

GEORGIA STATE UNIVERSITY

WRAS

ATLANTA, GEORGIA

RFR ANALYSIS

There are five broadcast stations on the tower proposed as the antenna support for WRAS. They are shown here with their RFR contributions at two meters Above Ground Level (AGL):

	$\mu\text{W}/\text{cm}^2$	Percent of $200 \mu\text{W}/\text{cm}^2$
WABE, channel 211C0, Atlanta (CP)	6.65	3.325
WSB-FM, channel 250C0, Atlanta (Lic)	9.73	4.865
WSTR, channel 231C0, Smyrna, GA (Lic)	9.73	4.865
WVEE, channel 277C0, Atlanta (Lic)	9.73	4.865
WPBA-DT, channel 21, Atlanta (Lic)	0.02	0.009
WRAS Proposed	43.50	21.750
Total	79.36	39.679

The source or derivation of the RFR levels is as follows:

WABE(CP) will utilize a Dielectric Communications DCRM-5 with 100 kW H&V at 313 meters AGL. Using FM Model, the maximum power density 2 meters above ground is  $6.65 \mu\text{W}/\text{cm}^2$  at 115 meters from the tower base. This is 3.325 percent of the recommended  $200 \mu\text{W}/\text{cm}^2$  level for uncontrolled spaces.

The WABE licensed facility is on an adjacent tower on the same premises with a 12 bay ERI antenna with half-wave spacing, model MP12C-DA-HW-SP, running 96 kilowatts at 232.5 meters AGL. According to FM Model, the maximum power density at two meters AGL is  $0.356 \mu\text{W}/\text{cm}^2$ . This contribution is not shown in the tabulation above as this facility is to be replaced with the authorized WABE facility.

WSB, WSTR and WVEE use the same Alan Dick 8 level panel antenna, model FC8.35H-16ND at 292 m AGL. As in the WSTR Application for Construction Permit (File 20060523ADI), it is assumed that the maximum field is less than 0.35 between the depression angles of 10 and 90 degrees. Then using equation (2), page 30 of Supplement A to OET-65 without the 0.4 conversion of Peak to Average power for analog TV:

$$\text{Eq (2)} \quad S = \frac{33.4 (F^2) (ERP_h + ERP_v)}{R^2}$$

$$S = \frac{33.4 (0.35)^2 (100,000 + 100,000)}{(290)^2}$$

where: S = power density in  $\mu\text{W}/\text{cm}^2$   
 F = relative field  
 $ERP_h$  = horizontal power in watts  
 $ERP_v$  = vertical power in watts  
 R = distance in meters from antenna radiation center to a point two meters above ground.

For each station the relative field is 0.35, power is 100 kilowatts Horizontal and 100 kilowatts Vertical, radiation center at 292 meters AGL (R = 290 meters).

S =  $9.73 \mu\text{W}/\text{cm}^2$  for each of the three stations or 4.87 percent of the permissible level of  $200 \mu\text{W}/\text{cm}^2$  for uncontrolled spaces for each station.

WPBA-DT operates with a Dielectric Communications model TFU-24J antenna with 55.4 kW ERP (horizontal only) 512-518 MHz at 250 meters AGL. In accordance with Supplement A to OET-65, first paragraph on page 31, a relative field value of 0.1 has been used for the TFU-24J. Again, using equation (2) above, where F is 0.1, ERP is 55.4 kW and R is 248 meters, S is  $0.03 \mu\text{W}/\text{cm}^2$ . Correcting for frequency above 300 MHz in accordance with Table 1A, page 67 of OET-65, the limit for uncontrolled areas is 300 MHz/512 MHz x  $0.03 \mu\text{W}/\text{cm}^2$  or  $0.017578 \mu\text{W}/\text{cm}^2$ . This is 0.0088 percent of the permissible  $200 \mu\text{W}/\text{cm}^2$  for uncontrolled spaces.

WPBA-DT is on an adjacent tower on the same premises. It has been treated as if it were on the proposed WRAS tower, which is a "worst case" scenario. Also, its contribution is insignificant.

