

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

June 21, 2017

Melanie A. Bachman, Esq.
Executive Director/Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **PE1133-VER-20150818 – Cellco Partnership d/b/a Verizon Wireless
330 Bishop Street, Waterbury, Connecticut**

Dear Ms. Bachman:

On October 2, 2015, the Siting Council approved Cellco's Eligible Facilities Request for modifications to the existing telecommunications facility at 330 Bishop Street in Waterbury, Connecticut.

As a condition of its approval, Cellco was required to provide the Council with post-construction measurements of the cumulative radio frequency emissions at the site to demonstrate compliance with the FCC standards. Attached is a Radio Frequency Exposure Report verifying the facility's compliance.

Also, construction activity associated with the modifications approved in PE1133-VER-20150818 have now been completed.

If you have any questions please do not hesitate to contact me.

Sincerely,



Kenneth C. Baldwin

Attachment

Copy to:

Elizabeth Jamieson

16674779-v1



C Squared Systems, LLC
65 Dartmouth Drive
Auburn, NH 03032
Phone: (603) 644-2800
support@csquaredsystems.com



RADIO FREQUENCY EXPOSURE REPORT

WATERBURY FULTON

**330 BISHOP STREET
WATERBURY, CT 06704**

June 13, 2017

Table of Contents

1. Introduction	1
2. FCC Guidelines for Evaluating RF Radiation Exposure Limits	2
3. Measurement Procedure	3
4. Antenna Inventory	4
5. Survey Results.....	10
6. Summary of Findings	12
7. Statement of Certification	12
Attachment A: References	13
Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)	14

List of Tables

Table 1: Site Specific Data	1
Table 2: Instrumentation Information.....	3
Table 3: Verizon Wireless & Collocator Antenna Configurations	4
Table 4: Measurement Results.....	10
Table 5: FCC Limits for Maximum Permissible Exposure	14

List of Figures

Figure 1: Ground View of Waterbury Fulton	1
Figure 2: Verizon Alpha Sector	5
Figure 3: Verizon Beta Sector	5
Figure 4: AT&T Alpha Sector	6
Figure 5: AT&T Beta Sector	6
Figure 6: AT&T Gamma Sector	7
Figure 7: Clearwire/Nextel Alpha Sector	7
Figure 8: Clearwire/Nextel Beta Sector.....	8
Figure 9: Clearwire/Nextel Gamma Sector & Microwave	8
Figure 10: T-Mobile Alpha/Beta/Gamma Sectors.....	9
Figure 11: Aerial View of Site & Measurement Locations	11
Figure 12: Graph of FCC Limits for Maximum Permissible Exposure (MPE).....	15

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the recent installation of Verizon Wireless antenna arrays on the rooftop of the building located at 330 Bishop Street in Waterbury, CT. AT&T, Clearwire, Nextel and T-Mobile are also collocated at this site. Figure 1 below is a view of the subject site.



Figure 1: Ground View of Waterbury Fulton

Site Address	330 Bishop Street, Waterbury, CT
Latitude	41° 33' 59.63" N
Longitude	73° 02' 17.99" W
Site Elevation AMSL	486'
751MHz License Information	WQIQ689
1900MHz License Information	KNLH262/WQEM953
2100MHz License Information	WQGA906/WQGB280
Name of Individual Conducting Survey	Marc Salas
Date and Time of Survey	6/7/2017; 1:45PM – 2:30PM

Table 1: Site Specific Data

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment provided they are fully aware of the potential for exposure, and are able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels considered acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population / uncontrolled exposure and for occupational / controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

3. Measurement Procedure

Frequencies from 300 KHz to 50 GHz were measured using the Narda Probe EA 5091, E-Field, shaped, FCC probe in conjunction with the NBM550 survey meter. The EA 5091 probe is “shaped” such that in a mixed signal environment (i.e.: more than one frequency band is used in a particular location), it accurately measures the percent of MPE.

