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RADIO FREQUENCY EXPOSURE ANALYSIS

SCRIPPS MEDIA, INC

NEW TRANSPORTABLE KU-BAND SATELLITE UPLINK

KANSAS CITY, MO

Background

Scripps Media, Inc. (Scripps) recently acquired a new transportable Ku-Band satellite uplink truck. The uplink transmit antenna is located on the vehicle roof and will be operated at various locations throughout the United States. As a part of its application to the FCC for licensure of the unit, a study was completed, in accordance with the FCC guidelines of OET-65, to evaluate the potential for human exposure to radiofrequency electromagnetic fields.

RFR Analysis

The FCC guidelines for evaluating exposure to RF emissions incorporate limits for Maximum Permissible Exposure (MPE) for transmitters operating at frequencies between 300 kHz and 100 GHz. The guidelines incorporate two separate tiers of exposure limits: Controlled (occupational) and Uncontrolled (general population). The assumption for comparing calculated exposure levels to the MPE for either tier is dependent on the situation in which the exposure is likely to take place and/or the status of the individuals that are subject to exposure. Controlled areas are those in which:

1. the area is identified with appropriate warning signage,
2. access to the area is controlled by its owner or agent,

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CORPORATE OFFICE
1475 NORTH 200 WEST
POST OFFICE BOX 311
NEPHI, UT 84648

TEL: (435) 623-8601
FAX: (435) 623-8610

REGIONAL OFFICE
1172 S. M-13
Lennon, MI 48449
TEL: (810) 621-5656

FAX: (810) 621-4146

3. persons entering such areas are aware of the presence of radio frequency radiation (RFR) and have been instructed on the hazards and mitigation methods and
4. there is an assumption that persons entering controlled areas will be exposed to the RFR for a limited time period.

Uncontrolled areas are those in which access is not controlled and/or those in which the persons entering are not aware of the presence of significant levels of RFR. In this case, the satellite uplink truck will operate on frequencies in the Ku Band (above 1500 GHz) and the limits for maximum permissible RFR exposure in each area for the frequencies of operation are as follows (as specified in OET 65):

	Power Density (mW/cm^2)	**Averaging Time (minutes)**
Controlled:	5.0	6
Uncontrolled:	1.0	30

The RFR analysis is based on the following data provided by the applicant and equipment manufacturer:

Parameter	**Symbol**	**Value**	**Units**
Center Frequency:	F	14.25	GHz
Wavelength at Center Frequency:	λ	0.021053	m
Transmit Power:	P	100	W
Antenna Diameter:	D	1.2	m
Antenna Gain:	G_{es}	43	dBi
Antenna Gain (Factor):	G	19952.62	
Antenna Efficiency:	η	0.62223	
Antenna Surface Area:	A	1.13	m^2
Feed Flange Diameter:	D_{fa}	8.1	cm
Area of Feed Flange:	A_{fa}	51.53	cm^2

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The study was conducted under the procedures and guidelines provided in OET-65 for Aperture Antennas and follows the format presented therein for calculating power flux density levels of the earth station at the main reflector surface, in the near-field, far-field, transition region, between the feed assembly and main reflector surface, and between the antenna edge and the ground. All of these values are then compared to the MPE limits, listed above, for controlled and uncontrolled areas.

Main Reflector (Antenna) Surface

Power density at the antenna surface ($S_{surface}$):

$$S_{surface} = \frac{4P}{A} = \frac{4(100W)}{\pi\left(\frac{1.2m}{2}\right)^2} = 353.68\ W/m^2\ or\ 35.368\ mW/cm^2$$

Near-Field Region

Distance to the limit of the near-field (R_{nf}):

$$R_{nf} = \frac{D^2}{4\lambda} = \frac{1.2^2}{4(0.021053)} = 17.1\ m$$

Maximum value of the near-field, on–axis, power density (S_{nf}):

$$S_{nf} = \frac{16\eta P}{\pi D^2} = \frac{16(0.62223)(100W)}{\pi(1.2m)^2} = 220.07\ W/m^2\ or\ 22.007\ mW/cm^2$$

Far-Field Region

Distance to the beginning of the far-field region (R_{ff}):

$$R_{ff} = \frac{0.6D^2}{\lambda} = \frac{0.6(1.2)^2}{0.021053} = 41.04\ m$$

Maximum main beam power density (S_{ff}):

$$S_{ff} = \frac{PG}{4\pi R^2} = \frac{(100W)(19952.62)}{4\pi(41.04m)^2} = 94.27\ W/m^2\ or\ 9.427\ mW/cm^2$$

