Exhibit C - Radiation Hazard Study

When applying for a license to construct and operate, modify, or renew an earth station, it is understood that the applicant must certify whether grant of the application will have significant environmental impact as defined in the Federal Communications Commission's (FCC) rules, 47 C.F.R. § 1.1307.

In this report Spacenet analyzes the maximum radiofrequency (RF) levels emitted from the satellite communications antenna described below. The reference document for this study is OET Bulletin No.65, Edition 97-01, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields,* August 1997.

1. Antenna Near-Field Power Density Calculation

The extent of the near-field is defined by the following equation[1]:

$$R_{near} = (D_{antenna})^2 / (4\lambda)$$

where: R_{near} = extent of the near-field (in meters)

$D_{antenna}$ = diameter of the antenna main reflector (in meters)

λ = wavelength of the RF transmit frequency (in meters)

The maximum on-axis power density within near-field is defined by the following equation[2]:

$$S_{near} = \{(16\eta\ P_{feed}) / [\pi(D_{antenna})^2]\} / 10$$

where: S_{near} = maximum on-axis power density within the near-field (in milliwatts per square centimeter)

η = antenna aperture efficiency

P_{feed} = maximum power into antenna feed flange (in watts)

$D_{antenna}$ = diameter of the antenna main reflector (in meters)

[1] See OET 65 page 27 formula (12).
[2] See OET 65 page 28 formula (13). The right side of the equation is divided by 10 so that the power spectral density units on the left side will be mW/cm^2.

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2. Antenna Far-Field Power Density Calculation

The distance to the beginning of the far-field region is defined by the following equation[3]:

$$R_{far} = [0.6(D_{antenna})^2] / \lambda$$

where: R_{far} = distance to beginning of far-field (in meters)

$D_{antenna}$ = diameter of the antenna main reflector (in meters)

λ = wavelength of the transmit frequency in (meters)

The maximum on-axis power density within the far-field is defined by the following equation[4]:

$$S_{far} = [(P_{feed}\ G_{antenna}) / 4\pi(R_{far})^2] / 10$$

where: S_{far} = maximum on-axis power density in the far-field (in milliwatts per square centimeter)

P_{feed} = maximum power into antenna feed flange (in watts)

$G_{antenna}$ = antenna main beam gain at AF transmit frequency (in numeric value)

R_{far} = distance to beginning of far-field (in meters)

The on-axis power densities calculated from the above formulas represent the maximum exposure levels that the system can produce. Off-axis power densities will be considerably less.

3. Antenna Transition Region Power Density Calculation

The on-axis power spectral density for the transition region is defined by the following formula[5]:

$$S_{tr} = S_{near}\ R_{near} / R$$

where: S_{tr} = maximum on-axis power density in the transition region (in milliwatts per square centimeter)

S_{near} = maximum on-axis power density in the near-field (in milliwatts per square centimeter)

[3] See OET 65 page 29 formula (16).
[4] See OET 65 Section 2, page 19, formula (3) and page 29, formula (18). The right side of the equation is divided by 10 so that the power spectral density units on the left side will be mW/cm^2.
[5] See OET 65 page 34, formula (17).

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R_{near} = is the distance that defines the end of the near field region.

R = is the distance within in the transition region between the near field and far field regions.

Since the distance within the transition region "R" will always be greater than the distance to the end of the near field region "R_{near}" then $S_{tr} \leq S_{near}$.

4. Antenna Feed-Flange Power Density Calculation

The maximum power density at the antenna feed-flange is defined by the following equation[6]:

$$S_{feed} = 1000\{[4(P_{feed})] / \{[\pi(D_{feed})^2] / 4\}\}$$

where:

S_{feed} = maximum power density at the antenna feed-flange (in milliwatts per square centimeter)

P_{feed} = maximum power into antenna feed flange (in watts)

D_{feed} = diameter of the antenna feed-flange (in centimeters)

5. Antenna Sub and Main Reflector Power Density Calculation

The maximum power density in the main reflector region of the antenna is defined by the following equation[7]:

$$S_{antenna} = \{[4P_{feed}] / \{[\pi D^2 / 4\}\} / 10$$

where:

S = maximum power density in the antenna sub or main reflector region (in milliwatts per square centimeter)

P_{feed} = maximum power into antenna feed flange (in watts)

D = diameter of the antenna sub or main reflector (in meters)

6. Power Density Calculation between the Antenna Main Reflector and the Ground

[6] The formula is multiplied by 1,000 on the right side of the equation to change the units from watts on the right side of the equation to milliwatts on the left side.

