Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained by the Educational Communications of Colorado Springs, Inc., licensee of Noncommercial Educational FM Station KTLF, Channel 213C0, 90.5 MHz, Colorado Springs, Colorado, to prepare the technical portions of an application for a new Ku-band satellite uplink station from the KTLF studios at 1665 Briargate Boulevard, Colorado Springs, Colorado.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar exposure limits. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

For 14.0–14.5 GHz Ku-Band satellite transmitting antennas, the prevailing standard for occupational exposures of unlimited duration is 5 mW/cm^2, and 1 mW/cm^2 for public exposures of unlimited duration.

Proposed Uplink Facilities

It is proposed to use a Prodelin Model 1184 1.8-meter diameter satellite earth station Ku-Band transmitting antenna, and the 2-watt version of the Raydyne ComSearch Model DT8000 transmitter. The antenna would be pole-mounted on the ground, in a fenced area at the rear of the KTLF studios parking lot, as shown by the attached Figure 1.

The eastern-most geostationary communication satellite that the proposed antenna would communicate with would be at 69°W longitude, and the western-most satellite would be at 125°W longitude. The antenna orientation to the eastern-most satellite would be 131.1°T with an elevation angle of 31.7°, the antenna orientation to a satellite at the middle of the domestic satellite arc would be 167.7°T with an elevation angle of 44.2°, and the antenna orientation to the western-most satellite would be 210.3°T with an elevation angle of 40.3°. The greatest elevation angle would occur when communicating with a satellite at 105°W, where an elevation angle of 44.9° would be needed. Thus, communication with the eastern-most satellite represents the antenna orientation with the lowest elevation angle.

NIST Nomograph

The highest power density was determined using a method developed by the staff of the National Bureau of Standards (NBS, now the National Institute for Standards and Technology, "NIST"), "An Efficient and Accurate Method for Calculating and Representing Power Density in the Near-Field Zone of Microwave Antennas."* Figure 2 from Page 6 of that report is applicable to the proposed installation, and it is reproduced here in Figure 2. According to the NIST paper, this nomograph is applicable to all aperture antennas with diameter-to-wavelength ratios of 30 or greater. Since a 1.8-meter diameter antenna at 14.25 GHz has a diameter-to-wavelength ratio of approximately 85.5 to 1, the nomograph is applicable.

Figure 2 characterizes the power density variation in the near-field. The extent of the near-field covered by this nomograph extends to a D^2/λ ratio of unity, where D is the antenna diameter and λ is the wavelength, expressed in compatible units (*i.e.*, either both in meters or both in centimeters). For Ku-Band uplinks the mid-band wavelength is 0.021 m (2.1 cm), so for the proposed 1.8-m antenna, D^2/λ equals approximately 154 meters. Thus, the distance over which this nomograph is applicable includes substantial distances from the uplink site.

At Page 3 of the NIST paper, the formula $S = 38.6 - 20\log_{10}D$ is given for calculating the maximum power density for <u>1 watt</u> of antenna input power, where S is the power density in dBm/cm^2 and D is the antenna diameter in centimeters. For higher input powers a $10\log_{10}(P)$ factor must be applied, where P is the antenna input power in watts. Thus for the maximum antenna input power of 2.0 watts the main beam the power density would be $38.6 - 20\log_{10}(180) + 10\log_{10}(2.0)$, or $-3.5\ dBm/cm^2$. This is 3.5 dB *lower* than the 1.0 mW/cm^2 (0 dBm/cm^2) the FCC guideline for uncontrolled (public) exposures. Thus, because of the relatively low transmitter power, there are no areas where the public limit would be exceeded, even for a person elevated above ground and in the main beam of the uplink antenna.

Because there is no portion of the uplink signal predicted to exceed even the public limit, the normally pertinent locations of the closest nearby structures in the satellite arc look angle become moot. The uplink antenna is therefore inherently compliant with respect to public exposures, and, of course, also

* Publication number NBSIR-85/8036, December 1985. This paper was written by Richard L. Lewis and Allen C. Newell, and was sponsored by the U.S. Environmental Protection Agency (EPA).

occupational exposures. Nevertheless, the applicant will keep the fence around the uplink antenna locked, to prevent unauthorized access, and in the event maintenance or repairs are needed on the feedhorn-side of the parabolic antenna, the uplink transmitter will first be shut off.

