

DONALD L. HAES, JR., PH.D., CHP

Radiation Safety Specialist

MA Radiation Control Program Health Physics Services Provider Registration #65-0017
PO Box 198, Hampstead, NH 03841 617-680-6262 Email: donald_haes_chp@comast.net

February 28, 2019

RE: Comparisons of *MEASURED* RF fields versus *PREDICTED* RF fields for six (6) different Verizon Wireless Small Cell Personal Wireless Services facilities located on utility poles in Dartmouth, MA.

PURPOSE

I have reviewed the information pertinent to several Verizon Wireless small cell (SC) personal wireless services (PWS) facilities in Dartmouth, MA. RF field measurements were obtained at six (6) different SC sites located on utility poles in Dartmouth, MA. Specifically, “SC01” near Faunce Corner, “SC04” near 154 Faunce Corner Rd, “SC05” near 653 State Rd, “SC08” near 533 State Rd, “SC10” near 789 State Rd, and “SC11” near 900 State Rd (See Figure 1). The physical conditions are that Verizon Wireless has installed PWS omni-directional canister type antennas on utility poles, which includes a single canister antenna and remote radio head (RRH) sets (See Figures 2A-2E). This report provides written comparisons between measured RF fields and predicted RF fields for six (6) different SC sites located on utility poles in Dartmouth, MA.

This report presents measured and calculated values of RF fields as a percent of current Maximum Permissible Exposures (%MPE) as adopted by the Federal Communications Commission (FCC),^{i,ii} and those established by the Massachusetts Department of Public Health (MDPH) for members of the public.ⁱⁱⁱ

SUMMARY

Previous theoretical RF field calculations data indicated the summation of the installed Verizon Wireless RF contributions would be well within the established RF exposure guidelines at the SC sites. The results of confirmatory measurements indicated there is good agreement between predicted RF fields and the actual RF fields measured. The measured values further confirm the validity of the theoretical predictions used to confirm the compliance with Federal and State guidelines for RF exposure. Theoretical predictions for RF fields below the antenna of a SC site are extremely low in value (< 0.1% MPE) and are often times are masked by ambient signals from additional local hand-held devices and distant sites. Since the measured values in this report include signals from all sources, the readings may be slightly higher than predicted. This does not occur at distances beyond the base of the SC site.

This report provides written proof that the installed facilities comply with the MDPH and FCC RF exposure guidelines.

Note: The analyses, conclusions and professional opinions are based upon the precise parameters and conditions of these particular sites; **Six (6) utility poles in Dartmouth, MA.** Utilization of these analyses, conclusions and professional opinions for any personal wireless services installation, existing or proposed, other than the aforementioned has not been sanctioned by the author, and therefore should not be accepted as evidence of regulatory compliance.

MEASUREMENT PROTOCOL

RF ambient field measurements were obtained on February 27, 2019, using accepted scientific procedures.^{iv, v} The following environmental conditions were noted: Mostly sunny skies; Temperature 25°F - 26°F; Humidity 25%; Dew Point - 5°F; Wind gusts up to 2 mph; Barometric pressure 30" Hg.

The measuring equipment included the following:

Narda model SRM-3006 Electromagnetic Radiation Meter/Spectrum Analyzer with model 3AX 75M-3G Broadband Isotropic (27 – 3000 MHz) probe. The equipment was last calibrated 9/27/2018 by the manufacturer. The SRM-3006 was used for an RF field evaluation and exposure assessment. The unit was set to provide a read-out in %MPE **for members of the general public** within the frequency band of 27 MHz to 3,000 MHz.

The RF field measurements were obtained during normal use of the existing transmitters at six different SC sites (See Figure 1). The measurements were obtained at several locations in the general vicinity including under the antenna (referred to as the “base”), and at distances of 25’, 100’, and 350’ away from the poles. At each location, measurements were obtained by continuously scanning an area at a height of **six feet** above ground level to make comparisons with theoretically predicted values. Both the average and the highest readings during the survey were recorded. The summary of the results is presented in graphical forms as shown in Figures 4A through 4F for the six measured SC sites. Detailed information is available in the form of a 248-page report including Date/Time and Location (latitude and longitude), Spectrum Analysis Results, Instrument Information & Configuration, Spectrum Analysis Peak Table (top 10 peaks), and Spectrum Analysis Graph.