From FCC OET Bulletin No. 65 - Edition 97-01 – “A useful characteristic of broadband probes used in multiple-frequency RF environments is a frequency-dependent response that corresponds to the variation in MPE limits with frequency. Broadband probes having such a “shaped” response permit direct assessment of compliance at sites where RF fields result from antennas transmitting over a wide range of frequencies. Such probes can express the composite RF field as a percentage of the applicable MPEs”.

Probe Description - As suggested in FCC OET Bulletin No. 65 - Edition 97-01, the response of the measurement instrument should be essentially isotropic, (i.e., independent of orientation or rotation angle of the probe). For this reason, the Narda EA 5091 probe was used for these measurements.

Sampling Description - At each measurement location, a spatially averaged measurement is collected over the height of an average human body. The NBM550 survey meter performs a time average measurement while the user slowly moves the probe over a distance range of 20 cm to 200 cm (about 6 feet) above ground level. The results recorded at each measurement location include average values over the spatial distance.

Instrumentation Information - A summary of specifications for the equipment used is provided in the table below.

Manufacturer	Narda Microwave			
Probe	EA 5091, Serial# 01162			
Calibration Date	December 2016			
Calibration Interval	24 Months			
Meter	NBM550, Serial# F-0147			
Calibration Date	December 2016			
Calibration Interval	24 Months			
Probe Specifications	Frequency Range	Field Measured	Standard	Measurement Range
	300 KHz-50 GHz	Electric Field	U.S. FCC 1997 Occupational/Controlled	0.2 – 600 % of Standard

Table 2: Instrumentation Information

Instrument Measurement Uncertainty - The total measurement uncertainty of the NARDA measurement probe and meter is no greater than ± 3 dB (0.5% to 6%), ± 1 dB (6% to 100%), ± 2 dB (100% to 600%). The factors which contribute to this include the probe’s frequency response deviation, calibration uncertainty, ellipse ratio, and isotropic response¹. Every effort is taken to reduce the overall uncertainty during measurement collection including pointing the probe directly at the likely highest source of emissions.

¹ For further details, please refer to Narda Safety Test Solutions NBM550 Probe Specifications, pg. 69

http://www.narda-sts.us/pdf_files/DataSheets/NBM-Probes_DataSheet.pdf

4. Antenna Inventory

The table below lists the current Verizon Wireless antenna configuration for the site, along with the antenna configurations of all active collocators. Please note that all Nextel iDEN antennas are inactive and are not included in the inventory below.

Operator	Sector/ Azimuth	TX Freq. (MHz)	BTS Output (Watts)	Coax Loss (dB)	Ant Gain (dBi)	Power EIRP (Watts)	Antenna Model	Beam Width	Mech. Tilt	Length (ft)
Verizon	Alpha/ 30	875	Inactive				LNX-6514DS-A1M_2	64	0	6.1
		1900	Inactive				HBXX-6517DS-A2M_0	66	0	6.3
		751	120	0.2	15.8	4357	LNX-6514DS-A1M_2	65	0	6.1
		2100	120	0.2	19.2	9532	HBXX-6517DS-A2M_0	65	0	6.3
	Beta/ 290	875	Inactive				LNX-6514DS-A1M_2	64	0	6.1
		1900	Inactive				HBXX-6517DS-A2M_0	66	0	6.3
		751	120	0.2	15.8	4357	LNX-6514DS-A1M_2	65	0	6.1
		2100	120	0.2	19.2	9532	HBXX-6517DS-A2M_0	65	0	6.3
Clearwire	Alpha/ 340	2500	48	0.0	17.8	2892	LLPX310R-V1	63	0	3.5
	Beta/ 150	2500	48	0.0	17.8	2892	LLPX310R-V1	63	0	3.5
	Gamma/ 250	2500	48	0.0	17.8	2892	LLPX310R-V1	63	0	3.5
	MW/ 154	22175	0.004	0.0	35.3	12	VHLP1-23	3	0	1.0
		22275	0.004	0.0	35.3	12		3		
T-Mobile	Alpha/ 0	731	60	0.0	14.2	1578	RV4PX306R	68	0	6.3
		1900	45	0.0	15.2	1490		63		
		2100	120	0.0	15.2	3974		63		
	Beta/ 120	731	60	0.0	14.2	1578	RV4PX306R	68	0	6.3
		1900	45	0.0	15.2	1490		63		
		2100	120	0.0	15.2	3974		63		
	Gamma/ 240	731	60	0.0	14.2	1578	RV4PX306R	68	0	6.3
		1900	45	0.0	15.2	1490		63		
		2100	120	0.0	15.2	3974		63		
AT&T	Alpha/ 30	885	80	0.0	13.5	1791	7770.00	85	0	4.5
		1900	40	0.0	16.0	1592		85		
		739	80	0.0	14.1	2056	HPA-65R-BUU-H6	66	0	6.0
		1900	120	0.0	16.9	5877		61		
	Beta/ 150	885	80	0.0	13.5	1791	7770.00	85	0	4.5
		1900	40	0.0	16.0	1592		85		
		739	80	0.0	15.3	2711	HPA-65R-BUU-H8	65	0	7.7
	1900	120	0.0	17.1	6154	62				
	Gamma/ 270	885	80	0.0	13.5	1791	7770.00	85	0	4.5
		1900	40	0.0	16.0	1592		85		
739		80	0.0	14.1	2056	HPA-65R-BUU-H6	66	0	6.0	
1900		120	0.0	16.9	5877		61			

