**Exhibit For**
**SES Americom, Inc**
**Sunset Beach, Hawaii**
**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 licensed SES Americom, Inc. 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): 21° 40' 16.4" N, 158° 1' 52.8" W
- Satellite Location for Earth Station: From 88.0° W to 228.0° W
- Frequency Band: 13.75-14.0 GHz for uplink
- Polarizations: Linear
- Emissions: N0N, 100KG7W, 800KG9D, 35M0G7W, 54M0G7W and 72M0G7W
- Modulation: Digital
- Maximum Aggregate Uplink EIRP:
  42.1 dBW for the N0N Carrier
  56.1 dBW for the 100 kHz Carriers
  65.1 dBW for the 800 kHz Carriers
  81.5 dBW for the 35 MHz Carriers
  83.4 dBW for the 54 MHz Carriers
  84.6 dBW for the 72 MHz Carriers
- Transmit Antenna Characteristics
  Antenna Size: 9.0 meters in Diameter
  Antenna Type/Model: GD Satcom
  Gain: 60.1 dBi
- RF power into Antenna Flange: No Modulation (N0N)
  -18.0 dBW or -18.0 dBW/4 kHz (Maximum)

100 kHz
-4.0 dBW
or -18.0 dBW/4 kHz

800 kHz
5.0 dBW
or -18.0 dBW/4 kHz

35 MHz
21.4 dBW
or –18.0 dBW/4 kHz (Maximum)

54 MHz
23.3 dBW
or –18.0 dBW/4 kHz (Maximum)

72 MHz
24.5 dBW
or –18.0 dBW/4 kHz (Maximum)

- Minimum Elevation Angles:
  Sunset Beach, HI. 9.9° @ 97.6° 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.

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 Sunset Beach earth station is approximately 1.0 km West toward the Pacific Ocean. The calculation of the power spectral density at this distance is given by:

| | | N0N | 100 kHz | 800kHz | 35MHz | 54 MHz | 72MHz |
|---|---|---|---|---|---|---|---|
| 1. | Clear Sky EIRP (dBW): | 42.1 | 56.1 | 65.1 | 81.5 | 83.4 | 84.6 |
| 2. | Carrier Bandwidth: | CW | 100 kHz | 800 kHz | 35 MHz | 54 MHz | 72MHz |
| 3. | PD at antenna Input: (dBW/4 kHz) | -18.0 | -18.0 | -18.0 | -18.0 | -18.0 | -18.0 |
| 4. | Transmit Antenna Gain: | 60.1 dBi | | | | | |
| 5. | Antenna Gain Horizon: | FCC Reference Pattern | | | | | |
| 6. | Antenna Elevation Angle: | 9.9° | | | | | |

The proposed earth station will radiate interference toward the Pacific Ocean according to its off-axis side-lobe performance. A conservative analysis, using FCC standard reference pattern, results in off-axis antenna gains of 1.84 dBi toward the Coast.

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-$m^2$).

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

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

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

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

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

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

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

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

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

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

= -18.0 dBw/4 kHz + (1.84) dBi – 10*log[4Π*(1000m)$^2$]
= -87.15 dBW/$m^2$/4 kHz + Additional Path Losses (~26.5 dB)
= -113.65 dBW/$m^2$/4 kHz

Our calculations show additional path loss of approximately 26.5 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 worst case calculated PFD including additional path losses to the closest shoreline location is –113.65 dBW/$m^2$/4 kHz. This is 53.35 dB above the –167 dBW/$m^2$/4 kHz interference criteria of R&O 96-377.

