

RFR Engineering Statement

WUBE (FM) Aux Antenna

A power density calculation can be made using the techniques outlined in the V-Soft Ver. 2.4.6 software program:

Data plugged into the program:

Antenna parameters: 9.0 KW Horizontal, 9.0 KW Vertical

Number of bays/spacing: 2 bays at a spacing of 1 full wavelength

COR Meters above ground level: 176 meters

Distance in Meters to tower base: 1 meter to 200 meters

Antenna manufacturer: ERI J8CP Roto-tiller type

In this first calculation, the program reveals that the maximum RFR level at any ground level is **2.72 uW/cm²** at 119 meters from the base of the tower or **1.36%** of allowable RFR in an un-controlled environment. This level is significantly below the 5% of maximum allowable and therefore the WUBE(FM) Aux antenna would not be included as a >5% contributor when added to other transmitters in the area for a total RFR level at the site.

A second calculation is made using the "*RFS, RF Specialties Technical Program Disk*", Version 2.48. Under section II, *FM Antenna Calculations*. The power density calculations for the proposed ERI 2- Bay "roto" antenna result in a maximum power density at 115 meters from the base of the antenna support structure of **2.14 uW/cm²**. This is just **1.07%** of the 200 uW/cm² (the ANSI standard for un-controlled environments). This calculation level is also significantly below the 5% of maximum allowable and therefore the WUBE(FM) Aux antenna would not be included as a >5% contributor when added to other transmitters in the area for a total RFR level at the site.

Careful measurements using a calibrated meter will be taken after construction and during initial turn-on to prove this facility meets specifications outlined in bulletin O.E.T. 65.

The permittee/licensee in coordination with other users of the site have a written program in place to reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radio frequency radiation in excess of FCC guidelines.

