

WEKP
BLED-20110922AAL
Pineville, Kentucky
Amendment to License Application for Noncommercial FM Station
On Channel 21.1 Class C2
by
Eastern Kentucky University

Exhibit 24
Compliance with Electromagnetic Exposure Limits

October 2011

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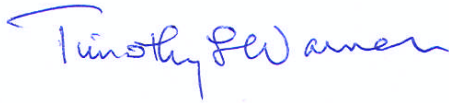
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Declaration

I declare, under penalty of perjury, that I am a technical consultant to broadcasting and other communications systems, that I have over twenty-five years of experience in the engineering of broadcast and other communications systems, that I am familiar with the Federal Communications Commission's Rules found in the Code of Federal Regulations Title 47, that I am a Professional Engineer registered in North Carolina, that I have prepared or supervised the preparation of the attached Exhibit 24 Compliance with Electromagnetic Exposure Limits for Eastern Kentucky University, and that all of the facts therein, except for facts of which the Federal Communications Commission may take official notice, are true to the best of my knowledge and belief.



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29 October 2011

Narrative

This Exhibit provides details of the Compliance with Electromagnetic Exposure Limits for the proposed new station to serve Pineville, Kentucky. The facility requires calculations which are beyond the scope of the worksheets for FCC Form 340. This proposal was studied under the procedures in FCC Bulletin OET-65¹ to determine compliance.

It is noted that this exhibit only addresses the potential for radiofrequency electromagnetic field exposure.

Background

The WEKP facilities were authorized, in modification application BMPED-20110531ALV, based on a Shively 6810-4-DA antenna. The facilities were constructed using a Propagation Systems Inc. PSIFM-4C-DA antenna. A new Compliance with Electromagnetic Exposure Limits Exhibit was supplied with the FCC Form 302-FM License to Cover Construction. This Exhibit supplies additional details, as requested by FCC Staff.

Pineville Calculations

The Pineville facilities, when evaluated under worst case methods in OET-65², would create 0.96 mW/cm² at 2 meters above ground level, which exceeds the limit for uncontrolled/public exposure, although it is 96% of the occupational/controlled limit.

When the vertical elevation pattern of the antenna, a four level Propagation Systems, Inc. PSIFM-4C-DA is considered, the power density at ground level will be significantly

¹ Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, OET Bulletin 65, Edition 97-01, Robert F. Cleveland, Jr., David M. Sylvar, and Jerry L. Ulcek, and Supplement A, Additional Information for Radio and Television Broadcast Stations.

² *ibid.*

reduced³. The manufacturer's elevation pattern is plotted below as Figure 1 and the tabulated data is shown as Figure 2.

Using the manufacturer's elevation pattern and the equations in OET-65, the power density was plotted at an assumed elevation of 2 meters above level ground. As will be shown later, the tower is at a relative high point on a ridge. There are no points on the ridge that are equal or higher to the tower base within a distance where the power density would exceed the limit for uncontrolled/public exposure. The equation used is:

$$S = \frac{33.4 * ERP}{R^2} \quad \text{OET-65 Equation 9}$$

Where: S = power density in $\mu\text{W}/\text{cm}^2$
 ERP = power in Watts
 R = distance in meters

Rewritten as:

$$S = \frac{334 * (ERP_H + ERP_V) * 1000}{(R * 100)^2} \quad \text{Equation 9 revised}$$

Where: S = power density in mW/cm^2
 ERP = power in kilowatts, Horizontally and Vertically polarized
 R = distance in meters

While the WEKP antenna is directional, all calculations assume full field in the horizontal plane. No adjustment was made for reductions in ERP at most azimuths.

The maximum electromagnetic power density is $0.181 \text{ mW}/\text{cm}^2$ at a distance of 6.5 meters from the tower base, or 90.5% of the maximum uncontrolled/public exposure. As expected, that depression angle corresponds to the relative maximum lobe at 68 degrees. The power density at 2 meters above ground is plotted as Figure 3 and tabulated as Table 1.

