz, and 77 MHz carriers, the results of the analysis and calculations performed in this exhibit indicate that compatible operation between the earth station at the Bristow facility and the US Navy and NASA systems space-to-earth link are possible. However, operations in NASA systems space-to-space link (13772.0 to 13778.0 MHz) will not be permitted. Frequencies from 17770.0 to 17780.0 MHz will need to be avoided for the 1 MHz and 77 MHz carriers.