Engineering Statement
RADIOFREQUENCY EXPOSURE CALCULATIONS
prepared for
KMBC Hearst Television, Inc.

KMBC Hearst Television, Inc. ("KMBC") is the licensee for transportable "Ku Band" satellite uplink E020034. The instant application seeks to incorporate narrower bandwidth emissions to permit *KMBC* 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 to occupational workers at locations in the vicinity of the uplink antenna, based on data provided by the applicant and representatives of the equipment manufacturers.

Human Exposure to Radiofrequency Electromagnetic Field

The *KMBC* proposed 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 mechanical design of the mounting equipment is optimized to orient the antenna toward satellites that are located well above the horizon. Prevention of public exposure to predicted RF electromagnetic field in excess of the general population/uncontrolled limit[1] depends on adherence to the following operational guidelines by the *KMBC* technicians.

As shown below, RF attributable to the KMBC uplink antenna at locations outside of the "main beam" and 1.5 meters or more from the center of the main beam will not exceed the FCC general population and uncontrolled RF exposure limits. According to representatives of *KMBC*, at its lowest elevation, the center of the uplink antenna is 4.0 meters above the ground and thus more than 1.5 meters above head level on level terrain.

[1] 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.

To assure that no publicly accessible area is within the "main beam" of the uplink antenna, sites and satellites will be selected such that the elevation angle of the antenna will always exceed five degrees and 1.5 meters above the horizon, nearby buildings, and places accessible by the public. In unusual cases where this isolation cannot be achieved, *KMBC* will utilize crowd control stanchions, cones, and RF exposure warning signs to control access to areas that are known to exceed the FCC's general population uncontrolled MPE limit. These areas will be defined either by measurements made by qualified, on-site, personnel or by the calculations described herein.

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

Antenna Manufacturer	Vertex
Antenna Model	1.5 SMK-LT
Center Transmit Frequency	14.250 MHz
Wavelength at Center Frequency	0.021 meters
Max Average Antenna Input Power	75 Watts
Antenna Diameter	1.5 meters
Antenna Gain	46.2 dBi
Antenna Gain Ratio	41,687
Antenna Aperture Efficiency	0.8309

The area in the immediate vicinity of the antenna is known as the "near field region." In this region (26.7 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 an absolute "worst case" exposure figure within this region. Additionally, OET 65 specifies that the "worst case" power density would be reduced by 20 dB at locations at least one antenna diameter (1.5 meters) off-axis from the "main beam" of the antenna. In this instance, the predicted off-axis, near field is 0.141 mW/cm^2, or 14.1 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 (in this case, starting at a distance of 64.2 meters from the antenna), the antenna directional characteristics have formed and the off-axis 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 proposed antenna specifies a minimum side-lobe attenuation of 34.7 dB.[2] Again using the methodology detailed in OET65, this "off-axis" attenuation is predicted to result in a power density of 0.002 mW/cm², or 0.2 percent of the general population/uncontrolled limit.

Controlled Access Area Exposure

Access to the vicinity of the antenna will be limited and restricted to authorized, trained personnel. Using data provided by the applicant, the potential for RF exposure to occupational workers was evaluated. As described previously, the maximum predicted off-axis, "near field" power density is 0.141 mW/cm², which is 2.82 percent of the controlled limit. As the operator will generally be posted at locations at ground level or within the truck itself, it is anticipated that actual exposure will be substantially less than the above "worst case" prediction.

With respect to worker safety, it is believed that based on the preceding analysis, excessive exposure would not occur provided that adequate physical separation is established. As mentioned previously, detailed operator policy will be employed protecting workers from excessive exposure when work must be performed where high RF levels may be present. Such protective measures may include, but will not be limited to, restriction of access to areas where levels in excess of the guidelines may be expected, or the complete shutdown of facilities when work or inspections must be performed in areas where the exposure guidelines would otherwise be exceeded. On-site RF exposure measurements may also be undertaken to establish the bounds of safe working areas. The applicant will coordinate exposure procedures with all pertinent facilities.

Conclusion

As demonstrated herein, excessive levels of RF energy will not be caused at publicly accessible areas by strictly following the policy detailed herein. Consequently, neither members of 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 will be restricted and controlled through the use of crowd control stanchions, cones, and conspicuous RFR warning signs as part of an overall RF safety program. The above study presumes that the subject antenna is the sole source of RF energy at the uplink site. In the case of multiple emitters, further analysis or measurement is necessary to assure compliance.

[2] The antenna's off-axis specification is based on FCC §25.209 or 29-25 Log(θ) dBi.

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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