RESULTS - RF FIELD EVALUATION

The SRM-3006 was used for an RF field evaluation and RF exposure assessment. The SRM-3006 was set to provide a read-out in %MPE for members of the general public within the frequency band of 27 to 3,000 MHz. The “Safety Analysis” mode was used to examine the total RF field presented by **VERIZON WIRELESS ONLY** with a visual representation of the spectrum. Each “peak” was evaluated by frequency and amplitude (intensity). The frequency bands used to monitor the Verizon Wireless SC signals are shown in Table 1, based on FCC license information. The summation of all readings 27 MHz – 3000 MHz for **VERIZON WIRELESS** is the total RF field. The measurements were recorded as an AVERAGE about each second (894 ms or 0.894 seconds), and the MAXIMUM observed reading. The built-in “MAX hold” feature was used during the continuous scan. The **highest observed** readings at each location were recorded in units of %MPE for members of the public 27 to 3000 MHz.

RF FREQUENCY INFORMATION

Table 1: Frequency Bands Used to Monitor the Verizon Wireless SC Signals Based on FCC License Information		
Service	Fmin	Fmax
Cellco Partnership d/b/a Verizon Wireless LTE	746.000 000 MHz	757.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless LTE	776.000 000 MHz	787.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless CDMA	846.500 000 MHz	848.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless CDMA	872.000 000 MHz	894.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless AWS	1 710.000 000 MHz	1 755.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless PCS	1 865.000 000 MHz	1 870.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless PCS	1 885.000 000 MHz	1 910.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless PCS	1 965.000 000 MHz	1 975.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless AWS	2 110.000 000 MHz	2 130.000 000 MHz
Cellco Partnership d/b/a Verizon Wireless AWS	2 145.000 000 MHz	2 155.000 000 MHz
Table Notes: AWS: Advanced Wireless Systems CDMA: Code Division Multiple Access (“cellular voice”) LTE : Long Term Evolution (aka “4G”) PCS: Personal Communication System		

SC SITE LOCATIONS

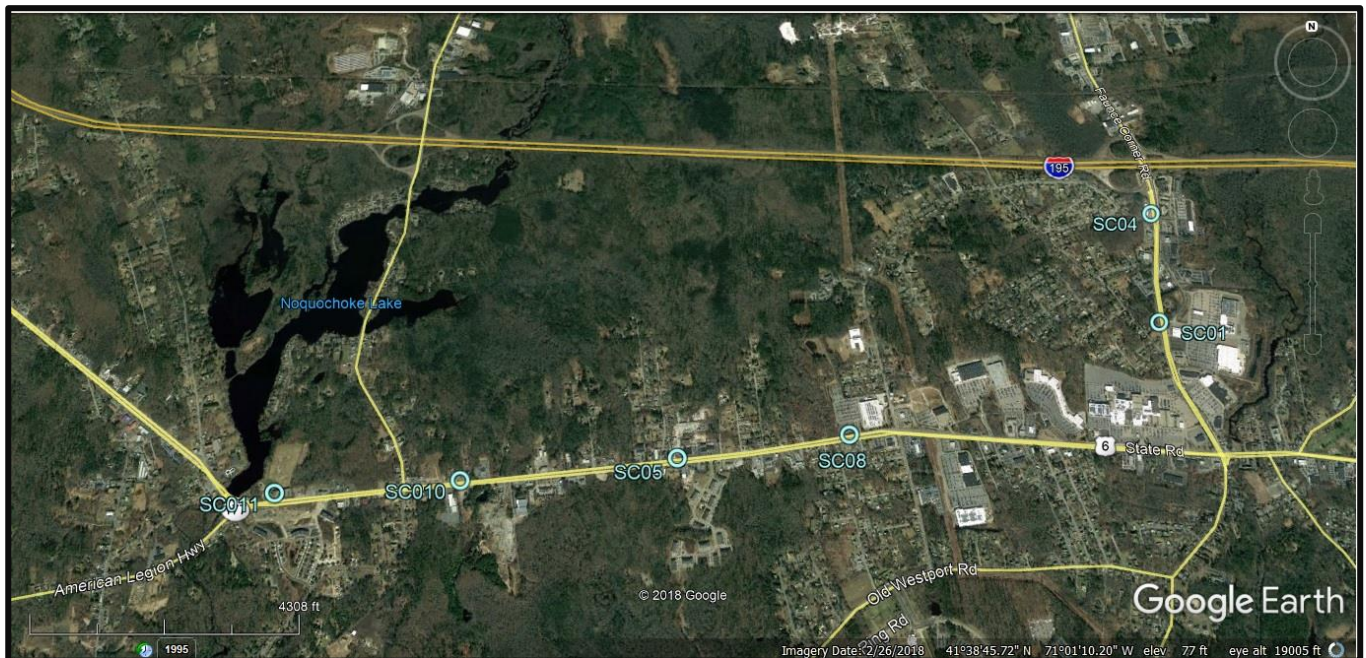
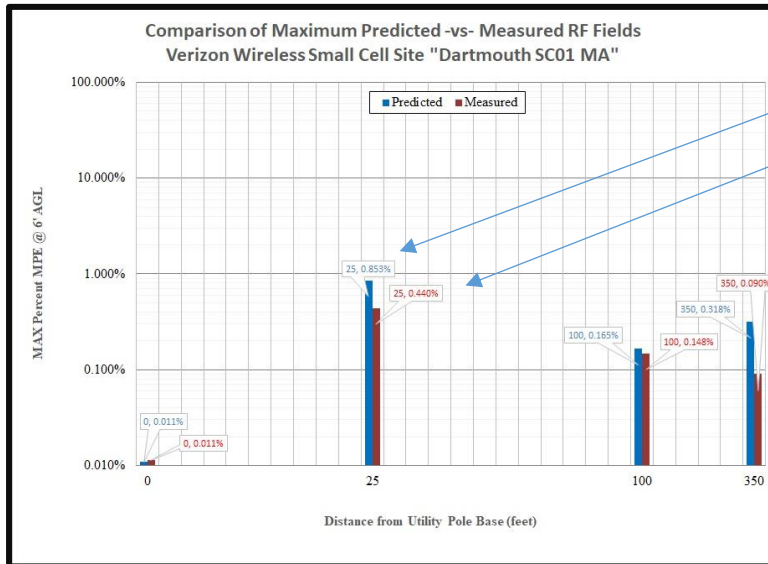