#### PROPOSED WRAS CONTRIBUTION

The proposed WRAS antenna will be a four level panel at 142.5 meters AGL with a maximum ERP of 100 kilowatts Horizontal and 100 kilowatts Vertical. The power densities were determined with OET-65 equation (2). Calculations were made from the base of the tower out to 110 meters at ten meter intervals as follows:

RFR ANALYSIS...(continued)

<u>FROM TWR BASE</u> <u>(c) (meters)</u>	<u>μW/cm<sup>2</sup></u>
0	6.6
10	13.5
20	22.4
30	33.2
40	38.4
50	43.4
60	43.5
70	39.2
80	29.6
90	17.5
100	8.1
110	0.8

As shown, the maximum power density is 43.5 μW/cm<sup>2</sup> at 60 meters from the tower. This is 21.8 percent of the permissible 200 μW/cm<sup>2</sup> for uncontrolled spaces.

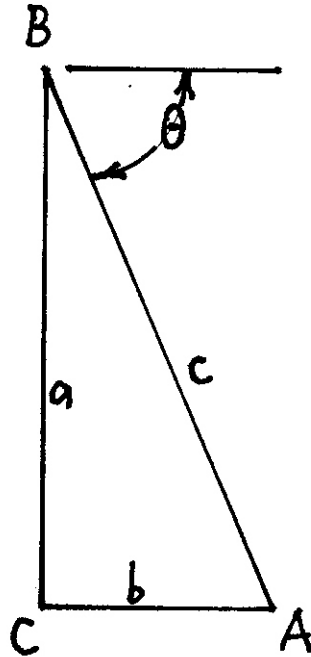
The following is a sample calculation for 60 meters from the tower base:

<u>RC AGL-2m</u> <u>SIDE (a)</u>	<u>DIST FROM</u> <u>TWR BASE</u>	<u>SLANT</u> <u>DIST</u>	<u>DEPRESSION</u> <u>ANGLE</u>	<u>RADIATED</u> <u>FIELD (F)</u>	<u>S in</u> <u>μW/cm<sup>2</sup></u>
	<u>SIDE (b)</u>	<u>SIDE c</u>	<u>(θ)</u>	<u>(FROM GRAPH)</u>	
140.5m	60.0m	152.78m	66.9°	0.39	43.5

$$\text{Eq (2)} \quad S = \frac{33.4 (F^2) (ERP_h + ERP_v)}{c^2}$$

where:

- S = power density in μW/cm<sup>2</sup>
- F = relative field (from attached graph)
- ERP<sub>h</sub> = horizontal power in watts
- ERP<sub>v</sub> = vertical power in watts
- c = distance in meters from Antenna Radiation Center to a point two meters above ground level



Referring to the schematic diagram above, line CA is two meters AGL. The antenna depression angle ( $\theta$ ) is the alternate of angle A. The antenna radiation center is at point B. The distance from the antenna Center of Radiation (B) to the point of interest two meters AGL (A) is side (c).

For (b) = 60 meters

$$(a) = 140.5 \text{ m (Antenna RC AGL - 2 meters)}$$

$$(b) = 60 \text{ m}$$

$$(c) = \sqrt{a^2 + b^2} = 152.8 \text{ m}$$

$$(\theta) = \tan^{-1} a/b = 66.9^\circ$$

Applied to equation (2):

$$S = \frac{33.4(0.1521)(200,000)}{23,341.73} = 43.5 \text{ } \mu\text{W}/\text{cm}^2$$

F (0.39) is taken from the graph on the following page at depression angle  $\theta$  ( $66.9^\circ$ ).

It has been demonstrated that the addition of the proposed WRAS facility is within FCC guidelines for RFR protection of areas open to the general public ( $200 \text{ } \mu\text{W}/\text{cm}^2$ ). (The maximum total power density of all tenants is less than shown above because the maximums of WABE, (WSB+WSTR+WVEE) and the proposed WRAS occur at different distances from the base of the tower.)