³ Ibid., page 21, "Use of actual vertical radiation pattern data for the antenna would most likely significantly reduce ground-level exposure predictions from those calculated below (see later discussion), resulting in a more realistic estimate of the actual exposure levels.:

⁴ Ibid., equation 9, page 21,

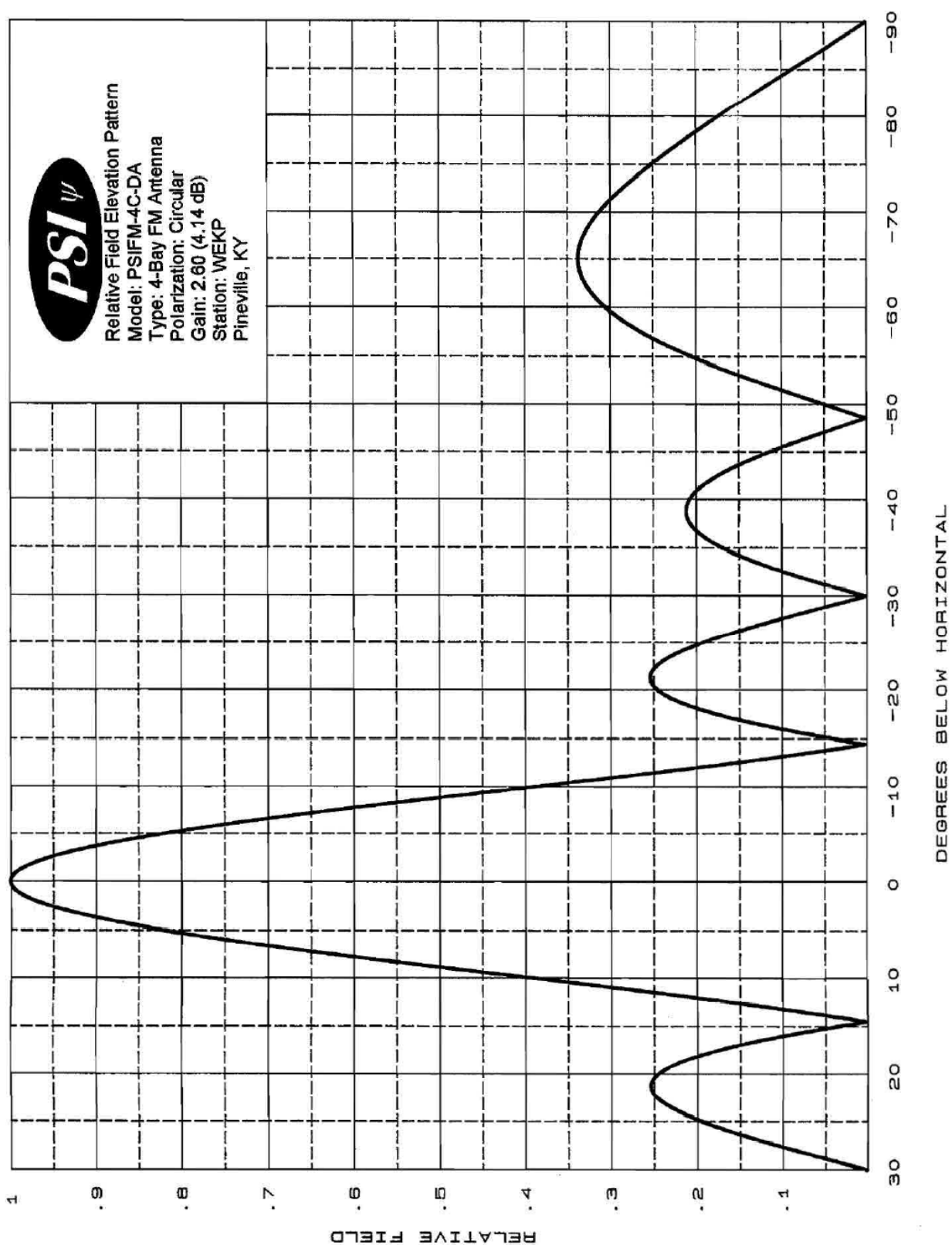


Figure 1: Elevation Pattern Plot


Propagation Systems Inc.