Summary

Operation of the proposed uplink will comply with the public exposure guidelines, since there are no portions even in the main beam of the uplink where the predicted power density will exceed the public limit.

List of Figures

In carrying out these engineering studies, the following attached figures were prepared under my direct supervision:

1. Satellite views of the KTLF studio site.
2. NIST nomograph

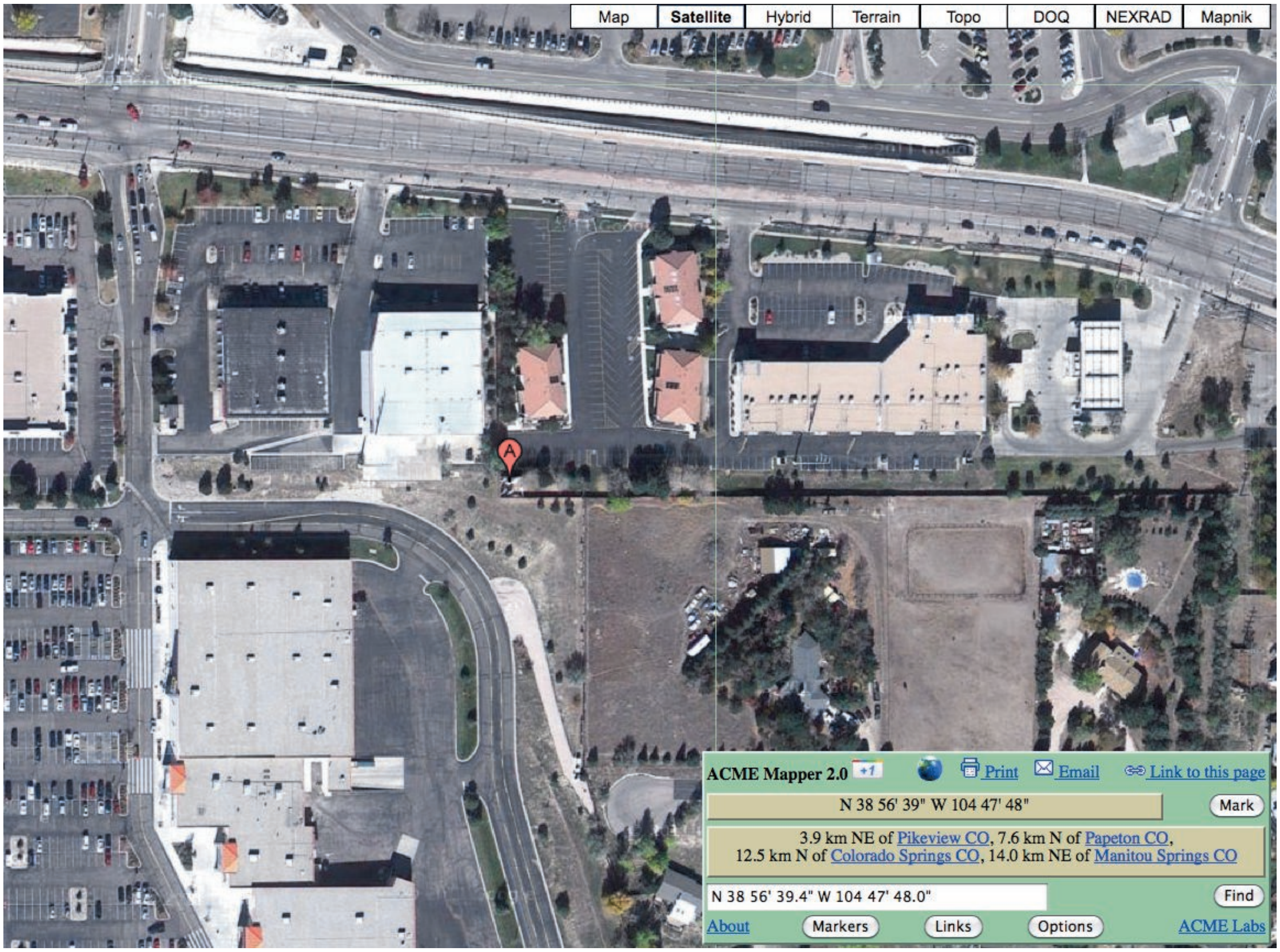
REGISTERED PROFESSIONAL ENGINEER
DANE E. ERICKSEN
No. 11654
Exp. 9-30-12
ELECTRICAL
STATE OF CALIFORNIA

February 9, 2012

Dane E. Ericksen, P.E.