In an effort to analyze the effects of earth station transmissions on naval radar systems, power flux densities were calculated from the earth station to the shipboard radars in increments from 12.8 miles to 60 miles (See Table 2). The calculation of interference level to the RADAR sidelobes was made at the initial distance of 12.8 miles. A distance of 12.8 miles (20.6 Km.) was used as the initial increment because it is the distance from the earth station site to the offshore operating shipping lane. This is the worst case condition. If the interference level is below the criteria at this range, it will be below the criteria at all of the greater ranges. A power flux density was also calculated from the shipboard radars to the shoreline and the reflection of the radar transmissions back to the radar. Since this flux density concerns the transmission from the ship to shore and back to the ship the mileage number is doubled. The power flux densities are based on the following formulas:

Earth Station to Naval Radars

$$P_{FD} = P_{ES}G_{ES} \,/\, 4\pi r^2$$

Where: $P_{FD}$ = Power Flux Density
$P_{ES}$ = Power of Earth Station (-14.0 dbW/4 kHz)
$G_{ES}$ = Worst Case Earth Station Gain Toward the Shipboard Radars (1.84 dB)
$4\pi$ = 10Log($4\pi$) = -11.0
r = Distance from ES to radars in Meters [Used 20Log(r)]

Naval Radars to Shore and Reflection back to the Radar Source

$P_{FD} = P_T G_T / 4\pi (2r)^2 * (0.01\ m^2)$

Where: $P_{FD}$ = Power Flux Density
$P_T$ = Power of Radar (Used 56.0 dBW for 3.65 MHz)
$G_T$ = Gain of Radar (Used 44 dB)
$4\pi = 10\text{Log}(4\pi) = -11.0$
$2r$ = Distance to Shoreline and Reflection back to Radar Source
$0.01 m^2$ = Size of the Radar Sectional Area of Target

Based upon calculations from the above formulas, it was determined that reflections of the radar transmissions from the shoreline and back to the radar were 86.5 dB higher than the earth station transmissions into the radar.

These calculations are presented in the tables below. This being the case, it can be concluded that in the main beam, earth station operations should not be a problem for naval radar operations.

**Table 2**

| Distance from ES to Radar (Miles) | Flux Density Interference From ES (dBW/4 kHz/m²) | Desired Radar Return from (0.01m)² Target (dBW/4 kHz/m²) | Radar Signal ES Interference (dB) |
|---|---|---|---|
| 12.8 | -113.6 | -63.2 | 50.4 |
| 15.0 | -114.3 | -63.9 | 50.4 |
| 20.0 | -117.8 | -67.4 | 50.4 |
| 30.0 | -121.1 | -70.7 | 50.4 |
| 40.0 | -123.5 | -73.1 | 50.4 |
| 50.0 | -125.5 | -75.1 | 50.4 |
| 60.0 | -127.1 | -76.7 | 50.4 |

The worst-case calculated PFD, which includes 26.5 dB of additional path losses to the shoreline location is –113.6 dBW/$m^2$/4 kHz. If off axis, side lobe considerations are made, 44 dB was used as the gain of the radar and -10.0 dBi was the radar antenna side lobe gain toward the direction of the earth station. This additional -54.0 dB will create an equivalent PFD of -167.6 dBW/$m^2$/4 kHz, which is 0.6 dB lower than the –167 dBW/m²/4 kHz interference criteria of R&O 96-377.

Therefore, there should be no interference to the US Navy RADAR from the Sunset Beach earth station in both the main beam and side lobe of the radar.

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

The geographic location of the SES Americom, Inc. earth station in Sunset Beach, Hawaii 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, Inc. earth station in Sunset Beach, Hawaii.

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 both the CW carrier, 100 kHz, 500 kHz and 1 MHz carriers in this band. The total EIRP for the CW Carrier is 42.1 dBW and the equivalent EIRP per 6 MHz segment will remain at 42.1 dBW/6 MHz. The total EIRP for the 100 kHz, carriers is 56.1 dBW. The equivalent EIRP per 6 MHz segment will remain at 56.1 dBW/6 MHz. The total EIRP for the 800 kHz is 65.1 dBW. The equivalent EIRP per 6 MHz will be 64.9 dBW/6 MHz. Therefore, there should not be interference to the TDRSS space-to-space link for the CW carriers, 100 kHz and 800 kHz.