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Study
☒ FM
☐ TV
☐ DTV

Method
☐ OET #65
☒ OET Mod

Scale = $\mu\text{W}/\text{sq cm}$

☐ 50
 ☐ 100
 ☒ 200
 ☐ 500
 ☐ 1000
 ☐ 2000
 ☐ 3000

Graph Distance
 100

Antenna Parameters

H kW

V kW

of Bays Spacing

COR Meters Above Ground

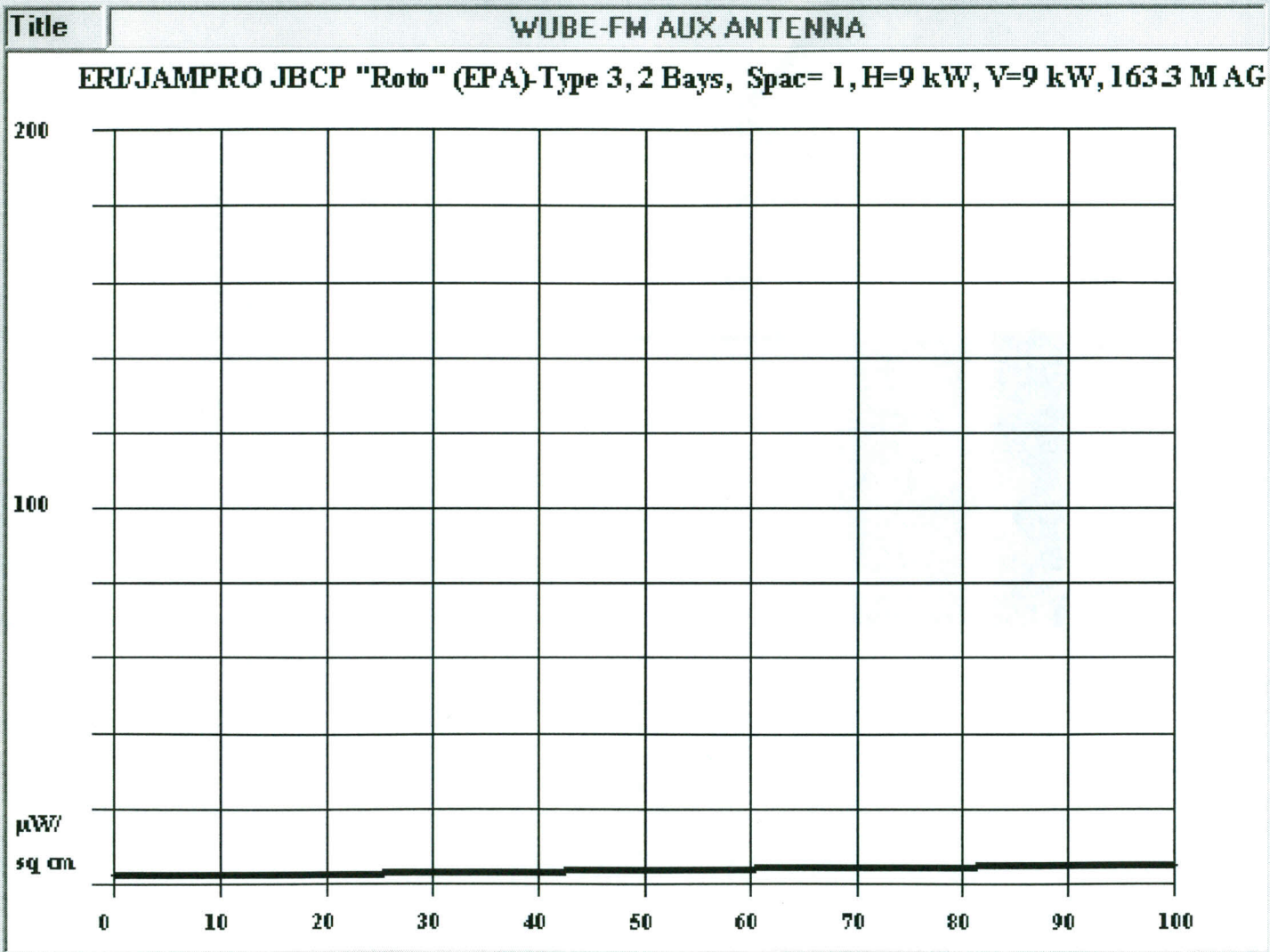
Dist. in Meters to Tower Base

- Phelps-Dodge "Ring Stub" (EPA)
- ERI "Dual Cycloid"
- Jampro "Double V" (EPA)
- ERI/JAMPRO JBCP "Roto" (EPA)**
- RCA "BFC" (EPA)
- RCA "BFG" (EPA)
- Shively 6800 series
- Shively 6810
- Dielectric DCRM
- Dielectric DCRQ
- Dielectric DCRC
- Shively 6513/6510 Vert. Dipole