Elevation Pattern Tabulation

Antenna: PSIFM-4C-DA

Bay spacing: fullwave

| Angle | Field | dB | Angle | Field | dB | Angle | Field | dB |
|-------|-------|---------|-------|-------|---------|-------|-------|---------|
| -90.0 | 0.001 | -60.000 | -50.0 | 0.048 | -26.315 | -10.0 | 0.388 | -8.216 |
| -89.0 | 0.017 | -35.177 | -49.0 | 0.014 | -36.928 | -9.0 | 0.483 | -6.326 |
| -88.0 | 0.035 | -29.156 | -48.0 | 0.020 | -34.179 | -8.0 | 0.575 | -4.804 |
| -87.0 | 0.052 | -25.634 | -47.0 | 0.053 | -25.584 | -7.0 | 0.663 | -3.563 |
| -86.0 | 0.070 | -23.136 | -46.0 | 0.084 | -21.489 | -6.0 | 0.745 | -2.553 |
| -85.0 | 0.087 | -21.198 | -45.0 | 0.114 | -18.890 | -5.0 | 0.819 | -1.738 |
| -84.0 | 0.104 | -19.626 | -44.0 | 0.140 | -17.049 | -4.0 | 0.882 | -1.095 |
| -83.0 | 0.122 | -18.297 | -43.0 | 0.164 | -15.714 | -3.0 | 0.932 | -0.609 |
| -82.0 | 0.139 | -17.153 | -42.0 | 0.183 | -14.750 | -2.0 | 0.970 | -0.269 |
| -81.0 | 0.156 | -16.151 | -41.0 | 0.198 | -14.085 | -1.0 | 0.992 | -0.067 |
| -80.0 | 0.173 | -15.260 | -40.0 | 0.207 | -13.676 | 0.0 | 1.000 | 0.000 |
| -79.0 | 0.189 | -14.460 | -39.0 | 0.211 | -13.512 | 1.0 | 0.992 | -0.067 |
| -78.0 | 0.205 | -13.746 | -38.0 | 0.209 | -13.587 | 2.0 | 0.970 | -0.269 |
| -77.0 | 0.221 | -13.104 | -37.0 | 0.202 | -13.914 | 3.0 | 0.932 | -0.609 |
| -76.0 | 0.237 | -12.517 | -36.0 | 0.188 | -14.529 | 4.0 | 0.882 | -1.094 |
| -75.0 | 0.252 | -11.989 | -35.0 | 0.168 | -15.492 | 5.0 | 0.819 | -1.737 |
| -74.0 | 0.266 | -11.515 | -34.0 | 0.143 | -16.901 | 6.0 | 0.745 | -2.552 |
| -73.0 | 0.279 | -11.095 | -33.0 | 0.113 | -18.959 | 7.0 | 0.664 | -3.561 |
| -72.0 | 0.291 | -10.720 | -32.0 | 0.078 | -22.121 | 8.0 | 0.575 | -4.802 |
| -71.0 | 0.302 | -10.392 | -31.0 | 0.040 | -27.861 | 9.0 | 0.483 | -6.323 |
| -70.0 | 0.312 | -10.114 | -30.0 | 0.001 | -60.000 | 10.0 | 0.388 | -8.213 |
| -69.0 | 0.321 | -9.881 | -29.0 | 0.041 | -27.700 | 11.0 | 0.294 | -10.621 |
| -68.0 | 0.327 | -9.698 | -28.0 | 0.083 | -21.647 | 12.0 | 0.203 | -13.855 |
| -67.0 | 0.332 | -9.566 | -27.0 | 0.123 | -18.221 | 13.0 | 0.116 | -18.718 |
| -66.0 | 0.336 | -9.483 | -26.0 | 0.160 | -15.926 | 14.0 | 0.035 | -29.007 |
| -65.0 | 0.337 | -9.460 | -25.0 | 0.193 | -14.301 | 15.0 | 0.037 | -28.679 |
| -64.0 | 0.335 | -9.495 | -24.0 | 0.220 | -13.164 | 16.0 | 0.100 | -20.013 |
| -63.0 | 0.331 | -9.594 | -23.0 | 0.240 | -12.412 | 17.0 | 0.153 | -16.322 |
| -62.0 | 0.325 | -9.758 | -22.0 | 0.251 | -12.010 | 18.0 | 0.195 | -14.220 |
| -61.0 | 0.316 | -10.005 | -21.0 | 0.253 | -11.942 | 19.0 | 0.225 | -12.951 |
| -60.0 | 0.304 | -10.336 | -20.0 | 0.245 | -12.233 | 20.0 | 0.245 | -12.233 |
| -59.0 | 0.290 | -10.761 | -19.0 | 0.225 | -12.951 | 21.0 | 0.253 | -11.942 |
| -58.0 | 0.272 | -11.300 | -18.0 | 0.195 | -14.213 | 22.0 | 0.251 | -12.010 |
| -57.0 | 0.252 | -11.968 | -17.0 | 0.153 | -16.313 | 23.0 | 0.240 | -12.412 |
| -56.0 | 0.229 | -12.794 | -16.0 | 0.100 | -20.000 | 24.0 | 0.220 | -13.164 |
| -55.0 | 0.204 | -13.816 | -15.0 | 0.037 | -28.643 | 25.0 | 0.193 | -14.301 |
| -54.0 | 0.176 | -15.087 | -14.0 | 0.035 | -29.044 | 26.0 | 0.160 | -15.918 |
| -53.0 | 0.146 | -16.691 | -13.0 | 0.116 | -18.729 | 27.0 | 0.123 | -18.221 |
| -52.0 | 0.115 | -18.797 | -12.0 | 0.203 | -13.862 | 28.0 | 0.083 | -21.647 |
| -51.0 | 0.082 | -21.727 | -11.0 | 0.294 | -10.626 | 29.0 | 0.041 | -27.700 |