When considering the 35 MHz, 54 MHz and 72 MHz carriers, the total EIRP of 81.5 dBW (35 MHz), 83.4 dBW (54 MHz) and 84.6 dBW (72 MHz) equate to an EIRP per 6 MHz of 75.67 dBW/6 MHz (35 MHz), 74.4 dBW/6 MHz (54MHz) and 72.6 dBW/6 MHz (72 MHz) respectively. To avoid interference to the TDRSS space-to-space link the 35 MHz, 54 MHz and 72 MHz carriers will not be used for the transmit spectrum of 13.772 to 13.778 GHz by this earth station.

## 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 Sunset Beach facility and the US Navy and NASA systems space-to-earth link are possible for all of the proposed carriers. Operations in NASA systems space-to-space link (13772.0 to 13778.0 MHz) will also be permitted for all of the carriers with the exception of the 35 MHz, 54 MHz and 72 MHz emissions.

# FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
**SES Americom, Inc.**
**SUNSET BEACH, HI**
**Satellite Earth Station**

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
April 26, 2019

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# 1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

# 2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

The following companies reported potential great circle interference conflicts that did not meet the objectives on a line-of-sight basis. When over-the-horizon losses are considered on the interfering paths, sufficient blockage exists to negate harmful interference from occurring with the proposed transmit-receive earth station.

Company

AT&T Corp
Scientel Solutions, LLC

No other carriers reported potential interference cases.

# 3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated 04/05/2019.

Company
AT&T Corp.
Cellco Partnership - Hawaii
Clearwire Hawaii Partners Spectrum LLC
Clearwire Spectrum Holdings III, LLC
Coral Wireless Licenses, LLC
County of Kauai Department of Police
Hawaii Catholic TV, Inc
Hawaii Dialogix Telecom LLC
Hawaii Public Television Foundation
Hawaii State
Hawaiian Electric Company, Inc
Hawaiian Telcom, Inc.
Honolulu Board of Water Supply
Honolulu City & County Dept of Info Tech
Kalo TV, Inc.
KITV, Inc
Lesea Broadcasting of Hawaii, Inc.
Maui, County of
Mid Pacific Communications Inc.
New Cingular Wireless PCS LLC - Hawaii
NEXSTAR BROADCASTING, INC.
NPCR, Inc.
NRJ TV Hawaii License Co, LLC
Oceanic Time Warner Cable LLC
Raycom Media Licensee, LLC
Scientel Solutions, LLC
Servpac, Inc
Sprint Spectrum L.P.
T-Mobile License LLC
Trex Broadband
University of Hawaii
Verizon Wireless VAW LLC - (Hawaii)

# 4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

# COMSEARCH

## Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

| | |
|---|---|
| Date: | 04/26/2019 |
| Job Number: | 190405COMSGE02 |

### Administrative Information

| | |
|---|---|
| Status | ENGINEER PROPOSAL |
| Call Sign | |
| Licensee Code | P3210 |
| Licensee Name | SES Americom, Inc. |

### Site Information — SUNSET BEACH, HI

| | |
|---|---|
| Venue Name | |
| Latitude (NAD 83) | 21° 40' 16.4" N |
| Longitude (NAD 83) | 158° 1' 52.8" W |
| Climate Zone | B |
| Rain Zone | 4 |
| Ground Elevation (AMSL) | 143.69 m / 471.4 ft |

