Engineering Statement
RADIOFREQUENCY EXPOSURE CALCULATIONS
prepared for
Hearst Properties Inc.

Hearst Properties Inc. ("Hearst") is the licensee[1] for the fixed "Ku Band" satellite uplink located at 100 South Commercial Street, Manchester, NH. The instant application seeks to incorporate narrower bandwidth, digital emissions to permit *Hearst* to improve spectral efficiency when feasible. The following study was conducted to evaluate these changes with respect to the potential for human exposure to radiofrequency ("RF") electromagnetic field. Specifically, the study determined whether exposure to RF electromagnetic field would exceed FCC maximum permissible exposure limits to the general public and, when certain procedures are followed, to occupational workers in the vicinity of the Earth station antenna.

Human Exposure to Radiofrequency Electromagnetic Field

The *Hearst* operation was evaluated using the procedures outlined in FCC OET Bulletin No. 65 ("OET 65"). OET 65 describes a means of determining whether a proposed facility exceeds the RF exposure guidelines specified in §1.1310 of the Rules. Under present Commission policy, a facility may be presumed to comply with the limits in §1.1310 if it satisfies the exposure criteria set forth in OET 65. Based upon that methodology, and as demonstrated in the following, the transmitting system under study will comply with the cited adopted guidelines at publicly accessible locations when procedures described herein are followed.

Public Exposure

The antenna is located on a rooftop that is accessible only to occupational personnel through a locked door having appropriate warning signs. The only areas accessible to the public are located at ground level or well beyond the main lobe.

The mechanical design of the antenna mount is normally configured such that the antenna main beam is aimed at a geostationary satellite located well above the horizon. Although not normally used with other satellites, the E920048 authorization permits operation throughout the entire satellite arc. Prevention of public exposure to predicted RF electromagnetic field in excess

of the general population/uncontrolled limit[2] depends on adherence to the following operational guidelines by the *Hearst* technicians.

As shown below, RF attributable to the *Hearst* Earth station antenna at locations outside of the "main beam"[3] will not exceed the FCC general population and uncontrolled RF exposure limits. To assure that no publicly accessible area is within the "main beam" of the uplink antenna, the Earth station transmitter will only be permitted to operate when the antenna elevation exceeds 4.6 meters and five degrees away from the horizon, nearby buildings, and places accessible by the public.

Based on data provided by the applicant, the following parameters were used in the study:

Antenna Manufacturer	Andrew
Antenna Model	ESA46-124
Center Transmit Frequency	14.250 MHz
Wavelength at Center Frequency	0.02104 meters
Max Average Antenna Input Power	50 Watts
Antenna Diameter	4.6 meters
Antenna Gain	55.4 dBi
Antenna Gain Ratio	346,737
Antenna Aperture Efficiency	0.7613

[1] *See* E920048

[2] The general population/uncontrolled maximum permissible exposure ("MPE") limit of 1 mW/cm² for 14,250 MHz is specified in §1.1310 of the Rules.

[3] For purposes of this study, the "main beam" extends 4.6 meters beyond an imaginary cylinder extending skyward from the "face" of the Earth station antenna plus any location within five degrees of the center-line of the antenna.

The area in the immediate vicinity of the antenna is known as the "near field region." In this region (247 meters in the case at hand), the antenna directional characteristics of have not fully formed. Therefore, antenna manufacturer "off-axis" discrimination specifications cannot be utilized for the purpose of determining potential RF exposure. OET 65 provides a methodology (Equation 13) for calculating a "worst case" exposure figure within this region. Additionally, OET 65 methodology suggests that the "worst case" power density would be reduced by 20 dB at locations at least one antenna diameter (4.6 meters) off-axis from the "main beam" of the antenna. In this instance, the predicted off-axis, near field is 0.012 mW/cm², or 1.2 percent of the general population/uncontrolled limit. Off-axis predicted fields reduce commensurately at greater distances from the antenna in the antenna transition region.

In the "far field" region of the antenna (starting at a distance of 593 meters from the antenna), the antenna directional characteristics have formed and the off-axis "far field" power density can be readily calculated using off-axis antenna discrimination specifications. At locations greater than five degrees off-axis from the "main beam," the manufacturer of the antenna specifies a side-lobe attenuation of 43.9 dB.[4] Again using the methodology detailed in OET65, this off-axis attenuation results in a power density of 0.00 mW/cm², or 0.00 percent of the general population/uncontrolled limit.[5]

Controlled Access Area Exposure

As described previously, access to the rooftop is limited and restricted to authorized, trained personnel. Additionally, all areas within 4.6 meters of the sides and back of the antenna, as well as areas located in the antenna "main beam" (as defined by footnote 3) have been conspicuously identified as having the potential to exceed occupational exposure limits. Access within these areas is permitted only when the Earth station transmitter has been disabled.

With respect to worker safety, it is believed that based on the preceding analysis,

[4] According to Andrew, the antenna gain at 5-degrees off-axis is 29-25log(θ), or 11.5 dBi, which is 43.9 dB less than the specified 55.4 dBi gain in the antenna main lobe.
[5] When rounded to nearest one-hundredth mW/cm² and percent.

excessive exposure would not occur because adequate physical separation has been established and maintained. On-site RF exposure measurements may also be undertaken to establish the bounds of safe working areas.

Conclusion

As demonstrated herein, excessive levels of RF energy will not be caused by strictly following the policies detailed herein. Consequently, neither the general public nor occupational staff will be exposed to RF levels in excess of the Commission's guidelines. Access to the vicinity of the uplink antenna is restricted and controlled through the use of locked doors, boundary markers, conspicuous RFR warning signs, as part of an overall RF safety program.

Certification

The undersigned hereby certifies that the foregoing statement was prepared by him or under his direction, and that it is true and correct to the best of his knowledge and belief. Mr. Ryson is a senior engineer in the firm of Cavell, Mertz & Associates, Inc.

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