Table 3: Verizon Wireless & Collocator Antenna Configurations



Figure 2: Verizon Alpha Sector



Figure 3: Verizon Beta Sector



Figure 4: AT&T Alpha Sector



Figure 5: AT&T Beta Sector



Figure 6: AT&T Gamma Sector



Figure 7: Clearwire/Nextel Alpha Sector

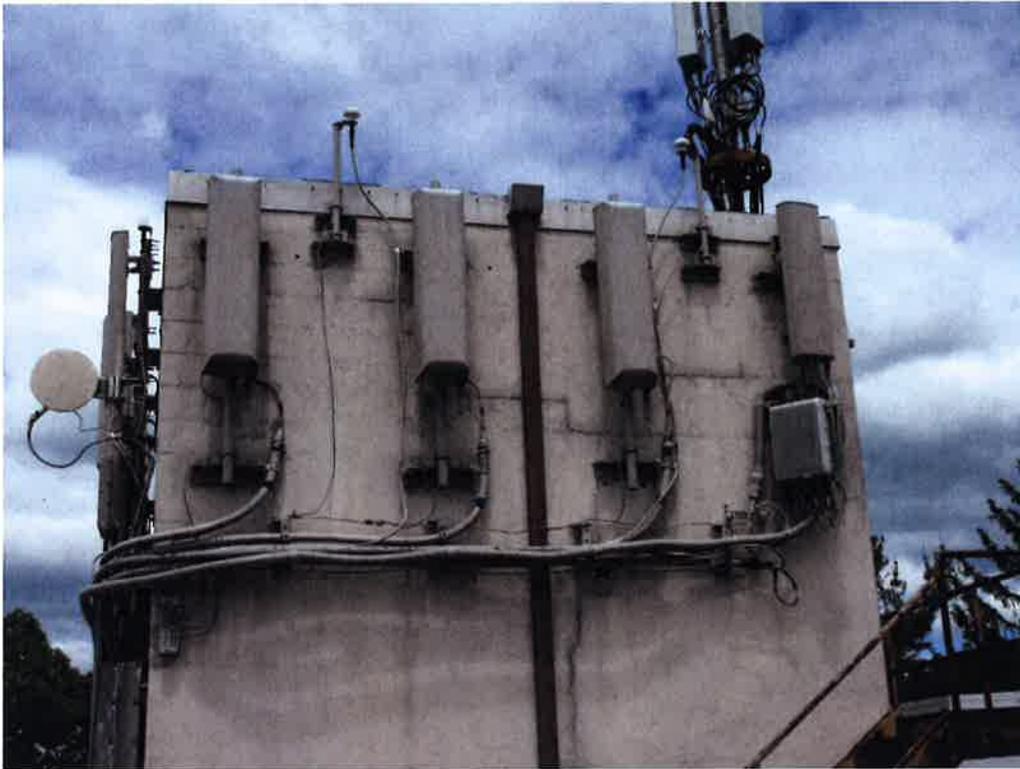


Figure 8: Clearwire/Nextel Beta Sector



Figure 9: Clearwire/Nextel Gamma Sector & Microwave

