



Radio Frequency Electromagnetic Energy (RF-EME) Maximum Permissible Exposure (MPE) Public Exposure Safety Report

Verizon Wireless 4G Small Cell Site
"CA_SUNNYVALE_005"
574 FORT LARAMIE DRIVE
SUNNYVALE, California 94087
LAT:37.343378, LONG:-122.036317

July 31, 2019



Prepared by RF GLOBAL SAFETY CONSULTANTS
California Registered Professional Engineer



Executive Summary

This report concludes that the proposed wireless 4G small cell site equipment to be installed at the aforementioned location with the specifications provided by Verizon Wireless complies with the applicable FCC- approved safety standards and guidelines for general public and occupational exposure.

General Information

In 1992, the American National Standards Institute (ANSI) published IEEE Standard C95.1-1991, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz." This current publication defines "controlled" (i.e., occupational) and "uncontrolled" (i.e., public) environments, setting for the latter more restrictive exposure limits, but longer periods for time averaging.

The FCC has provided direction to the telecommunications industry on determining compliance with ANSI standards. This is presented in the Office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields," dated August 1997. The equations given in this document are designed to yield a "worst-case" prediction of RF power densities.

The occupational (controlled) exposure limit is for personnel operating and maintaining the facilities small cell wireless equipment. This type of personnel should have training on the radiating equipment and will be able to disable the equipment when performing routine maintenance and replacement of equipment.

The general public (uncontrolled) exposure limit is for people who are unaware of the facilities small cell equipment and they are unfamiliar with any safety measures for being near this type of equipment.

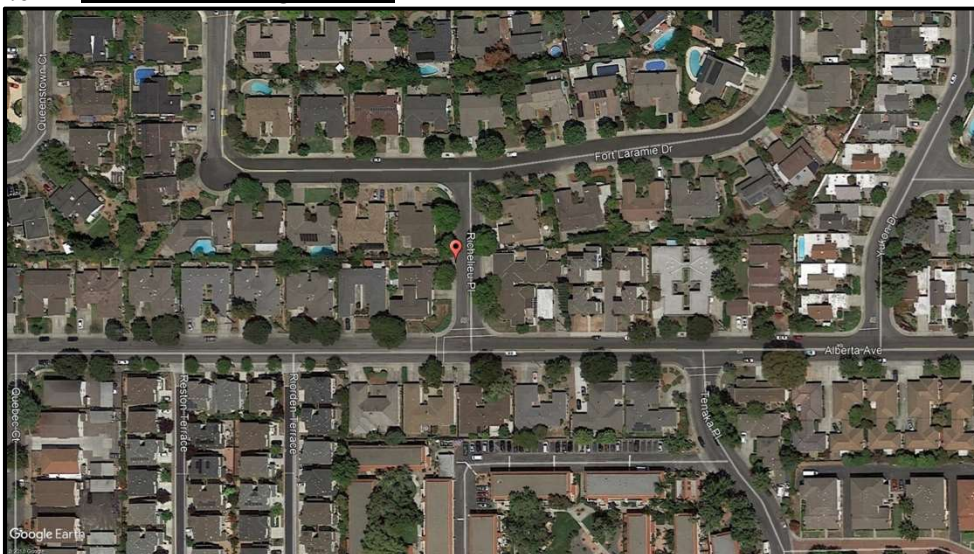
I. Introduction

Verizon Wireless is proposing to build a 4G small cell site at the location described below. This is part of the 4G Network Verizon Wireless is building nationwide. The equipment to be installed at this site will be mounted on the electric utility pole. The cell site will include a radio mounted near the base of the pole and antenna will be mounted on an extended mast on top of the utility pole. This report will determine if the proposed cell site equipment when in operation, complies with the applicable FCC and ANSI safety guidelines.

II. Proposed Site Information

The proposed site will be located in the City of Sunnyvale at aforementioned location. The equipment will be mounted on the utility pole at 44.9 feet above ground. The base station and antenna units will be mounted at the designated height and connected to the Verizon fiber network.

II.a Site Map - Google Earth



Equipment Information

The site equipment will be comprised of base station(s) and antenna(s) mounted on a utility pole.

Base Station make and Model: Ericsson, RRU-4449 & 8843.

Operating Frequencies (MHz): 700 (LTE); 850 (LTE); 1900 (PCS); 2100 (AWS).

Antenna make and model: Amphenol, CUUT360X12F0Y-0.

Output Power (ERP, dBm): 700 (54.43); 850 (54.53); 1900 (56.34); 2100 (55.64).

Output Power (ERP, Watts): 700 (367), 850 (431), 1900 (284); 2100 (278) – Net values, taking into consideration antenna gains and line losses.

Antenna Type: Quasi-Omnidirectional multi-port.

Unit Dimension (in), Height x Diameter: 48x14.6

Table-3 Below is a snapshot of the unit specification

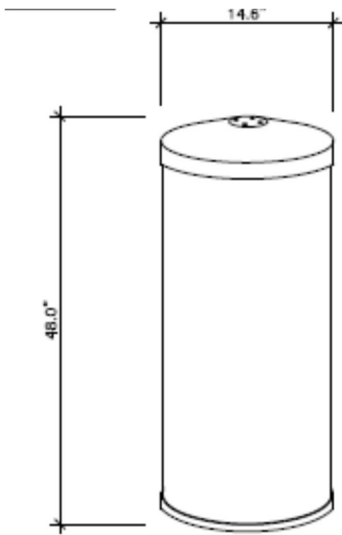
**IV. Theoretical Calculation of the proposed cell site exposure limits**

Table IV.1

Ground Level,	% of Limit, (Highest)	Compliance Y/N	Mitigation Y/N
Occupational/ Controlled Exposure	0.28	Y	N,1
General Public/ Uncontrolled Exposure	1.29	Y	N,1

Table IV.2

Antenna Face Level	Distance, Feet (closest)	% of limit	Compliance, Y/N	Mitigation Y/N
Occupational/ Controlled Exposure	18	85	Y	N,1
General Public/Uncontrolled Exposure	28	85	Y	N,1

1 It is recommended that RF safety signage and warnings to be posted to remind general public and personnel of the existence of cell transmitter that is generating electromagnetic energy equipment at this location.