### Link Information

| | |
|---|---|
| Satellite Type | Geostationary |
| Mode | TR - Transmit-Receive |
| Modulation | Digital |
| Satellite Arc | 88° W to 228° West Longitude |
| Azimuth Range | 97.6° to 262.3° |
| Corresponding Elevation Angles | 9.9° / 10.0° |
| Antenna Centerline (AGL) | 5.49 m / 18.0 ft |

| Antenna Information | | Receive - FCC32 | | Transmit - FCC32 | |
|---|---|---|---|---|---|
| Manufacturer | | GD Satcom | | GD Satcom | |
| Model | | 9.0KXK200 | | 9.0KXK200 | |
| Gain / Diameter | | 58.5 dBi / 9.0 m | | 60.1 dBi / 9.0 m | |
| 3-dB / 15-dB Beamwidth | | 0.20° / 0.38° | | 0.16° / 0.32° | |
| Max Available RF Power | (dBW/4 kHz) | | | -8.0 | |
| | (dBW/MHz) | | | 16.0 | |
| Maximum EIRP | (dBW/4 kHz) | | | 52.1 | |
| | (dBW/MHz) | | | 76.1 | |
| Interference Objectives: | Long Term | -156.0 dBW/MHz | 20% | -151.0 dBW/4 kHz | 20% |
| | Short Term | -146.0 dBW/MHz | 0.01% | -128.0 dBW/4 kHz | 0.0025% |

| Frequency Information | Receive 11.0 GHz | Transmit 14.0 GHz |
|---|---|---|
| Emission / Frequency Range (MHz) | N0N - 72M0G7W / 10950.0 - 12750.0 | N0N - 72M0G7W / 13750.0 - 14500.0 |
| Max Great Circle Coordination Distance | 483.3 km / 300.3 mi | 233.0 km / 144.8 mi |
| Precipitation Scatter Contour Radius | 380.4 km / 236.4 mi | 100.0 km / 62.1 mi |

# COMSEARCH

## Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

| **Coordination Values** | **SUNSET BEACH, HI** | | | |
|---|---|---|---|---|
| Licensee Name | SES Americom, Inc. | | | |
| Latitude (NAD 83) | 21° 40' 16.4" N | | | |
| Longitude (NAD 83) | 158° 1' 52.8" W | | | |
| Ground Elevation (AMSL) | 143.69 m / 471.4 ft | | | |
| Antenna Centerline (AGL) | 5.49 m / 18.0 ft | | | |
| Antenna Model | GD Satcom 9 meter | | | |
| Antenna Mode | Receive 11.0 GHz | | Transmit 14.0 GHz | |
| Interference Objectives: Long Term | -156.0 dBW/MHz | 20% | -151.0 dBW/4 kHz | 20% |
| Short Term | -146.0 dBW/MHz | 0.01% | -128.0 dBW/4 kHz | 0.0025% |
| Max Available RF Power | | | -8.0 (dBW/4 kHz) | |

