



NON-IONIZING RADIO FREQUENCY RADIATION STUDY

NEW CENTRAL FACILITY

IN

ORANGE, CONNECTICUT

Presented by:



ENERGY WATER INFORMATION GOVERNMENT

May 14th, 2010

THE UNITED ILLUMINATING COMPANY

PROPOSED RADIO ANTENNA TOWER

NON-IONIZING RADIO FREQUENCY RADIATION STUDY

by Black & Veatch, Inc.

The United Illuminating Company hired Black & Veatch, Inc., to conduct a study of non-ionizing radio frequency radiation at the base of its proposed radio antenna tower to be built at its new central facility at 100 – 110 Marsh Hill Road in the Town of Orange, Connecticut. Black & Veatch had previously provided United Illuminating with a proposed drawing of the tower, recommended antenna heights and types, and projected transmitter power for each of the proposed antennas. This data was used to calculate the radio frequency energy at the base of the proposed tower.

Since the antennas are designed to send signals to a distant receiver, levels at the base of the tower are intentionally extremely low. Due to the very low power density values, the numbers to focus on are the distance to uncontrolled compliance. In the direction toward the base of the tower, the distance to meet the uncontrolled compliance point is 1.5 feet below the worst case of the ten antennas. At the base of tower the RMS sum of the RF power is 0.00148 mW/cm².

The Federal Communications Commission's (FCC) Office of Engineering & Technology issued OET Bulletin 65 (Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields) with three supplements. The documents lay out the limits, calculation method and measurement techniques of exposure to RF energy for occupational groups and the general population. The levels calculated show the ground level exposure under the proposed tower is significantly **under** the limits for the General Population or Uncontrolled Exposure level. See the following tables and the calculations for each antenna.

Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Power Density (S) in mW/cm ²	Averaging Time in Minutes
0.3-3.0	(100)*	6
3.0-30	(900/f)*	6
30-300	1.0	6
300-1500	f/300	6
1500-100,000	5	6

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Power Density (S) in mW/cm ²	Averaging Time in Minutes
0.3-3.0	(100)*	30
3.0-30	(180/f)*	30
30-300	.2	30
300-1500	f/1500	30
1500-100,000	1.0	30

*Plane-wave equivalent power density
f = frequency in MHz

RF Safety Compliance Calculator Results

Antenna A

Frequency of operation : 37.600 MHz
Average power at antenna : 100.000 Watts
 Antenna gain : -18.000 dBi
Distance from antenna : 27.737 meters (91.000 feet)
Estimated power density : 0.00006 mW/cm²
Ground reflections : Yes

Maximum Permissible Exposure (MPE)

Controlled environment : 1.005 mW/cm²
Uncontrolled environment : 0.205 mW/cm²

Distance to compliance from center of antenna

Controlled environment : 0.195 meters (0.639 feet)
Uncontrolled environment : 0.416 meters (1.366 feet)

Is the controlled environment area compliant : Yes
Is the uncontrolled environment area compliant : Yes

Antenna B

Frequency of operation : 451.075 MHz
Average power at antenna : 42.000 Watts
 Antenna gain : -16.000 dBi
Distance from antenna : 24.689 meters (81.000 feet)
Estimated power density : 0.00014 mW/cm²
Ground reflections : Yes

Maximum Permissible Exposure (MPE)

Controlled environment : 1.508 mW/cm²
Uncontrolled environment : 0.306 mW/cm²

Distance to compliance from center of antenna

Controlled environment : 0.135 meters (0.441 feet)
Uncontrolled environment : 0.282 meters (0.925 feet)

Is the controlled environment area compliant : Yes
Is the uncontrolled environment area compliant : Yes

Antenna C

Frequency of operation : 814.0625 MHz
Average power at antenna : 30.000 Watts
Antenna gain : -46.000 dBi
Distance from antenna : 23.774 meters (78.000 feet)
Estimated power density : 0.00000 mW/cm²
Ground reflections : Yes

Maximum Permissible Exposure (MPE)

Controlled environment : 2.718 mW/cm²
Uncontrolled environment : 0.548 mW/cm²

Distance to compliance from center of antenna

Controlled environment : 0.023 meters (0.075 feet)
Uncontrolled environment : 0.033 meters (0.107 feet)

Is the controlled environment area compliant : Yes
Is the uncontrolled environment area compliant : Yes