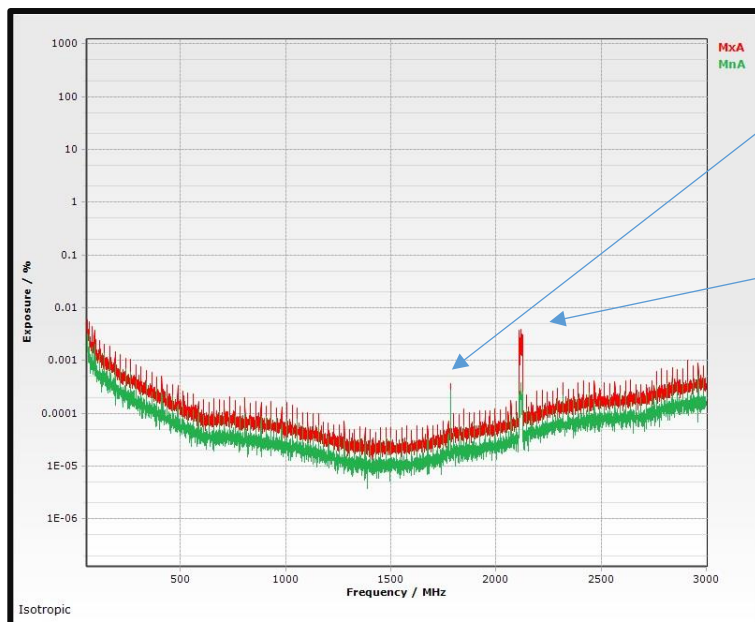
Figure 1: Verizon Wireless Small Cell sites: “SC01” near Faunce Corner, “SC04” near 154 Faunce Corner Rd, “SC05” near 653 State Rd, “SC08” near 533 State Rd, “SC10” near 789 State Rd, and “SC11” near 900 State Rd.

DATA RESULT EXPLANATION



Data labels shows values of distance from base, then value of RF field as a percent of the Maximum Permissible Exposure for members of the public.

Figures 3A-3F: Comparison of Predicted versus Measured RF Fields at Six (6) Small Cell sites.