Transition Region

The transition region is between the end of near-field region (R_{nf} = 17.1m) and the beginning of the far-field region (R_{ff} = 41.04m). The power density in the transition region decreases linearly with an increase in distance; therefore, the maximum power density in the transition (S_{tr}) region will not exceed the power density calculated for the near-field region.

$$S_{tr} = \frac{S_{nf}R_{nf}}{R} = \frac{(220.07\ W/m^2)(17.1m)}{17.1m} = 220.07\ W/m^2\ or\ 22.007\ mW/cm^2$$

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Region Between Feed Assembly (Sub-Reflector) and Main Reflector

Maximum power density at the antenna feed-flange (S_{feed}):

$$S_{feed} = \frac{4000P}{\pi\left(\frac{D_{fa}}{2}\right)^2} = \frac{4000(100W)}{\pi\left(\frac{8.1cm}{2}\right)^2} = 7762.47\ mW/cm^2$$

Region Between Main Reflector and Ground

Maximum power density between the main reflector and ground (S_{ground}):

$$S_{ground} = \frac{P}{A} = \frac{100W}{\pi\left(\frac{1.2m}{2}\right)^2} = 88.42\ W/m^2\ or\ 8.842\ mW/cm^2$$

The table below provides a summary of the above calculations:

Region	Symbol	Calculated Maximum Power Density (mW/cm2)	Assessment
Main Reflector Surface	$S_{surface}$	35.368	Potential Hazard
Near-Field	S_{nf}	22.007	Potential Hazard
Far-Field	S_{ff}	9.427	Potential Hazard
Transition	S_{tr}	22.007	Potential Hazard
Between Feed Assembly and Main Reflector	S_{feed}	7762.472	Potential Hazard
Between Main Reflector and Ground	S_{ground}	8.842	Potential Hazard

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Utilization

The uplink antenna will have a center of radiation 4.4 meters above ground when erected above the truck in an operational mode. OET-65 stipulates that, at a distance of one diameter (D=1.2m) from the edge of the cylinder formed by the "face" of the circular antenna, the field will be reduced by a factor of 100 (20 dB). Thus, at a distance of 1.2m from the lower edge of the antenna (2.4m from the antenna centerline and approximately 2m above ground level) the field can be expected to be 2.20 W/m^2 or 0.220 mW/cm^2 based on the above calculation of the near field maximum value.

Mitigation

When in operation, the licensee shall establish an area around the truck extending at least 2 meters (horizontally) using access restricting devices to define the perimeter (rope cordon and appropriate signage) to restrict public access. In addition, operating personnel will monitor the area to prevent unauthorized access. As shown above, at distances greater than one diameter removed from the main beam, the calculated power density is less than the MPE limit for uncontrolled areas.

Access within the area around and on-top of the truck will be limited to authorized persons eligible to be considered under the occupational exposure MPE. These persons will be trained as to the extent of potential for RFR exposure in excess of the limits and the areas where this condition might occur will be defined. Mitigation will include mandatory shut-down for antenna maintenance or adjustment.

The licensee will conduct measurements with appropriate equipment to verify the conclusions drawn from the calculations herein and shall make a permanent record of that data.

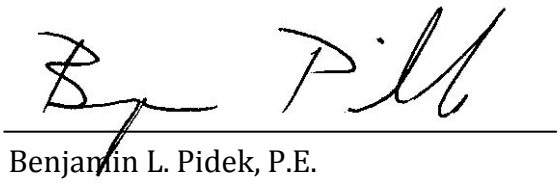
Should measured data indicate fields in excess of the values calculated herein, appropriate adjustments will be made in establishing the area in which public access will be limited.

Conclusion

Based on the above analyses, it is concluded that the subject transportable earth station can be operated in accordance with the exposure limits established in Section 1.1310 of the Commission's Rules and Regulations as detailed in OET-65 provided that the specified precautionary measures to protect members of the public and workers are adhered-to.

Certification

I hereby certify that the foregoing report or statement was prepared by me but may include work performed by others under my supervision or direction. The statements of fact contained therein are believed to be true and correct based on personal knowledge, information and belief unless otherwise stated; with respect to facts not known of my own personal knowledge, I believe them to be true and correct based on their origin from sources known to me to be generally reliable and accurate. I have prepared this document with due care and in accordance with applicable standards of professional practice.



Benjamin L. Pidek, P.E.
May 17, 2012

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