Educational Communications of Colorado Springs, Inc.
Ku-Band Satellite Uplink Application • Colorado Springs, Colorado

Uplink Site



A = Satellite uplink location. Source: ACME Mapper

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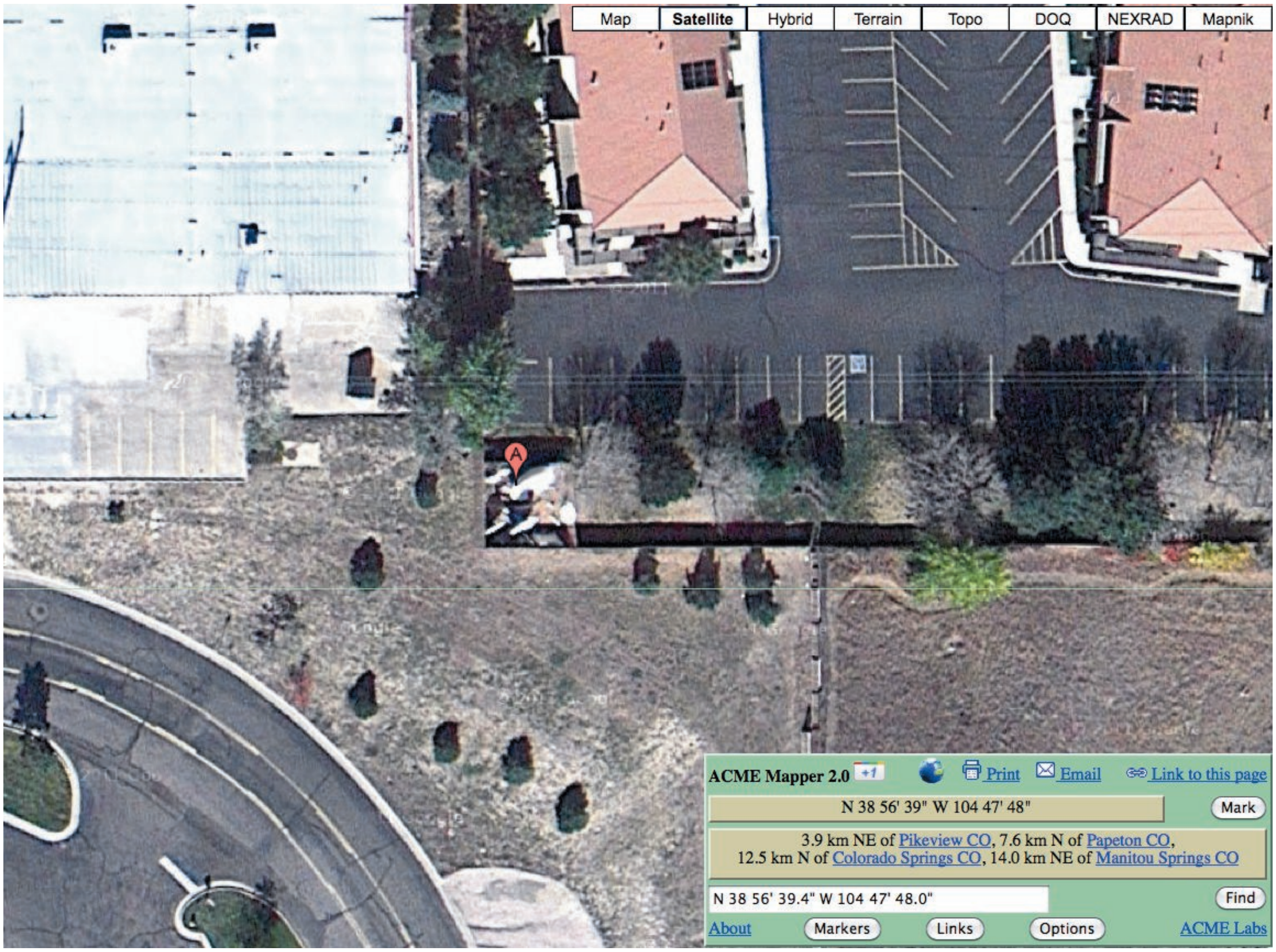
Uplink Site



A = Satellite uplink location. Source is again ACME Mapper.