Graph shows relative percent of the Maximum Permissible Exposure for members of the public for each frequency.

NOTE: Signal "peaks" around 1900 MHz and 2150 MHz, substantiating values used in the calculated predictions.

Figures 4A-4F: Spectrum obtained from Six (6) Small Cell sites.

RESULTS



Figure 2A: Verizon Wireless Small Cell site “SC01” near Faunce Corner.

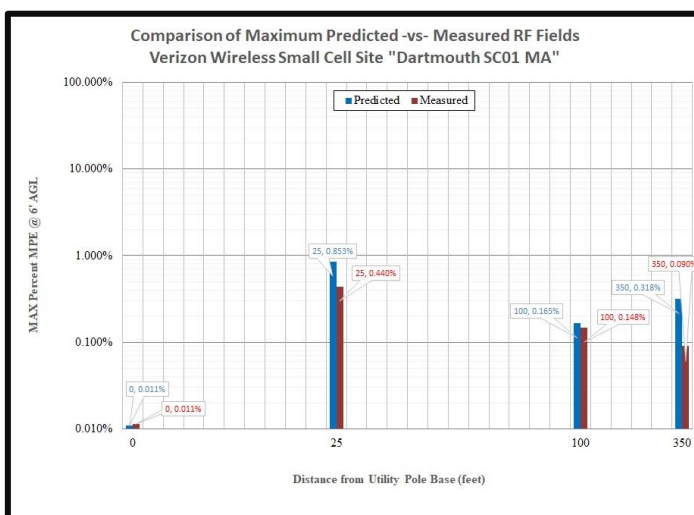


Figure 3A: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC01”.

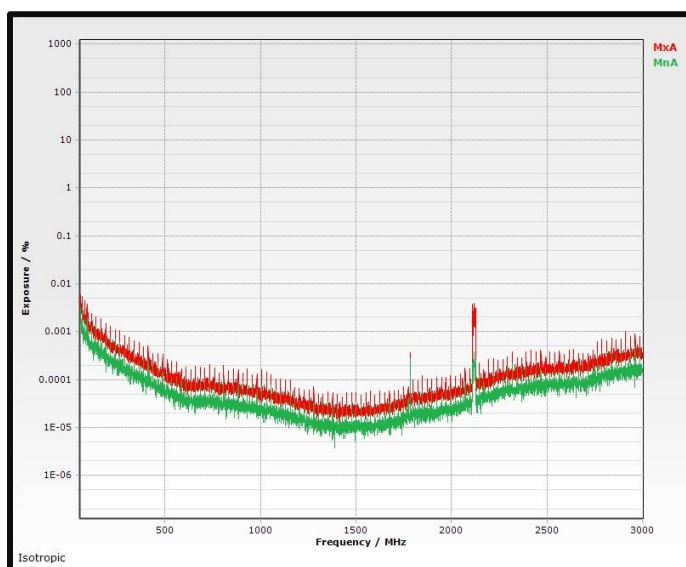


Figure 4A: Spectrum Obtained from Small Cell site “Dartmouth MA SC01”.

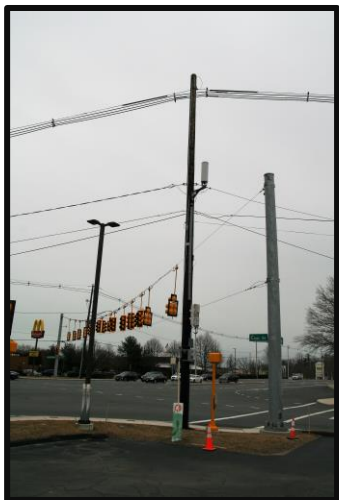


Figure 3B: Verizon Wireless Small Cell site “SC04” near Faunce Corner Rd.