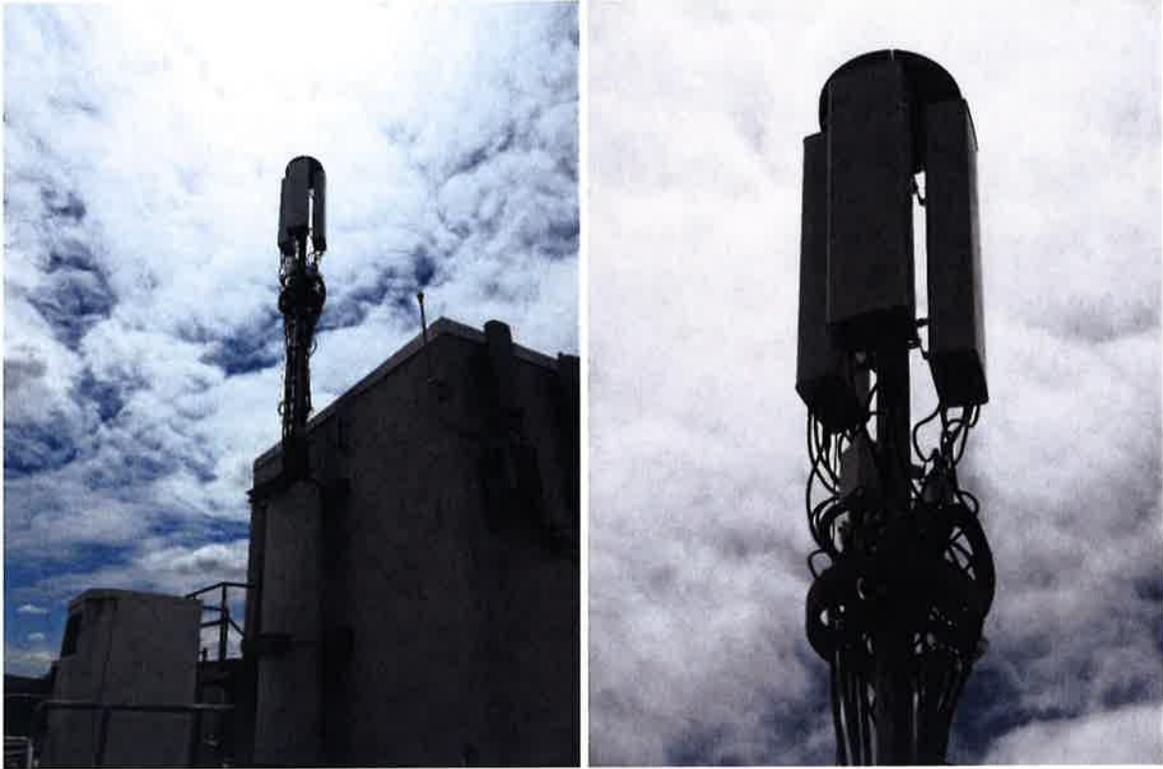


Figure 10: T-Mobile Alpha/Beta/Gamma Sectors

5. Survey Results

Measured results and a description of each survey location are detailed in the table below. Measurements were recorded on June 7, 2017, between 1:45 PM and 2:30 PM. All %MPE values are in reference to the FCC Uncontrolled/General Population exposure limit.