IV.a Power Density calculation method

The calculation was based on the [OET Bulletin 65 guidelines](#) for Maximum Permissible Exposure (MPE) to humans. A worst case scenario is used to calculate the power density using the following mathematical formula: [\(Equation used to calculate the MPE limits\)](#)

$$S = 0.0334 * P / R^2$$

S is the power density in mW/cm²

P is the Effective radiated power in Watts

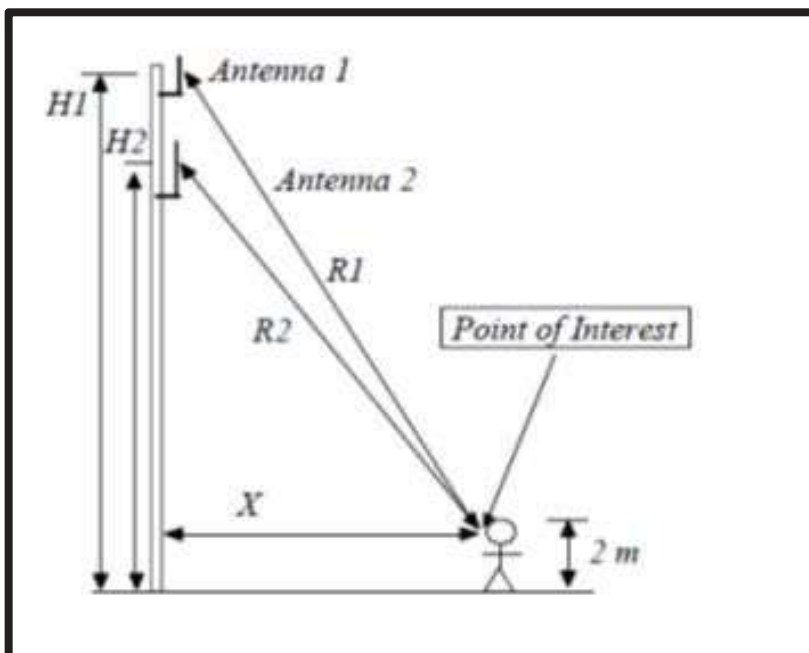
R is the distance from the center of the antenna in meters

IV.b Distance Calculation from the small cell antenna

The above calculation was based on a worst case scenario for a person with an average height of 6.56 feet and standing at various distances in feet from the base of the utility pole. The direct distance R used in the calculation below is determined by using the mathematical formula:

$$R = \text{SQRT}(H^2 + X^2)$$

Illustration-1



Where X is the distance from the general public to the base of the pole and H is the distance from the general public (individual) standing on the ground to the bottom of the panel antenna. The average height of an individual used in the calculations is 2 meters or 6.56 feet.

It should be noted that the strongest energy radiated from the antenna is at the face and center of the antenna. The general public may be exposed to more RF energy when standing in the face of the panel antenna. Additional calculations were done to determine the power density when general public is exposed to the energy at the antenna face level, such as on balconies in a residential area or in an office building that is in close proximity to the cell site. Calculations were completed at various distances for locations in direct path of the antenna beam. The table shows the calculated values of the minimum safe distances from the cell site.

V. Conclusion

The proposed Verizon Wireless 4G small cell site to be installed at the designated location with the equipment specifications provided will comply with the applicable FCC safety guidelines for maximum permissible occupational and general public exposure limits. This conclusion based on the analysis conducted in this report that showed the power density calculated to be below the safety limits set by the FCC OET Bulletin 65. The minimum distance from the face of the antenna where occupational and general public are below safety guidelines are 18 feet and 28 feet respectively. The power density calculated above the roof of the closest building (about 40 feet from the pole and 20 feet below antenna face level) is 20.90% of the general public exposure limit. Furthermore, since the study was based on worst case scenario, the actual power density that may result from the equipment when in operation will most likely be far less than showing in the tables IV.1 and IV.2. And even though the proposed site to be installed will comply with applicable safety standards, it is recommended that signage to be posted on the utility pole to let the general public and personnel know of the presence of the cell site.

References:**A) Technical Standards applicable to this measurement.**

1. "Safety Levels with Respect to Human Exposure Frequency Electromagnetic Fields", American National Standards Institute (ANSI); IEEE Standard C95.1-1991.

2. "Evaluating Compliance with FCC Guidelines for Human Exposure to Frequency Electromagnetic Fields, Federal Communications Commission, Office of Engineering and Technology; OET Bulletin 65, Edition 97-01, August 1997.

B) Occupational and general public exposure limits as guidelines per the FCC OET Bulletin 65.**Table 1. LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)****(A) Limits for Occupational/Controlled Exposure**

Frequency Range (MHz)	Electric Field Strength(E) (V/m)	Magnetic Field Strength(H) (A/m)	Power Density(S) (mW/cm ²)
0.3-3.0	614	1.63	(100)*
3.0-30	1842/f	4.89/f	(900/f ²)*
30-300	61.4	0.163	1.0
300-1500	--	--	f/300
1500-100,000	--	--	5.0

(B) Limits for General Population/Uncontrolled Exposure

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

f=frequency in MHz

*Plane-wave equivalent power density