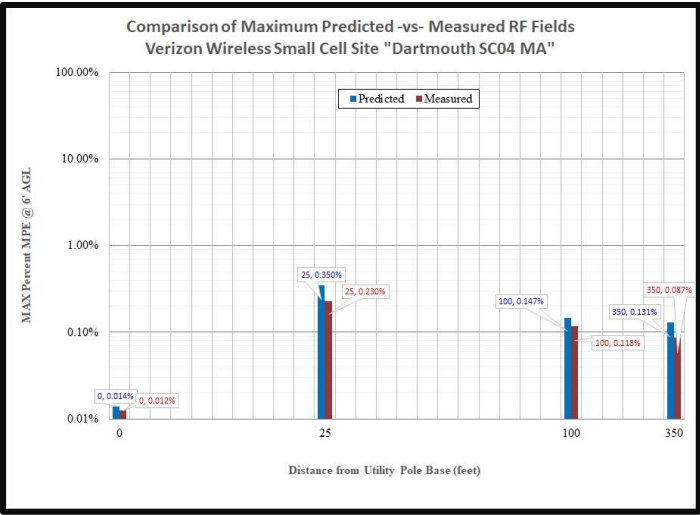


Figure 3B: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC04”.

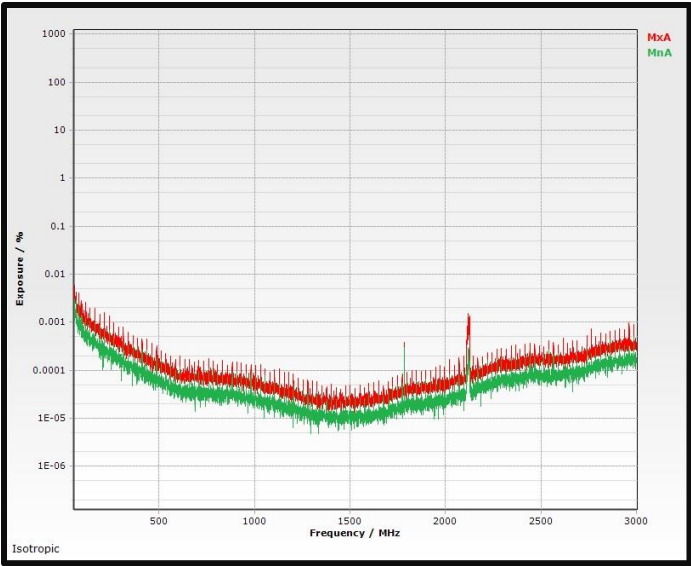


Figure 4B: Spectrum Obtained from Small Cell site “Dartmouth MA SC04”.



Figure 4C: Verizon Wireless Small Cell site “SC05” near 653 State Rd.

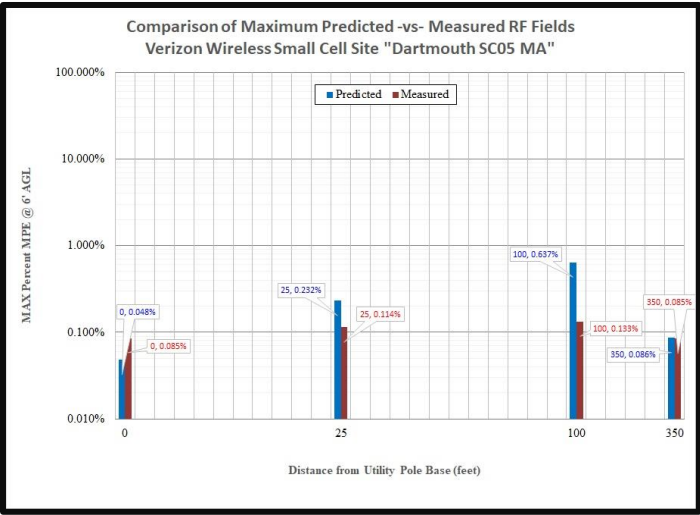


Figure 3C: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC05”.

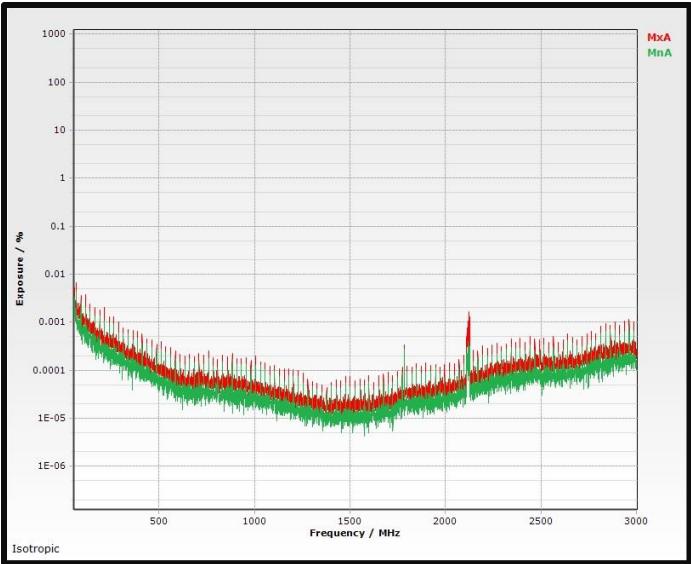


Figure 4C: Spectrum Obtained from Small Cell site “Dartmouth MA SC05”.