Figure 2: Elevation Pattern Tabulation

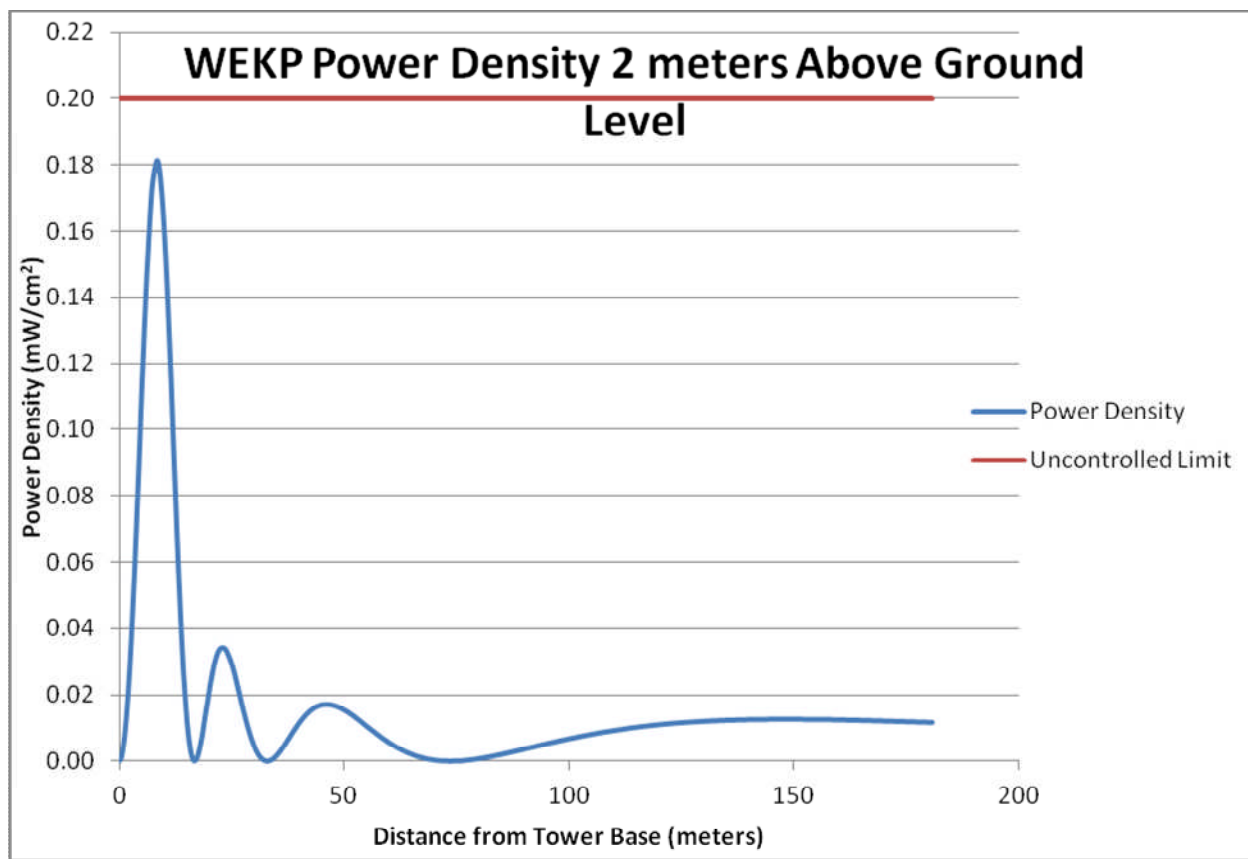


Figure 3: Power Density Plot for WEKP Antenna

Table 1: Power Density Calculations at 2 meters Above Ground

| Depression Angle (degrees) | Relative Field | ERP (kW) | ERP H + V (kW) | Radius to Ground (meters) | Slant Distance to Ground (meters) | S ⁵ (mW/cm ²) | Uncontrolled Public Limit (mW/cm ²) |
|----------------------------|----------------|----------|----------------|---------------------------|-----------------------------------|--------------------------------------|---|
| 0 | 1.000 | 5.200 | 10.400 | inf | inf | n/a | 0.20 |
| 1 | 0.992 | 5.117 | 10.234 | 1088.5 | 1088.7 | 0.0006 | 0.20 |
| 2 | 0.970 | 4.893 | 9.785 | 544.1 | 544.4 | 0.0022 | 0.20 |
| 3 | 0.932 | 4.517 | 9.034 | 362.5 | 363.0 | 0.0046 | 0.20 |
| 4 | 0.882 | 4.045 | 8.090 | 271.7 | 272.4 | 0.0073 | 0.20 |
| 5 | 0.819 | 3.488 | 6.976 | 217.2 | 218.0 | 0.0098 | 0.20 |
| 6 | 0.745 | 2.886 | 5.772 | 180.8 | 181.8 | 0.0117 | 0.20 |
| 7 | 0.663 | 2.286 | 4.572 | 154.7 | 155.9 | 0.0126 | 0.20 |
| 8 | 0.575 | 1.719 | 3.439 | 135.2 | 136.5 | 0.0123 | 0.20 |
| 9 | 0.483 | 1.213 | 2.426 | 120.0 | 121.5 | 0.0110 | 0.20 |
| 10 | 0.388 | 0.783 | 1.566 | 107.8 | 109.4 | 0.0087 | 0.20 |
| 11 | 0.294 | 0.449 | 0.899 | 97.7 | 99.6 | 0.0061 | 0.20 |
| 12 | 0.203 | 0.214 | 0.429 | 89.4 | 91.4 | 0.0034 | 0.20 |
| 13 | 0.116 | 0.070 | 0.140 | 82.3 | 84.5 | 0.0013 | 0.20 |
| 14 | 0.035 | 0.006 | 0.013 | 76.2 | 78.5 | 0.0001 | 0.20 |
| 15 | 0.037 | 0.007 | 0.014 | 70.9 | 73.4 | 0.0002 | 0.20 |