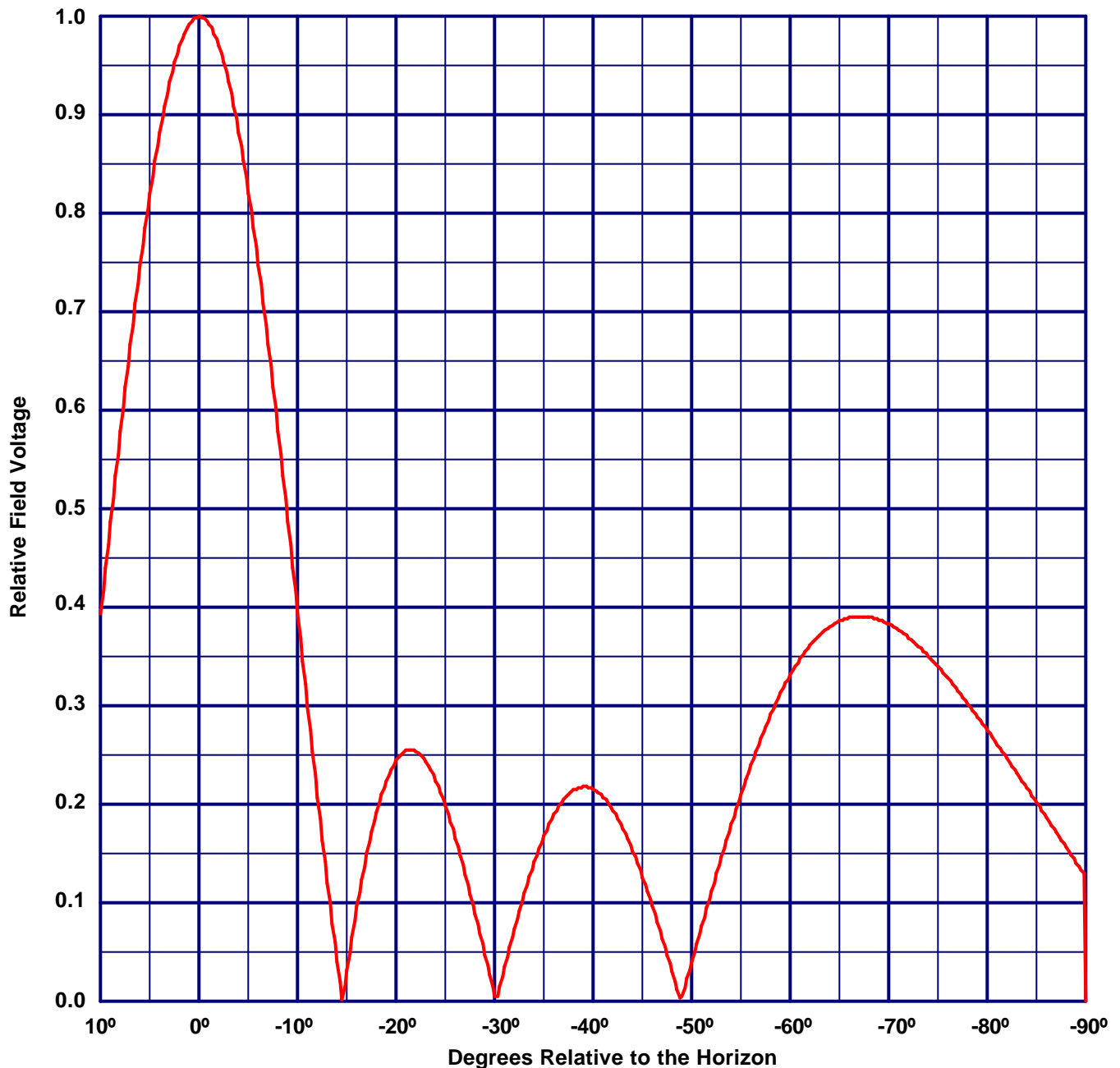
## ***Vertical Plane Relative Field Pattern***

**WRAS, Atlanta, GA, 88.5 MHz**

**Figure#: 3**

**Date: 6/21/2010**

***A 4 level, 1 wave-length spaced 1184-4CP-DAdirectional antenna  
with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.000***



**Vertical Polarization Gain:**

**Maximum: 3.951 (5.552 dB)**

**Horizontal Plane: 3.951 (5.552 dB)**

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