Figure 5D: Verizon Wireless Small Cell site “SC08” near 533 State Rd.

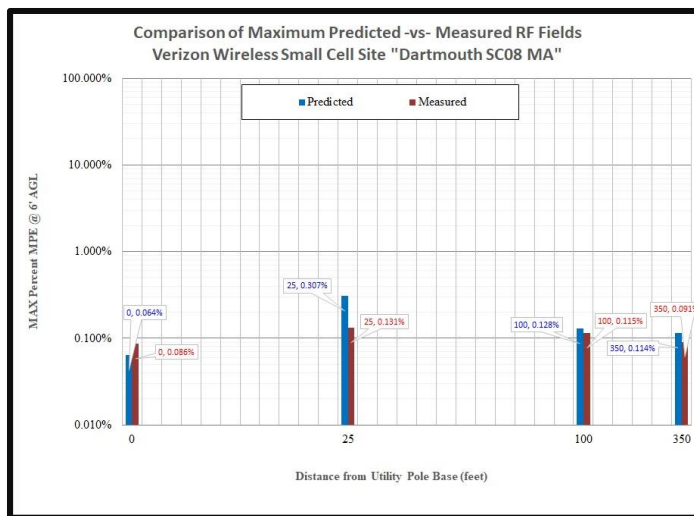


Figure 3D: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC08”.

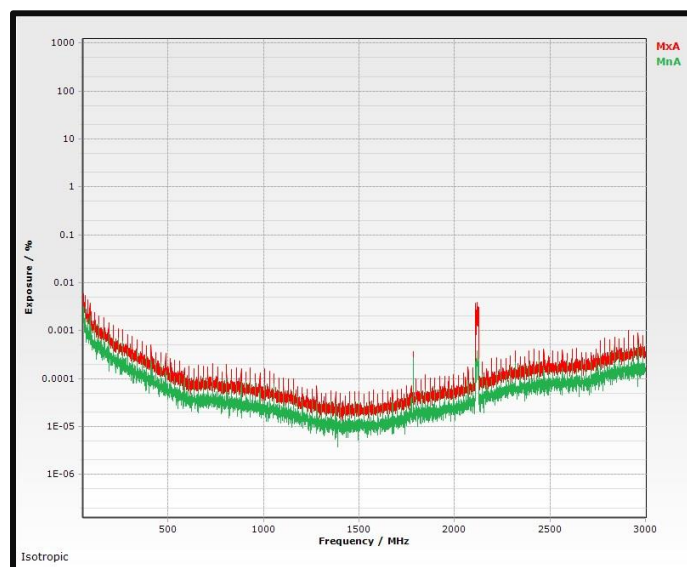


Figure 4D: Spectrum Obtained from Small Cell site “Dartmouth MA SC08”.



Figure 6E: Verizon Wireless Small Cell site “SC10” near 789 State Rd.

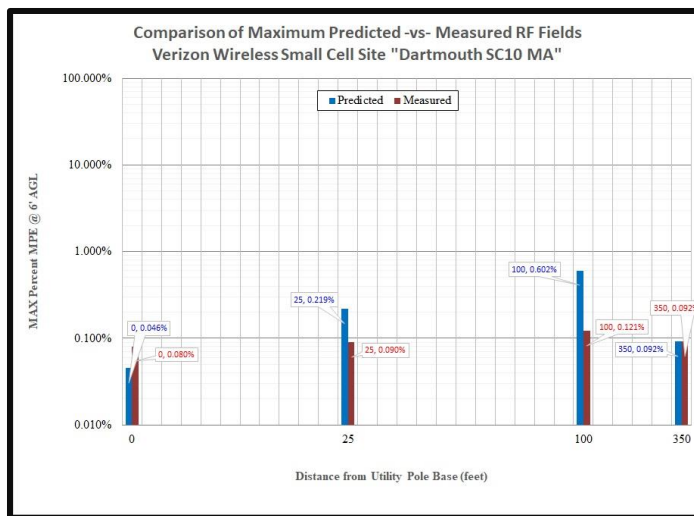


Figure 3E: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC10”.