| | | | Receive 11.0 GHz | | Transmit 14.0 GHz | |
|---|---|---|---|---|---|---|
| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Horizon Gain (dBi) | Coordination Distance (km) | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 0.00 | 97.53 | -10.00 | 307.68 | -10.00 | 143.68 |
| 5 | 0.00 | 92.60 | -10.00 | 307.68 | -10.00 | 143.68 |
| 10 | 0.00 | 87.68 | -10.00 | 307.68 | -10.00 | 143.68 |
| 15 | 0.00 | 82.76 | -10.00 | 307.68 | -10.00 | 143.68 |
| 20 | 0.00 | 77.83 | -10.00 | 307.68 | -10.00 | 143.68 |
| 25 | 0.00 | 72.91 | -10.00 | 307.68 | -10.00 | 143.68 |
| 30 | 0.00 | 68.00 | -10.00 | 307.68 | -10.00 | 143.68 |
| 35 | 0.00 | 63.09 | -10.00 | 307.68 | -10.00 | 143.68 |
| 40 | 0.25 | 58.16 | -10.00 | 295.09 | -10.00 | 139.65 |
| 45 | 0.30 | 53.26 | -10.00 | 283.49 | -10.00 | 133.97 |
| 50 | 0.60 | 48.33 | -10.00 | 236.49 | -10.00 | 108.10 |
| 55 | 0.58 | 43.47 | -8.95 | 245.22 | -8.95 | 112.49 |
| 60 | 0.53 | 38.63 | -7.67 | 255.86 | -7.67 | 119.11 |
| 65 | 0.92 | 33.73 | -6.20 | 225.53 | -6.20 | 101.58 |
| 70 | 1.30 | 28.86 | -4.51 | 212.43 | -4.51 | 100.00 |
| 75 | 1.31 | 24.15 | -2.57 | 224.45 | -2.57 | 100.00 |
| 80 | 1.46 | 19.52 | -0.26 | 231.85 | -0.26 | 102.85 |
| 85 | 1.70 | 15.05 | 2.56 | 237.54 | 2.56 | 104.81 |
| 90 | 1.72 | 11.21 | 5.76 | 255.68 | 5.76 | 114.74 |
| 95 | 2.62 | 7.78 | 9.73 | 244.33 | 9.73 | 106.48 |
| 100 | 2.75 | 7.56 | 10.04 | 240.93 | 10.04 | 104.76 |
| 105 | 3.23 | 9.95 | 7.06 | 202.46 | 7.06 | 100.00 |
| 110 | 3.27 | 14.01 | 3.34 | 174.98 | 3.34 | 100.00 |
| 115 | 3.39 | 18.48 | 0.33 | 155.82 | 0.33 | 100.00 |
| 120 | 3.85 | 22.82 | -1.96 | 138.04 | -1.96 | 100.00 |
| 125 | 3.30 | 27.53 | -3.99 | 141.50 | -3.99 | 100.00 |
| 130 | 3.50 | 31.86 | -5.58 | 131.62 | -5.58 | 100.00 |
| 135 | 3.22 | 36.33 | -7.01 | 132.02 | -7.01 | 100.00 |
| 140 | 3.08 | 40.63 | -8.22 | 130.40 | -8.22 | 100.00 |
| 145 | 2.94 | 44.79 | -9.28 | 129.63 | -9.28 | 100.00 |
| 150 | 2.21 | 49.06 | -10.00 | 144.08 | -10.00 | 100.00 |
| 155 | 2.06 | 52.81 | -10.00 | 146.11 | -10.00 | 100.00 |
| 160 | 2.47 | 55.88 | -10.00 | 137.77 | -10.00 | 100.00 |
| 165 | 2.09 | 58.88 | -10.00 | 145.32 | -10.00 | 100.00 |
| 170 | 2.59 | 60.53 | -10.00 | 134.79 | -10.00 | 100.00 |
| 175 | 2.36 | 61.89 | -10.00 | 140.38 | -10.00 | 100.00 |
| 180 | 2.21 | 62.40 | -10.00 | 143.92 | -10.00 | 100.00 |
| 185 | 1.95 | 62.28 | -10.00 | 149.24 | -10.00 | 100.00 |

# COMSEARCH

## Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

| **Coordination Values** | **SUNSET BEACH, HI** | | | |
|---|---|---|---|---|
| Licensee Name | SES Americom, Inc. | | | |
| Latitude (NAD 83) | 21° 40' 16.4" N | | | |
| Longitude (NAD 83) | 158° 1' 52.8" W | | | |
| Ground Elevation (AMSL) | 143.69 m / 471.4 ft | | | |
| Antenna Centerline (AGL) | 5.49 m / 18.0 ft | | | |
| Antenna Model | GD Satcom 9 meter | | | |
| Antenna Mode | Receive 11.0 GHz | | Transmit 14.0 GHz | |
| Interference Objectives: Long Term | -156.0 dBW/MHz | 20% | -151.0 dBW/4 kHz | 20% |
| Short Term | -146.0 dBW/MHz | 0.01% | -128.0 dBW/4 kHz | 0.0025% |
| Max Available RF Power | | | -8.0 (dBW/4 kHz) | |