| 16 | 0.100 | 0.052 | 0.104 | 66.3 | 68.9 | 0.0015 | 0.20 |
| 17 | 0.153 | 0.122 | 0.243 | 62.1 | 65.0 | 0.0039 | 0.20 |
| 18 | 0.195 | 0.198 | 0.395 | 58.5 | 61.5 | 0.0070 | 0.20 |
| 19 | 0.225 | 0.263 | 0.527 | 55.2 | 58.4 | 0.0103 | 0.20 |
| 20 | 0.245 | 0.312 | 0.624 | 52.2 | 55.6 | 0.0135 | 0.20 |
| 21 | 0.253 | 0.333 | 0.666 | 49.5 | 53.0 | 0.0158 | 0.20 |
| 22 | 0.251 | 0.328 | 0.655 | 47.0 | 50.7 | 0.0170 | 0.20 |
| 23 | 0.240 | 0.300 | 0.599 | 44.8 | 48.6 | 0.0169 | 0.20 |
| 24 | 0.220 | 0.252 | 0.503 | 42.7 | 46.7 | 0.0154 | 0.20 |
| 25 | 0.193 | 0.194 | 0.387 | 40.7 | 45.0 | 0.0128 | 0.20 |
| 26 | 0.160 | 0.133 | 0.266 | 39.0 | 43.3 | 0.0095 | 0.20 |
| 27 | 0.123 | 0.079 | 0.157 | 37.3 | 41.9 | 0.0060 | 0.20 |
| 28 | 0.083 | 0.036 | 0.072 | 35.7 | 40.5 | 0.0029 | 0.20 |
| 29 | 0.041 | 0.009 | 0.017 | 34.3 | 39.2 | 0.0008 | 0.20 |
| 30 | 0.001 | 0.000 | 0.000 | 32.9 | 38.0 | 0.0000 | 0.20 |
| 31 | 0.040 | 0.008 | 0.017 | 31.6 | 36.9 | 0.0008 | 0.20 |
| 32 | 0.078 | 0.032 | 0.063 | 30.4 | 35.9 | 0.0033 | 0.20 |
| 33 | 0.113 | 0.066 | 0.133 | 29.3 | 34.9 | 0.0073 | 0.20 |
| 34 | 0.143 | 0.106 | 0.213 | 28.2 | 34.0 | 0.0123 | 0.20 |
| 35 | 0.168 | 0.147 | 0.294 | 27.1 | 33.1 | 0.0179 | 0.20 |
| 36 | 0.188 | 0.184 | 0.368 | 26.2 | 32.3 | 0.0235 | 0.20 |
| 37 | 0.202 | 0.212 | 0.424 | 25.2 | 31.6 | 0.0284 | 0.20 |
| 38 | 0.209 | 0.227 | 0.454 | 24.3 | 30.9 | 0.0319 | 0.20 |
| 39 | 0.211 | 0.232 | 0.463 | 23.5 | 30.2 | 0.0339 | 0.20 |
| 40 | 0.207 | 0.223 | 0.446 | 22.6 | 29.6 | 0.0341 | 0.20 |