Max = 200 $\mu\text{W}/\text{sq cm}$

Pwr Density $\mu\text{W}/\text{sq cm}$ Controlled

☐ Yes
☒ No



RF SPECIALTIES -- POWER DENSITY TABLE

DATE: FEBRUARY 3, 1911

MODEL: ERI-2 RMS GAIN= .997

PREPARED FOR: WUBE-FM

H-ERP: 9 kW -- V-ERP: 9 kW -- CENTER OF RADIATION

FREQ: 105.1 MHz

BEAM TILT= 0 Deg

NULL FILL= 0%

SPACING: 1 Wave

HAGL: 163.3 Meters

| ANGLE OF ELEVATION | HORIZONTAL ERP | VERTICAL ERP | DISTANCE FROM TOWER | VOLTAGE RATIO | POWER DENSITY |
|-----------------------|-------------------|-----------------|------------------------|------------------|------------------|
| -1° | 8.969 kW | 8.969 kW | 9,355.49 m | .998 | .01 uW/cm2 |
| -2° | 8.877 kW | 8.877 kW | 4,676.31 m | .993 | .03 uW/cm2 |
| -3° | 8.725 kW | 8.725 kW | 3,115.95 m | .985 | .06 uW/cm2 |
| -4° | 8.515 kW | 8.515 kW | 2,335.30 m | .973 | .10 uW/cm2 |
| -5° | 8.252 kW | 8.252 kW | 1,866.53 m | .958 | .16 uW/cm2 |
| -6° | 7.938 kW | 7.938 kW | 1,553.70 m | .939 | .22 uW/cm2 |
| -7° | 7.581 kW | 7.581 kW | 1,329.97 m | .918 | .28 uW/cm2 |
| -8° | 7.184 kW | 7.184 kW | 1,161.94 m | .893 | .35 uW/cm2 |
| -9° | 6.754 kW | 6.754 kW | 1,031.04 m | .866 | .41 uW/cm2 |
| -10° | 6.297 kW | 6.297 kW | 926.12 m | .836 | .48 uW/cm2 |
| -11° | 5.821 kW | 5.821 kW | 840.11 m | .804 | .53 uW/cm2 |
| -12° | 5.333 kW | 5.333 kW | 768.27 m | .770 | .58 uW/cm2 |
| -13° | 4.838 kW | 4.838 kW | 707.33 m | .733 | .61 uW/cm2 |
| -14° | 4.344 kW | 4.344 kW | 654.96 m | .695 | .64 uW/cm2 |
| -15° | 3.857 kW | 3.857 kW | 609.44 m | .655 | .65 uW/cm2 |
| -16° | 3.384 kW | 3.384 kW | 569.49 m | .613 | .64 uW/cm2 |
| -17° | 2.929 kW | 2.929 kW | 534.13 m | .570 | .63 uW/cm2 |
| -18° | 2.498 kW | 2.498 kW | 502.59 m | .527 | .60 uW/cm2 |
| -19° | 2.094 kW | 2.094 kW | 474.26 m | .482 | .56 uW/cm2 |
| -20° | 1.722 kW | 1.722 kW | 448.66 m | .437 | .50 uW/cm2 |
| -21° | 1.384 kW | 1.384 kW | 425.41 m | .392 | .45 uW/cm2 |
| -22° | 1.082 kW | 1.082 kW | 404.18 m | .347 | .38 uW/cm2 |
| -23° | .819 kW | .819 kW | 384.71 m | .302 | .31 uW/cm2 |
| -24° | .593 kW | .593 kW | 366.78 m | .257 | .25 uW/cm2 |
| -25° | .406 kW | .406 kW | 350.20 m | .212 | .18 uW/cm2 |
| -26° | .256 kW | .256 kW | 334.81 m | .169 | .12 uW/cm2 |
| -27° | .143 kW | .143 kW | 320.49 m | .126 | .07 uW/cm2 |
| -28° | .064 kW | .064 kW | 307.12 m | .084 | .04 uW/cm2 |
| -29° | .017 kW | .017 kW | 294.60 m | .044 | .01 uW/cm2 |
| -30° | .000 kW | .000 kW | 282.84 m | .004 | .00 uW/cm2 |
| -31° | .010 kW | .010 kW | 271.78 m | .033 | .01 uW/cm2 |
| -32° | .043 kW | .043 kW | 261.33 m | .069 | .03 uW/cm2 |
| -33° | .097 kW | .097 kW | 251.46 m | .104 | .07 uW/cm2 |
| -34° | .168 kW | .168 kW | 242.10 m | .137 | .13 uW/cm2 |
| -35° | .253 kW | .253 kW | 233.22 m | .168 | .21 uW/cm2 |
| -36° | .349 kW | .349 kW | 224.76 m | .197 | .30 uW/cm2 |
| -37° | .452 kW | .452 kW | 216.71 m | .224 | .41 uW/cm2 |
| -38° | .560 kW | .560 kW | 209.01 m | .249 | .53 uW/cm2 |
| -39° | .670 kW | .670 kW | 201.66 m | .273 | .66 uW/cm2 |
| -40° | .779 kW | .779 kW | 194.61 m | .294 | .81 uW/cm2 |
| -41° | .886 kW | .886 kW | 187.86 m | .314 | .96 uW/cm2 |
| -42° | .988 kW | .988 kW | 181.36 m | .331 | 1.11 uW/cm2 |
| -43° | 1.083 kW | 1.083 kW | 175.12 m | .347 | 1.26 uW/cm2 |
| -44° | 1.171 kW | 1.171 kW | 169.10 m | .361 | 1.42 uW/cm2 |
| -45° | 1.251 kW | 1.251 kW | 163.30 m | .373 | 1.57 uW/cm2 |
| -46° | 1.321 kW | 1.321 kW | 157.70 m | .383 | 1.71 uW/cm2 |
| -47° | 1.381 kW | 1.381 kW | 152.28 m | .392 | 1.85 uW/cm2 |
| -48° | 1.430 kW | 1.430 kW | 147.04 m | .399 | 1.98 uW/cm2 |
| -49° | 1.469 kW | 1.469 kW | 141.95 m | .404 | 2.10 uW/cm2 |
| -50° | 1.498 kW | 1.498 kW | 137.02 m | .408 | 2.20 uW/cm2 |