Table 4 below lists 19 measurements recorded in the vicinity of the 330 Bishop Street facility. The highest spatially averaged measurement was **1.81%** (Uncontrolled/General Population MPE) and was recorded at Location 2, at the corner of Pine Street & Cooke Street, approximately 622 feet southwest of the site. Please note that broadband measurement equipment was used for this survey, which records cumulative % MPE values from all transmitting bands of the Verizon, AT&T, Clearwire and T-Mobile antenna installations, along with any other RF sources in the vicinity of each measurement point.

Meas. Location	Location Description	Latitude	Longitude	Dist. From Site (feet)	Measured % MPE (Uncontrolled / General Pop.)
1	Pine St. & Bishop St.	41.56683	-73.03855	128	1.71%
2	Pine St. & Cooke St.	41.56576	-73.04030	622	1.81%
3	Pine St. & Templeton St.	41.56529	-73.04192	1096	< 1.00%
4	Hopkins St. & Pearl St.	41.56359	-73.03846	1078	1.20%
5	Hopkins St. & Bishop St.	41.56411	-73.03725	932	< 1.00%
6	259 Bishop St.	41.56541	-73.03797	421	< 1.00%
7	Pine St. & Byrneside Ave.	41.56755	-73.03810	372	< 1.00%
8	North end of Pine Street	41.56883	-73.03816	835	< 1.00%
9	Pine St. & Doran St.	41.56913	-73.03634	1084	< 1.00%
10	Byrneside Ave. & Woodstock St.	41.56894	-73.03523	1210	< 1.00%
11	Pilgrim Ave.	41.56783	-73.03446	1146	< 1.00%
12	Pilgrim Ave. & N. Barnes St.	41.56758	-73.03584	769	< 1.00%
13	NW Corner of Pilgrim Ave.	41.56706	-73.03745	296	< 1.00%
14	Pilgrim Ave. & Fleet St.	41.56562	-73.03661	566	< 1.00%
15	Fleet St. & N. Barnes St.	41.565982	-73.035082	898	< 1.00%
16	Fleet St. & Hill St.	41.566076	-73.033639	1280	< 1.00%
17	Crown St. & Barnes St.	41.564405	-73.034882	1213	< 1.00%
18	Sterling St. & Cooke St.	41.567665	-73.040765	794	< 1.00%
19	Farmington Ave. & Cooke St.	41.569188	-73.040994	1219	< 1.00%

Table 4: Measurement Results²

² Due to measurement uncertainty at low levels, any readings < 1.00% FCC Uncontrolled/General Pop. MPE are listed as such. See Table 2 for the measurement range of the probe.

The figure below shows an aerial view of the subject site location and the surrounding area. Labeled points indicate the locations of the measurements recorded on June 7, 2017, as listed above in Table 4.