Antenna D

Frequency of operation : 47.820 MHz
Average power at antenna : 97.000 Watts
Antenna gain : -18.000 dBi
Distance from antenna : 20.7264 meters (68.000 feet)
Estimated power density : 0.00028 mW/cm²
Ground reflections : Yes

Maximum Permissible Exposure (MPE)

Controlled environment : 1.005 mW/cm²
Uncontrolled environment : 0.205 mW/cm²

Distance to compliance from center of antenna

Controlled environment : 0.192 meters (0.631 feet)
Controlled environment : 0.411 meters (1.350 feet)

Is the controlled environment area compliant : Yes
Is the uncontrolled environment area compliant : Yes

Antenna E

Frequency of operation : 451.075 MHz
Average power at antenna : 45.000 Watts
 Antenna gain : -16.000 dBi
 Distance from antenna : 17.6784 meters (58.000 feet)
Estimated power density : 0.00029 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 1.508 mW/cm²
 Uncontrolled environment : 0.306 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.139 meters (0.456 feet)
 Uncontrolled environment : 0.292 meters (0.958 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna F

Frequency of operation : 451.150 MHz
Average power at antenna : 42.000 Watts
 Antenna gain : -16.000 dBi
 Distance from antenna : 29.261 meters (96.000 feet)
Estimated power density : 0.00010 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 1.508 mW/cm²
 Uncontrolled environment : 0.306 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.135 meters (0.442 feet)
 Uncontrolled environment : 0.283 meters (0.927 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna G

Frequency of operation : 451.150 MHz
Average power at antenna : 42.000 Watts
 Antenna gain : -16.000 dBi
 Distance from antenna : 28.3464 meters (93.000 feet)
Estimated power density : 0.00010 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 1.508 mW/cm²
 Uncontrolled environment : 0.306 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.146 meters (0.479 feet)
 Uncontrolled environment : 0.307 meters (1.009 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna H

Frequency of operation : 47.9400 MHz
Average power at antenna : 97.000 Watts
 Antenna gain : -18.000 dBi
 Distance from antenna : 25.2984 meters (83.000 feet)
Estimated power density : 0.00019 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 1.005 mW/cm²
 Uncontrolled environment : 0.205 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.192 meters (0.631 feet)
 Uncontrolled environment : 0.411 meters (1.350 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna I

Frequency of operation : 451.200 MHz
Average power at antenna : 20.000 Watts
 Antenna gain : -16.000 dBi
 Distance from antenna : 22.250 meters (73.000 feet)
Estimated power density : 0.00008 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 1.525 mW/cm²
 Uncontrolled environment : 0.309 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.097 meters (0.319 feet)
 Uncontrolled environment : 0.198 meters (0.651 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna J

Frequency of operation : 952.6938 MHz
Average power at antenna : 3.800 Watts
 Antenna gain : 1.800 dBi
 Distance from antenna : 18.1051 meters (59.400 feet)
Estimated power density : 0.00140 mW/cm²
 Ground reflections : Yes

Maximum Permissible Exposure (MPE)

 Controlled environment : 3.178 mW/cm²
 Uncontrolled environment : 0.640 mW/cm²

Distance to compliance from center of antenna

 Controlled environment : 0.207 meters (0.680 feet)
 Uncontrolled environment : 0.445 meters (1.460 feet)

 Is the controlled environment area compliant : Yes
 Is the uncontrolled environment area compliant : Yes

Antenna	Frequency in MHz	Power Watts	Pattern adjustment	Distance ft	eirp mW	Volume cm ²	Power Density mW/cm ²
A	37.6000	100	-22.18	91	605.341	9667686.84	0.00006
B	451.0750	42	-16	81	1054.992	7659665.9	0.00014
C	814.0625	30	-46	78	0.754	7102790.33	0.00000
D	47.8200	97	-18	68	1537.346	5398307.44	0.00028
E	451.0750	45	-16	58	1130.349	3927315.36	0.00029
F	451.1500	42	-16	96	1054.992	10759256.4	0.00010
G	451.1500	42	-16	93	1054.992	10097309.9	0.00010
H	47.9400	97	-18	83	1537.346	8042590.83	0.00019
I	451.2000	20	-16	73	502.377	6221362.54	0.00008
J	952.6938	3.8	1.8	59.4	5751.533	4119198.11	0.00140

RMS Sum 0.00148