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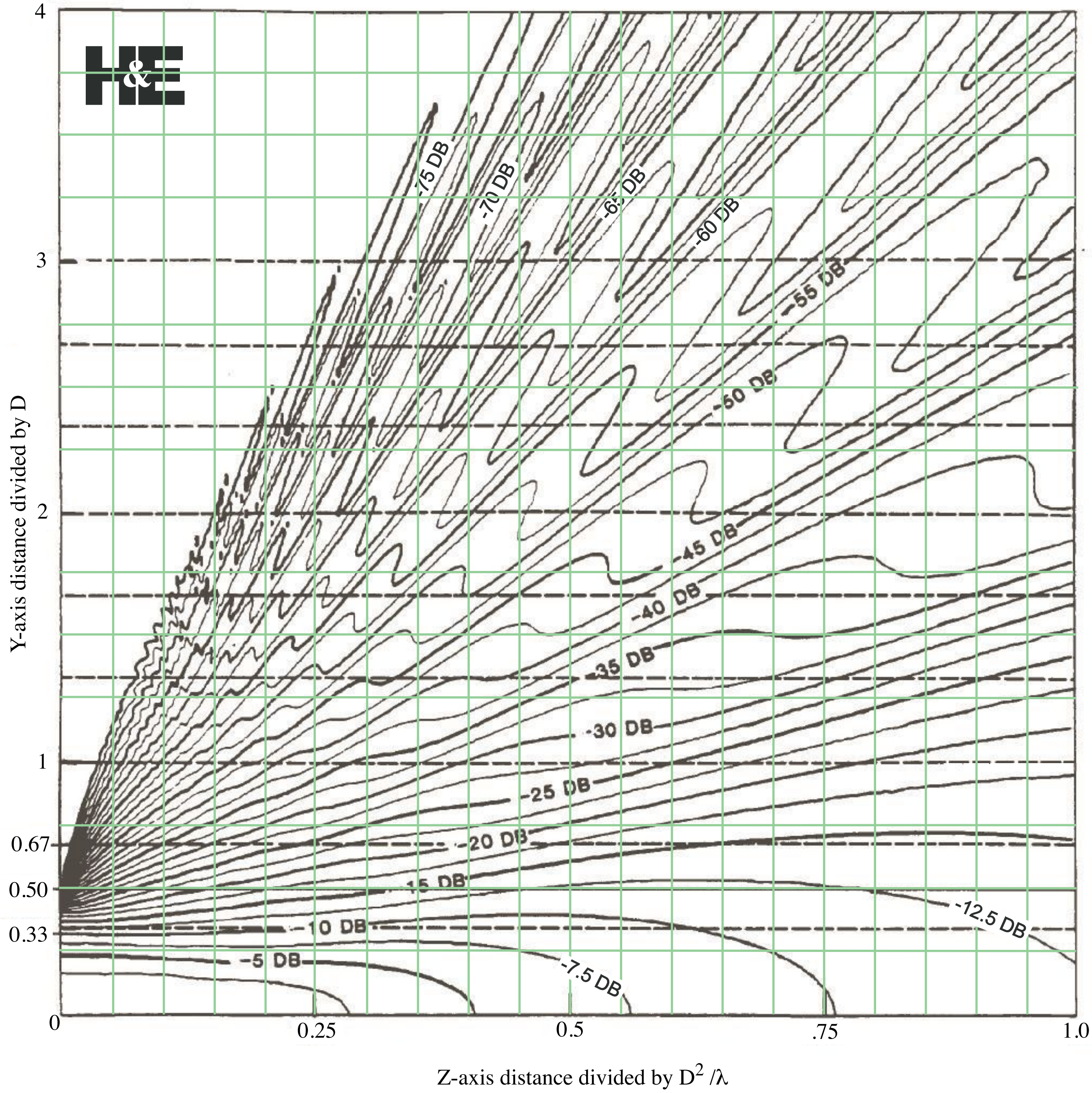
Relative Power Density Contours in the Y-Z Plane for D >30λ



Nomograph from NTIS #NBSIR85-3036, page 6.
Additional notations by Hammett & Edison, Inc., Consulting Engineers, San Francisco