| | | | | | |
|------|----------|----------|----------|------|-------------|
| -51° | 1.517 kW | 1.517 kW | 132.24 m | .410 | 2.30 uW/cm2 |
| -52° | 1.525 kW | 1.525 kW | 127.58 m | .412 | 2.37 uW/cm2 |
| -53° | 1.525 kW | 1.525 kW | 123.06 m | .412 | 2.44 uW/cm2 |
| -54° | 1.516 kW | 1.516 kW | 118.64 m | .410 | 2.49 uW/cm2 |
| -55° | 1.499 kW | 1.499 kW | 114.34 m | .408 | 2.52 uW/cm2 |
| -56° | 1.475 kW | 1.475 kW | 110.15 m | .405 | 2.54 uW/cm2 |
| -57° | 1.445 kW | 1.445 kW | 106.05 m | .401 | 2.55 uW/cm2 |
| -58° | 1.409 kW | 1.409 kW | 102.04 m | .396 | 2.54 uW/cm2 |
| -59° | 1.368 kW | 1.368 kW | 98.12 m | .390 | 2.52 uW/cm2 |
| -60° | 1.323 kW | 1.323 kW | 94.28 m | .383 | 2.49 uW/cm2 |
| -61° | 1.275 kW | 1.275 kW | 90.52 m | .376 | 2.44 uW/cm2 |
| -62° | 1.224 kW | 1.224 kW | 86.83 m | .369 | 2.39 uW/cm2 |
| -63° | 1.171 kW | 1.171 kW | 83.21 m | .361 | 2.33 uW/cm2 |
| -64° | 1.116 kW | 1.116 kW | 79.65 m | .352 | 2.26 uW/cm2 |
| -65° | 1.061 kW | 1.061 kW | 76.15 m | .343 | 2.18 uW/cm2 |
| -66° | 1.006 kW | 1.006 kW | 72.71 m | .334 | 2.10 uW/cm2 |
| -67° | .950 kW | .950 kW | 69.32 m | .325 | 2.02 uW/cm2 |
| -68° | .896 kW | .896 kW | 65.98 m | .315 | 1.93 uW/cm2 |
| -69° | .842 kW | .842 kW | 62.68 m | .306 | 1.84 uW/cm2 |
| -70° | .789 kW | .789 kW | 59.44 m | .296 | 1.75 uW/cm2 |
| -71° | .738 kW | .738 kW | 56.23 m | .286 | 1.65 uW/cm2 |
| -72° | .689 kW | .689 kW | 53.06 m | .277 | 1.56 uW/cm2 |
| -73° | .641 kW | .641 kW | 49.93 m | .267 | 1.47 uW/cm2 |
| -74° | .595 kW | .595 kW | 46.83 m | .257 | 1.38 uW/cm2 |
| -75° | .552 kW | .552 kW | 43.76 m | .248 | 1.29 uW/cm2 |
| -76° | .510 kW | .510 kW | 40.72 m | .238 | 1.20 uW/cm2 |
| -77° | .471 kW | .471 kW | 37.70 m | .229 | 1.12 uW/cm2 |
| -78° | .434 kW | .434 kW | 34.71 m | .220 | 1.04 uW/cm2 |
| -79° | .399 kW | .399 kW | 31.74 m | .211 | .96 uW/cm2 |
| -80° | .366 kW | .366 kW | 28.79 m | .202 | .89 uW/cm2 |
| -81° | .336 kW | .336 kW | 25.86 m | .193 | .82 uW/cm2 |
| -82° | .307 kW | .307 kW | 22.95 m | .185 | .75 uW/cm2 |
| -83° | .280 kW | .280 kW | 20.05 m | .176 | .69 uW/cm2 |
| -84° | .255 kW | .255 kW | 17.16 m | .168 | .63 uW/cm2 |
| -85° | .232 kW | .232 kW | 14.29 m | .161 | .58 uW/cm2 |
| -86° | .211 kW | .211 kW | 11.42 m | .153 | .53 uW/cm2 |
| -87° | .191 kW | .191 kW | 8.56 m | .146 | .48 uW/cm2 |
| -88° | .173 kW | .173 kW | 5.70 m | .139 | .43 uW/cm2 |
| -89° | .156 kW | .156 kW | 2.85 m | .132 | .39 uW/cm2 |
| -90° | .141 kW | .141 kW | .00 m | .125 | .35 uW/cm2 |