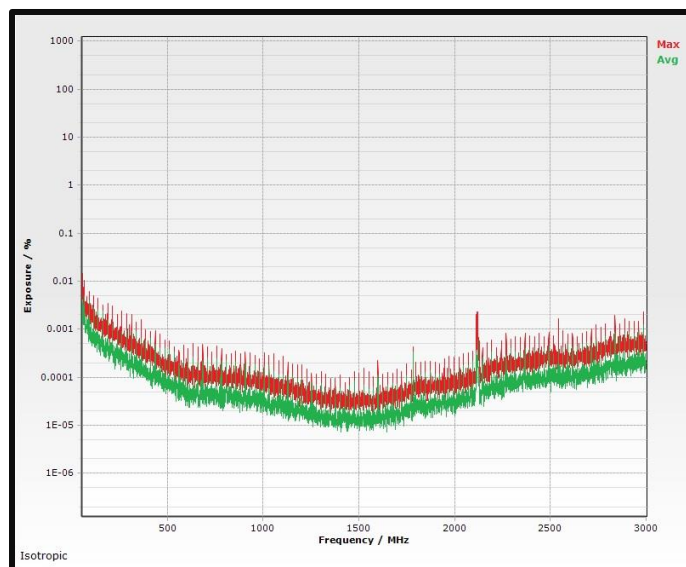


Figure 4E: Spectrum Obtained from Small Cell site “Dartmouth MA SC10”.



Figure 7F: Verizon Wireless Small Cell site SC11 near 900 State Rd.

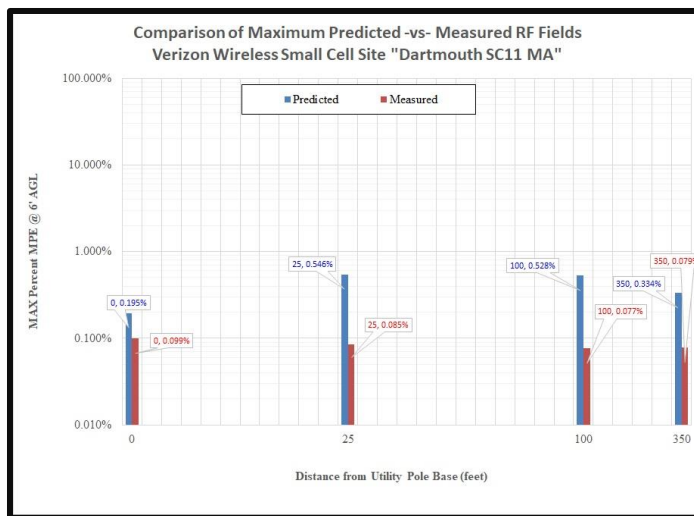


Figure 3F: Comparison of Predicted versus Measured RF Fields at Small Cell site “SC11”.

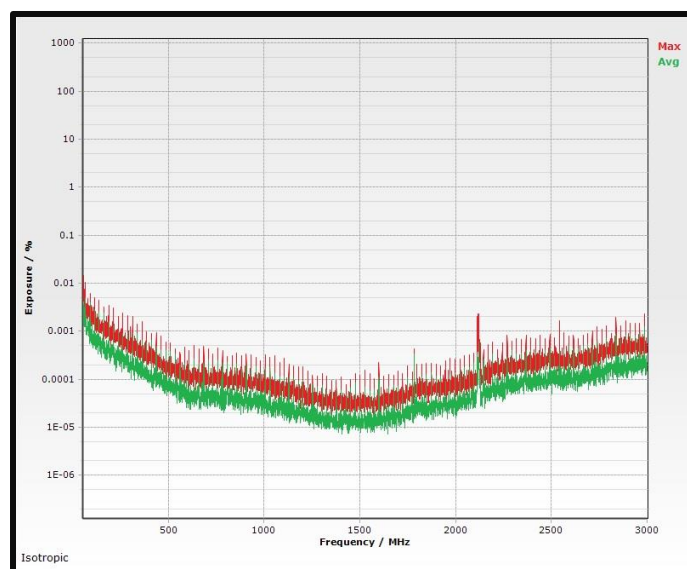


Figure 4F: Spectrum Obtained from Small Cell site “Dartmouth MA SC11”.