| | | | Receive 11.0 GHz | | Transmit 14.0 GHz | |
|---|---|---|---|---|---|---|
| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Horizon Gain (dBi) | Coordination Distance (km) | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 2.26 | 60.81 | -10.00 | 142.75 | -10.00 | 100.00 |
| 195 | 2.13 | 58.86 | -10.00 | 146.09 | -10.00 | 100.00 |
| 200 | 1.86 | 56.23 | -10.00 | 152.50 | -10.00 | 100.00 |
| 205 | 1.58 | 53.06 | -10.00 | 163.43 | -10.00 | 100.00 |
| 210 | 1.53 | 49.39 | -10.00 | 165.37 | -10.00 | 100.00 |
| 215 | 0.95 | 45.70 | -9.50 | 200.93 | -9.50 | 100.00 |
| 220 | 0.40 | 41.80 | -8.53 | 274.45 | -8.53 | 128.99 |
| 225 | 0.34 | 37.55 | -7.36 | 295.99 | -7.36 | 139.24 |
| 230 | 0.29 | 33.20 | -6.03 | 320.11 | -6.03 | 148.33 |
| 235 | 0.33 | 28.73 | -4.46 | 322.94 | -4.46 | 149.13 |
| 240 | 0.00 | 24.36 | -2.67 | 375.31 | -2.67 | 176.18 |
| 245 | 0.00 | 19.93 | -0.49 | 398.37 | -0.49 | 188.13 |
| 250 | 0.00 | 15.82 | 2.02 | 426.50 | 2.02 | 205.08 |
| 255 | 0.00 | 12.37 | 4.69 | 456.73 | 4.69 | 220.85 |
| 260 | 0.00 | 10.26 | 6.72 | 483.31 | 6.72 | 232.99 |
| 265 | 0.00 | 10.34 | 6.63 | 482.15 | 6.63 | 232.47 |
| 270 | 0.00 | 12.58 | 4.51 | 454.51 | 4.51 | 219.80 |
| 275 | 0.00 | 16.09 | 1.84 | 424.43 | 1.84 | 204.03 |
| 280 | 0.00 | 20.22 | -0.65 | 396.64 | -0.65 | 187.22 |
| 285 | 0.00 | 24.67 | -2.80 | 373.91 | -2.80 | 175.47 |
| 290 | 0.00 | 29.29 | -4.67 | 355.33 | -4.67 | 166.15 |
| 295 | 0.00 | 34.00 | -6.29 | 339.95 | -6.29 | 158.66 |
| 300 | 0.00 | 38.78 | -7.72 | 327.26 | -7.72 | 152.53 |
| 305 | 0.00 | 43.61 | -8.99 | 316.18 | -8.99 | 147.46 |
| 310 | 0.00 | 48.46 | -10.00 | 307.68 | -10.00 | 143.68 |
| 315 | 0.00 | 53.33 | -10.00 | 307.68 | -10.00 | 143.68 |
| 320 | 0.00 | 58.22 | -10.00 | 307.68 | -10.00 | 143.68 |
| 325 | 0.00 | 63.12 | -10.00 | 307.68 | -10.00 | 143.68 |
| 330 | 0.00 | 68.03 | -10.00 | 307.68 | -10.00 | 143.68 |
| 335 | 0.00 | 72.94 | -10.00 | 307.68 | -10.00 | 143.68 |
| 340 | 0.00 | 77.86 | -10.00 | 307.68 | -10.00 | 143.68 |
| 345 | 0.00 | 82.78 | -10.00 | 307.68 | -10.00 | 143.68 |
| 350 | 0.00 | 87.71 | -10.00 | 307.68 | -10.00 | 143.68 |
| 355 | 0.00 | 92.63 | -10.00 | 307.68 | -10.00 | 143.68 |

# 5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY: 

Gary K. Edwards
Senior Manager
COMSEARCH
19700 Janelia Farm Boulevard
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DATED: April 26, 2019