⁵ Equation 9 Revised, supra.

| Depression Angle (degrees) | Relative Field | ERP (kW) | ERP H + V (kW) | Radius to Ground (meters) | Slant Distance to Ground (meters) | S (mW/cm ²) | Uncontrolled Public Limit (mW/cm ²) |
|----------------------------|----------------|--------------|----------------|---------------------------|-----------------------------------|-------------------------|---|
| 41 | 0.198 | 0.204 | 0.408 | 21.9 | 29.0 | 0.0325 | 0.20 |
| 42 | 0.183 | 0.174 | 0.348 | 21.1 | 28.4 | 0.0289 | 0.20 |
| 43 | 0.164 | 0.140 | 0.280 | 20.4 | 27.9 | 0.0241 | 0.20 |
| 44 | 0.140 | 0.102 | 0.204 | 19.7 | 27.4 | 0.0182 | 0.20 |
| 45 | 0.114 | 0.068 | 0.135 | 19.0 | 26.9 | 0.0125 | 0.20 |
| 46 | 0.084 | 0.037 | 0.073 | 18.3 | 26.4 | 0.0070 | 0.20 |
| 47 | 0.053 | 0.015 | 0.029 | 17.7 | 26.0 | 0.0029 | 0.20 |
| 48 | 0.020 | 0.002 | 0.004 | 17.1 | 25.6 | 0.0004 | 0.20 |
| 49 | 0.014 | 0.001 | 0.002 | 16.5 | 25.2 | 0.0002 | 0.20 |
| 50 | 0.048 | 0.012 | 0.024 | 15.9 | 24.8 | 0.0026 | 0.20 |
| 51 | 0.082 | 0.035 | 0.070 | 15.4 | 24.4 | 0.0078 | 0.20 |
| 52 | 0.115 | 0.069 | 0.138 | 14.8 | 24.1 | 0.0158 | 0.20 |
| 53 | 0.146 | 0.111 | 0.222 | 14.3 | 23.8 | 0.0262 | 0.20 |
| 54 | 0.176 | 0.161 | 0.322 | 13.8 | 23.5 | 0.0390 | 0.20 |
| 55 | 0.204 | 0.216 | 0.433 | 13.3 | 23.2 | 0.0538 | 0.20 |
| 56 | 0.229 | 0.273 | 0.545 | 12.8 | 22.9 | 0.0694 | 0.20 |
| 57 | 0.252 | 0.330 | 0.660 | 12.3 | 22.7 | 0.0860 | 0.20 |
| 58 | 0.272 | 0.385 | 0.769 | 11.9 | 22.4 | 0.1024 | 0.20 |
| 59 | 0.290 | 0.437 | 0.875 | 11.4 | 22.2 | 0.1189 | 0.20 |
| 60 | 0.304 | 0.481 | 0.961 | 11.0 | 21.9 | 0.1334 | 0.20 |
| 61 | 0.316 | 0.519 | 1.039 | 10.5 | 21.7 | 0.1470 | 0.20 |
| 62 | 0.325 | 0.549 | 1.099 | 10.1 | 21.5 | 0.1585 | 0.20 |
| 63 | 0.331 | 0.570 | 1.139 | 9.7 | 21.3 | 0.1674 | 0.20 |
| 64 | 0.335 | 0.584 | 1.167 | 9.3 | 21.1 | 0.1745 | 0.20 |
| 65 | 0.337 | 0.591 | 1.181 | 8.9 | 21.0 | 0.1796 | 0.20 |
| 66⁶ | 0.336 | 0.587 | 1.174 | 8.5 | 20.8 | 0.1814 | 0.20 |
| 67 | 0.332 | 0.573 | 1.146 | 8.1 | 20.6 | 0.1798 | 0.20 |