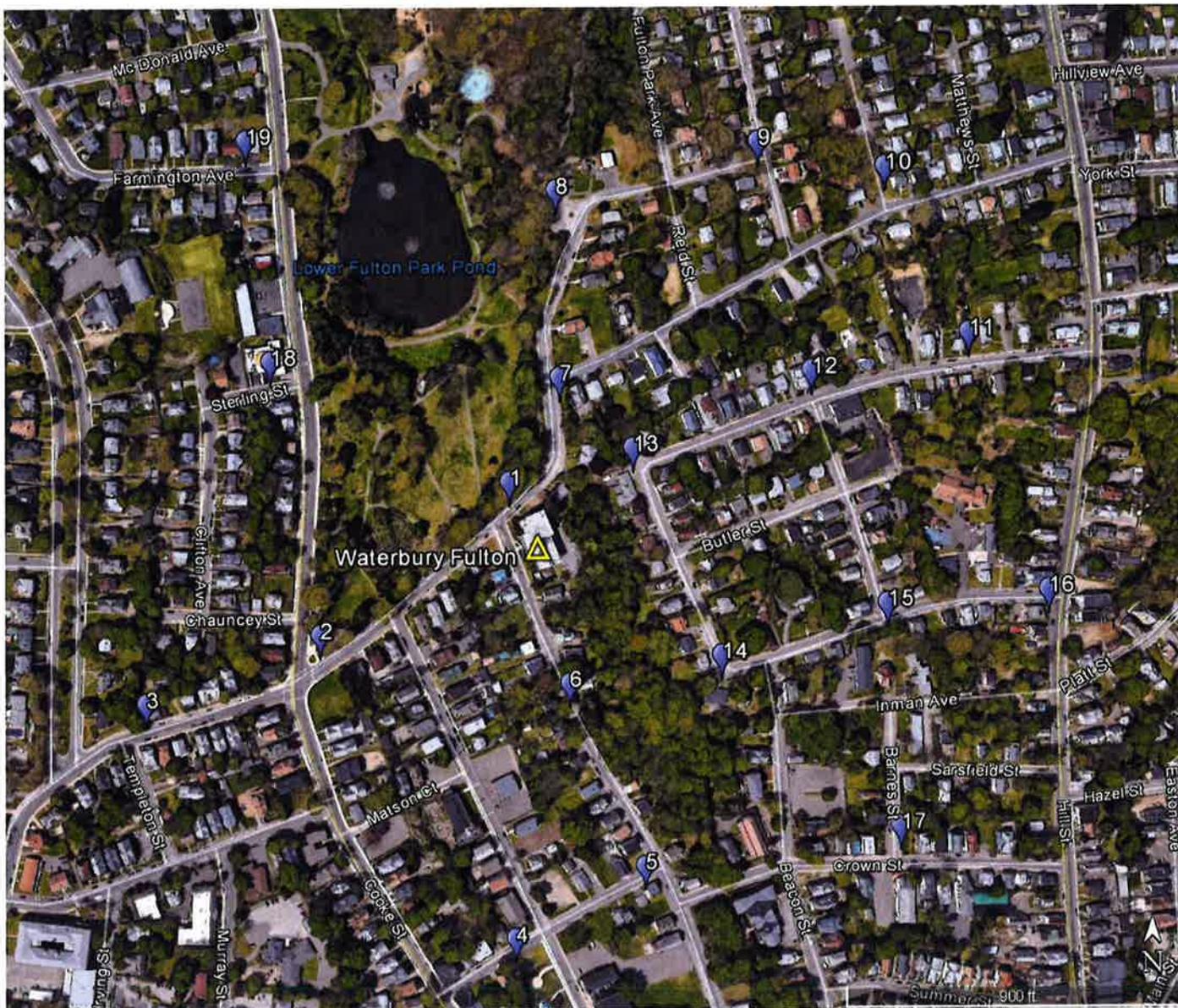


Figure 11: Aerial View of Site & Measurement Locations

6. Summary of Findings

A number of publicly accessible areas in the vicinity of the 330 Bishop Street facility were surveyed and found to be well within the mandated General Population/Uncontrolled limits for Maximum Permissible Exposure, as delineated in the Federal Communications Commission's Radio Frequency exposure rules published in 47 CFR 1.1307(b)(1)-(b)(3).

The highest spatially averaged %MPE measurement of all surveyed points based on the 1997 FCC standard for exposure to the general population was 1.81% MPE. This measurement was recorded at Location 2, approximately 622 feet southwest of the site, at the intersection of Pine Street & Cooke Street.

The above analysis verifies that exposure levels at ground level surrounding the existing site are well below the Maximum Permissible Exposure levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01.

7. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The field measurements were obtained with properly calibrated equipment using techniques and guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEEE Std. C95.1, and FCC OET Bulletin 65 Edition 97-01.