CONCLUSION

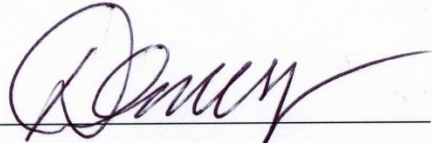
Previous theoretical RF field calculations data indicated the summation of the installed Verizon Wireless RF contributions would be well within the established RF exposure guidelines at the SC sites. The results of confirmatory measurements indicated there is good agreement between predicted RF fields and the actual RF fields measured. The measured values further confirm the validity of the theoretical predictions used to confirm the compliance with Federal and State guidelines for RF exposure.

Theoretical predictions for RF fields below the antenna of a SC site are extremely low in value (< 0.1% MPE) and are often times are masked by ambient signals from additional local hand-held devices and distant sites. Since the measured values in this report include signals from all sources, the readings may be slightly higher than predicted. This does not occur at distances beyond the base of the SC site.

This report provides written proof that the installed facilities comply with the MDPH and FCC RF exposure guidelines.

Feel free to contact me if you have any questions.

Sincerely,



Donald L. Haes, Jr., Ph.D
Certified Health Physicist

Note: The analyses, conclusions and professional opinions are based upon the precise parameters and conditions of these particular sites; **Six (6) utility poles within Dartmouth, MA.** Utilization of these analyses, conclusions and professional opinions for any personal wireless services installation, existing or proposed, other than the aforementioned has not been sanctioned by the author, and therefore should not be accepted as evidence of regulatory compliance.

DONALD L. HAES, JR., PH.D., CHP

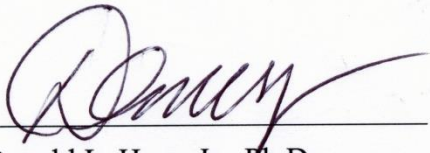
Radiation Safety Specialist

MA Radiation Control Program Health Physics Services Provider Registration #65-0017
PO Box 198, Hampstead, NH 03841 603-303-9959 Email: donald_haes_chp@comast.net

STATEMENT OF CERTIFICATION

1. I certify to the best of my knowledge and belief, the statements of fact contained in this report are true and correct.
2. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are personal, unbiased professional analyses, opinions and conclusions.
3. I have no present or prospective interest in the property that is the subject of this report and I have no personal interest or bias with respect to the parties involved.
4. My compensation is not contingent upon the reporting of a predetermined energy level or direction in energy level that favors the cause of the client, the amount of energy level estimate, the attainment of a stipulated result, or the occurrence of a subsequent event.
5. This assignment was not based on a requested minimum environmental energy level or specific power density.
6. My compensation is not contingent on an action or event resulting from the analyses, opinions, or conclusions in, or the use of, this report.
7. The consultant has accepted this assessment assignment having the knowledge and experience necessary to complete the assignment competently.
8. My analyses, opinions, and conclusions were developed and this report has been prepared, in conformity with the *American Board of Health Physics* (ABHP) statements of standards of professional responsibility for Certified Health Physicists.

Date: February 28, 2019



Donald L. Haes, Jr., Ph.D
Certified Health Physicist

ENDNOTES

- ⁱ. Federal Register, Federal Communications Commission Rules; *Radiofrequency radiation; environmental effects evaluation guidelines* Volume 1, No. 153, 41006-41199, August 7, 1996. (47 CFR Part 1; Federal Communications Commission).
- ⁱⁱ. Telecommunications Act of 1996, 47 USC; Second Session of the 104th Congress of the United States of America, January 3, 1996.
- ⁱⁱⁱ. 105 CMR 122.000: Massachusetts Department of Public Health, *Non-Ionizing Radiation Limits for: The General Public from Non-Occupational Exposure to Electromagnetic Fields, Employees from Occupational Exposure to Electromagnetic Fields, and Exposure from Microwave Ovens*.
- ^{iv}. ANSI/IEEE C95.3-2002: American National Standard, *IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz*.
- ^v. NCRP Report No. 119: National Council on Radiation Protection and Measurements, 1993; *A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields*.