| 68 | 0.327 | 0.556 | 1.112 | 7.7 | 20.5 | 0.1770 | 0.20 |
| 69 | 0.321 | 0.536 | 1.072 | 7.3 | 20.4 | 0.1729 | 0.20 |
| 70 | 0.312 | 0.506 | 1.012 | 6.9 | 20.2 | 0.1655 | 0.20 |
| 71 | 0.302 | 0.474 | 0.949 | 6.5 | 20.1 | 0.1570 | 0.20 |
| 72 | 0.291 | 0.440 | 0.881 | 6.2 | 20.0 | 0.1474 | 0.20 |
| 73 | 0.279 | 0.405 | 0.810 | 5.8 | 19.9 | 0.1370 | 0.20 |
| 74 | 0.266 | 0.368 | 0.736 | 5.4 | 19.8 | 0.1259 | 0.20 |
| 75 | 0.252 | 0.330 | 0.660 | 5.1 | 19.7 | 0.1141 | 0.20 |
| 76 | 0.237 | 0.292 | 0.584 | 4.7 | 19.6 | 0.1018 | 0.20 |
| 77 | 0.221 | 0.254 | 0.508 | 4.4 | 19.5 | 0.0893 | 0.20 |
| 78 | 0.205 | 0.219 | 0.437 | 4.0 | 19.4 | 0.0774 | 0.20 |
| 79 | 0.189 | 0.186 | 0.371 | 3.7 | 19.4 | 0.0663 | 0.20 |
| 80 | 0.173 | 0.156 | 0.311 | 3.4 | 19.3 | 0.0559 | 0.20 |
| 81 | 0.156 | 0.127 | 0.253 | 3.0 | 19.2 | 0.0457 | 0.20 |

⁶ Maximum power density at 2 meters above ground level occurs at a depression angle of 66°, at 90.7% of the limit for uncontrolled public exposure, and at a distance of 8.5 meters (27.9 feet) from the tower base, assuming level ground.

| | | | | | | | |
|----|-------|-------|-------|-----|------|--------|------|
| 82 | 0.139 | 0.100 | 0.201 | 2.7 | 19.2 | 0.0365 | 0.20 |
| 83 | 0.122 | 0.077 | 0.155 | 2.3 | 19.1 | 0.0282 | 0.20 |
| 84 | 0.104 | 0.056 | 0.112 | 2.0 | 19.1 | 0.0206 | 0.20 |
| 85 | 0.087 | 0.039 | 0.079 | 1.7 | 19.1 | 0.0145 | 0.20 |
| 86 | 0.070 | 0.025 | 0.051 | 1.3 | 19.0 | 0.0094 | 0.20 |
| 87 | 0.052 | 0.014 | 0.028 | 1.0 | 19.0 | 0.0052 | 0.20 |
| 88 | 0.035 | 0.006 | 0.013 | 0.7 | 19.0 | 0.0024 | 0.20 |
| 89 | 0.017 | 0.002 | 0.003 | 0.3 | 19.0 | 0.0006 | 0.20 |
| 90 | 0.001 | 0.000 | 0.000 | 0.0 | 19.0 | 0.0000 | 0.20 |

Site Considerations

The site is at a high point along a ridge. Land drops steeply on either side of the ridge. Elevation loss along the ridge is gentle for 200 meters in one direction, and somewhat steeper in the other. There are no areas elevated above the base of the tower within 300 meters of the tower base. The site is fenced and marked with signs indicating the nature of the exposure.