Report Prepared By: Marc Salas June 13, 2017
Date
Marc Salas
RF Engineer
C Squared Systems, LLC

Reviewed/Approved By: Evan Thibodeau June 20, 2017
Date
Evan Thibodeau
RF Engineer
C Squared Systems, LLC

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

IEEE Std C95.1-2005, IEEE Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz IEEE-SA Standards Board

IEEE Std C95.3-2002 (R2008), IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz-300 GHz IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure³

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure⁴

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

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

Table 5: FCC Limits for Maximum Permissible Exposure

³ Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

⁴ General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

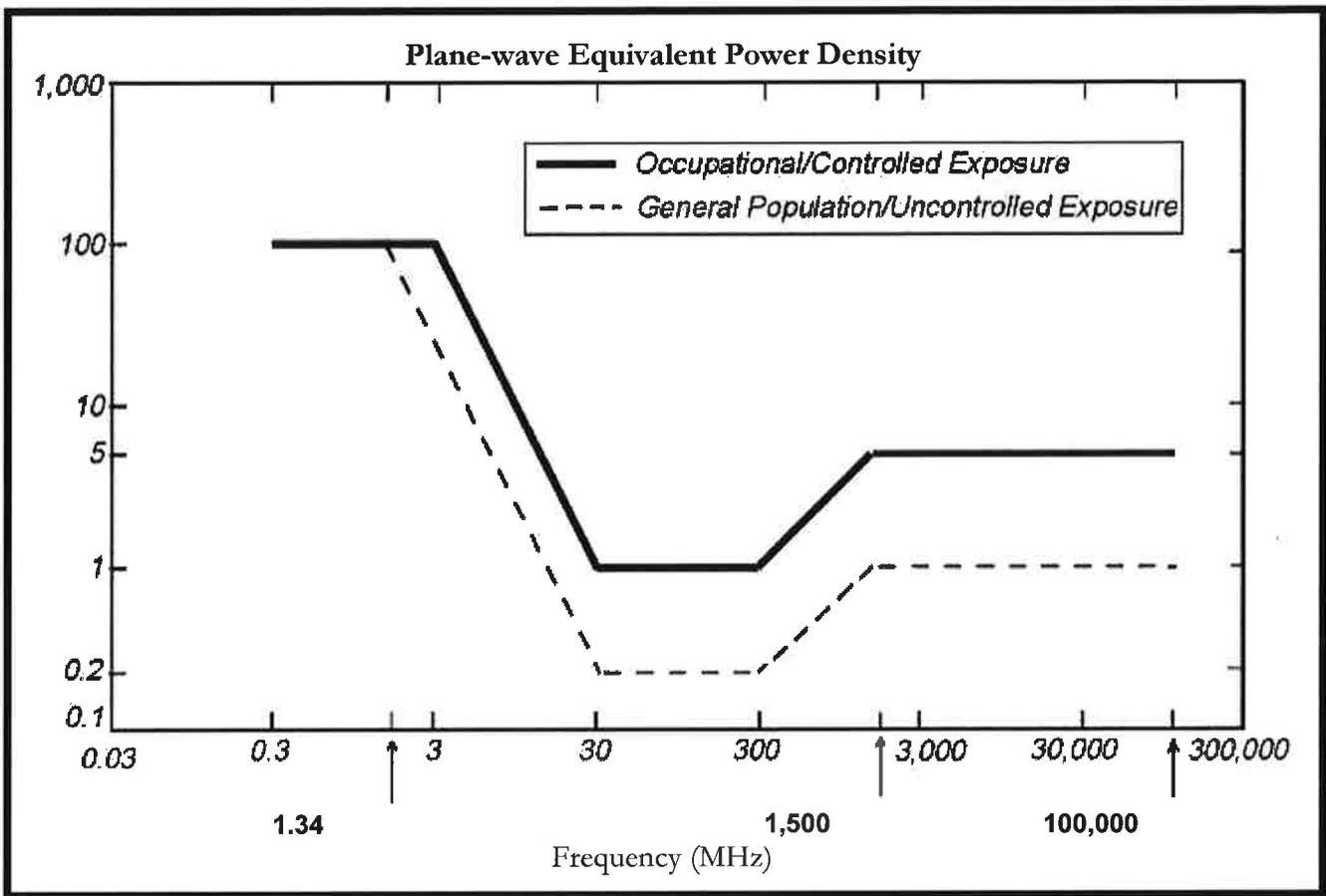


Figure 12: Graph of FCC Limits for Maximum Permissible Exposure (MPE)