[7] See OET 65 equation (11) which is "S = 4 P / A", where "A" is the area of the reflector and for a circular reflector A = $\pi (D_{antenna})^2 / 4$. The formula is divided by 10 on the right side to change the units from meters and watts on the right side of the formula to cm and mW on the left side.

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The maximum power density between the antenna main reflector and the ground is defined by the following equation:

$$S_{ground} = \{P_{feed} / \{[\pi\{(D_{antenna})^2] / 4\}\} / 10$$

where: S_{ground} = maximum power density between the antenna main reflector and the ground (in milliwatts per square centimeter)

P_{feed} = maximum power into antenna feed flange (in watts)

$D_{antenna}$ = diameter of the antenna main reflector (in meters)

7. Calculation of Radiation Levels and FCC Standards

Spacenet understands that a licensee must ensure that people are not exposed to harmful levels of radiation. Spacenet plans to utilize the 3.7 meter ASC Signal antenna with Gregorian optics in fixed installations with up to 100-watt transmitters. The transmitters will be operated at full output power. The preceding formulas were used to calculate the power densities shown on the following page.

The Commission's maximum permissible exposure (MPE) limits at the transmit frequency band for the earth stations included in this application are provided in the table set forth below.

Maximum Permissible Exposure (MPE) Limits at 14,000-14,500 MHz

Exposure Criteria	Power Density (mW/cm^2)	Averaging Time (minutes)	Reference
general population/uncontrolled exposure	1	6	OET 65 page 67 Appendix A Table 1 (A)
occupational/controlled exposure	5	30	OET 65 page 67 Appendix A Table 1 (B)

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Radiation Hazard Calculations – 3.7 meter ASC Signal Antenna

Antenna IDs	1 & 2
Antenna main reflector diameter	3.7 m
Feed flange diameter	17.4 cm
Sub-reflector diameter	48.0 cm
RF transmit frequency	14.250 GHz
Maximum power into antenna feed-flange	100 watts
Main-beam antenna transmit gain	52.6 dBi
Antenna aperture efficiency	0.6%
Antenna main reflector surface area	10.75 m²
Feed flange surface area	237.8 cm²
Sub-reflector surface area	1,809.6 cm²
Wavelength at RF transmit frequency	2.1 cm
Distance to beginning of far-field region	391 m
Distance to extent of near-field region	163 m

Maximum on-axis power density in far-field	**0.95 mW/cm^2**	**Satisfies MPE Limits**
Maximum on-axis power density in near-field (see note 2)	**2.22 mW/cm^2**	**Satisfies controlled MPE Limits**
Maximum power density at feed-flange (see note 1)	**1,682 mW/cm^2**	**Potential Hazard**
Maximum power density at sub-reflector (see note 1)	**221 mW/cm^2**	**Potential Hazard**
Maximum on-axis power density in transition region (see note 1)	**221 mW/cm^2**	**Potential Hazard**
Maximum power density at main reflector (see note 2)	**3.72 mW/cm^2**	**Satisfies controlled MPE Limits**
Maximum power density between main reflector and ground	**0.93 mW/cm^2**	**Satisfies MPE Limits**

Note 1:

Feed flange, sub-reflector and transition region power density exceeds both uncontrolled MPE limit of 1 mW/cm^2 and controlled MPE limit of 5 mW/cm^2

Note 2:
Satisfies controlled MPE limit of 5 mW/cm^2, but is a potential hazard for uncontrolled MPE limit of 1 mW/cm^2

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8. Conclusion

The calculations provided in this exhibit indicate that MPE limits are exceeded in certain areas of the 3.7 meter earth stations with 100-watt transmitters which are the subject of this application. The 3.7 meter ASC Signal antenna is a Gregorian design that utilizes a feed horn, sub-reflector and main reflector. The 3.7 meter antenna exceeds the MPE limits for occupational/controlled and general population/uncontrolled exposure at the feed horn, sub-reflector, in the area between the feed horn and sub-reflector and the area between the sub-reflector and main reflector (transition regions). The MPE limit for general population/uncontrolled exposure is exceeded at the antenna reflector and in the near field region, but the MPE limit is met for occupational/controlled exposure. All 3.7 meter fixed antennas will be installed such that the area where the MPE is exceeded will not be readily accessible to humans. Additionally, all transmissions will be terminated whenever the technical staff is required, for maintenance or other activities, to occupy the regions where potentially hazardous power density levels can exist. The 3.7 meter fixed earth stations will have an automatic shut-off mechanism that will terminate transmissions if the outbound receive signal is lost.