EKU staff measured the following elevations and distances:

| | |
|--|---|
| Tower to access road | 65' (19.8 m) lateral and 24' (7.3m) vertical drop |
| Tower to entrance gate (South, facing fence) | 30' (9.1m) lateral and 10' (3m) vertical drop |
| Eastern facing fence to tower center | 4' (1.2m) |
| Western facing fence to tower center | 75' (22.9m) |
| North facing fence to tower center (inaccessible side) | 20' (6.1m) |

The following site layout survey and photographs provide details of the site, the elevations, and the general accessibility of the site.

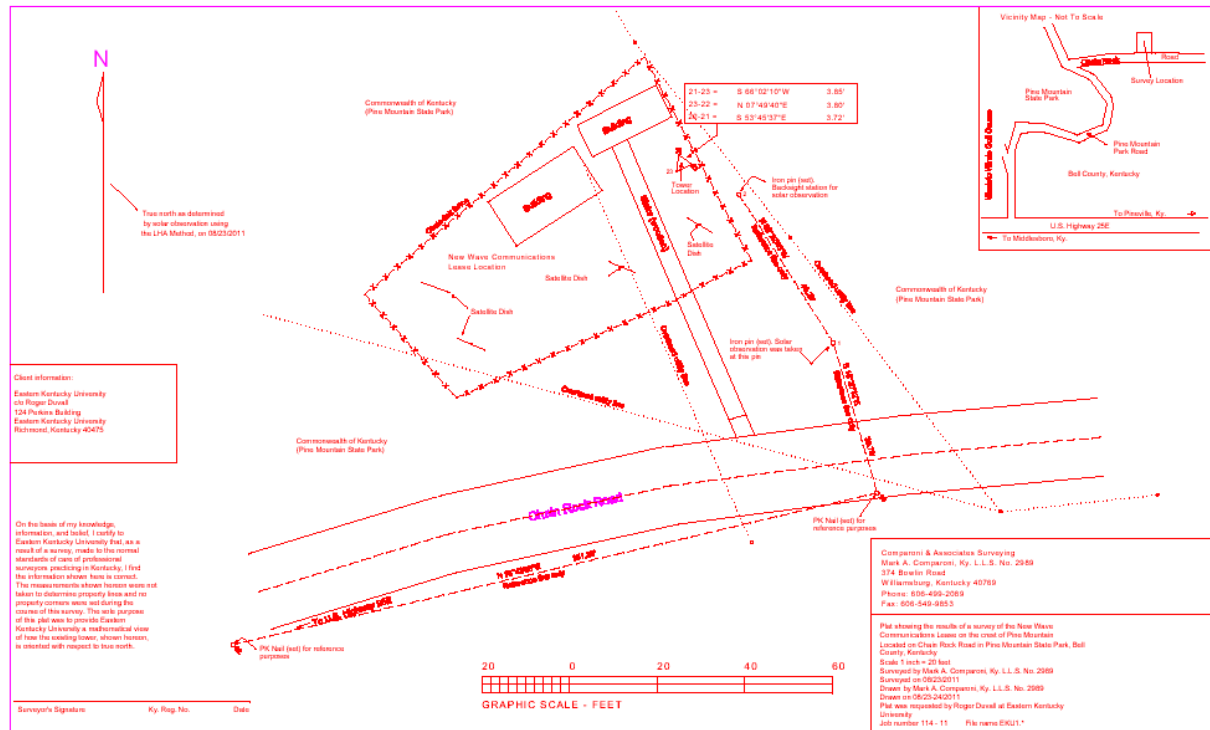


Figure 4: Site Layout



Figure 5: Site, view along East Fence



Figure 6: Site, from Roadway, looking North



Figure 7: Inside Fence, looking East



Figure 8: View of Site from North



Figure 9: View from Northwest Guy Anchor



Figure 10: Detail of Sign on East Fence