

# Radio Frequency - Electromagnetic Energy (RF-EME) Jurisdictional Report

Site No. 427812  
Sunnyvale 007  
1055 Dunford Way  
Sunnyvale, California 94087  
Santa Clara County  
37° 20' 43.33" N, -122° 0' 22.27" W NAD83

EBI Project No. 6217004560  
October 17, 2017



Prepared for:  
Verizon Wireless  
c/o The CBR Group Inc.  
841 Arnold Drive, Suite A & B  
Martinez, CA 94553

Prepared by:



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## EXECUTIVE SUMMARY

### Purpose of Report

EnviroBusiness Inc. (dba EBI Consulting) has been contracted by Verizon Wireless to conduct radio frequency electromagnetic (RF-EME) modeling for Verizon Site 427812 located at 1055 Dunford Way in Sunnyvale, California to determine RF-EME exposure levels from proposed Verizon wireless communications equipment at this site. As described in greater detail in Section 2.0 of this report, the Federal Communications Commission (FCC) has developed Maximum Permissible Exposure (MPE) Limits for general public exposures and occupational exposures. This report summarizes the results of RF-EME modeling in relation to relevant FCC RF-EME compliance standards for limiting human exposure to RF-EME fields.

### Statement of Compliance

A site is considered out of compliance with FCC regulations if there are areas that exceed the FCC exposure limits and there are no RF hazard mitigation measures in place. Any carrier which has an installation that contributes more than 5% of the applicable MPE must participate in mitigating these RF hazards.

As presented in the sections below, based on worst-case predictive modeling, there are no modeled areas on any accessible ground-level walking/working surface related to the proposed antennas that exceed the FCC's occupational or general public exposure limits at this site. Additionally, there are areas where workers who may be elevated above the ground may be exposed to power densities greater than the occupational limits. Therefore, workers should be informed about the presence and locations of antennas and their associated fields.

At the nearest walking/working surfaces to the Verizon antennas, the maximum power density generated by the Verizon antennas is approximately **2.50** percent of the FCC's general public limit (**0.50** percent of the FCC's occupational limit).

Recommended control measures are outlined in Section 5.0 and within a Site Safety Plan (attached); this plan includes instructions to shut down and lockout/tagout this wireless equipment in accordance with Verizon's standard operating protocol.

## 1.0 INTRODUCTION

Radio frequency waves are electromagnetic waves from the portion of the electromagnetic spectrum at frequencies lower than visible light and microwaves. The wavelengths of radio waves range from thousands of meters to around 30 centimeters. These wavelengths correspond to frequencies as low as 3 cycles per seconds (or hertz [Hz]) to as high as one gigahertz (one billion cycles per second).

Personal Communication (PCS) facilities used by Verizon in this area operate within a frequency range of 700-2100 MHz. Facilities typically consist of: 1) electronic transceivers (the radios or cabinets) connected to wired telephone lines; and 2) antennas that send the wireless signals created by the transceivers to be received by individual subscriber units (PCS telephones). Transceivers are typically connected to antennas by coaxial cables.

Because of the short wavelength of PCS services, the antennas require line-of-site paths for good propagation, and are typically installed a distance above ground level. Antennas are constructed to concentrate energy towards the horizon, with as little energy as possible scattered towards the ground or the sky. This design, combined with the low power of PCS facilities, generally results in no possibility for exposure to approach Maximum Permissible Exposure (MPE) levels, with the exception of in areas in the immediate vicinity of the antennas.

MPE limits do not represent levels where a health risk exists, since they are designed to provide a substantial margin of safety. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size or health.

## 2.0 SITE DESCRIPTION

This project site includes one (1) omni-directional wireless telecommunication antenna on a utility pole located at 1055 Dunford Way in Sunnyvale, California.

Verizon Antenna Information (proposed Configuration)									
Antenna# and Model	Frequency (MHz)	# of Transmitters	Transmit Power (Watts)	Azimuth	Gain (dBd)	Feet above Ground (CL)	X	Y	Z
AI	700	2	40	Omni	3.35	49.33 ft AGL	50	50	47.33
Amphenol	2100	4	40		7.85				
CUUT360X12FI24	1900	4	40		7.35				

The FCC guidelines incorporate two separate tiers of exposure limits that are based upon occupational/controlled exposure limits (for workers) and general population/uncontrolled exposure limits for members of the general public that may be exposed to antenna fields. While access to this site is considered uncontrolled, the analysis has considered exposures with respect to both controlled and uncontrolled limits as an untrained worker may access adjacent rooftop locations. Additional information regarding controlled/uncontrolled exposure limits is provided in Section 3.0. Appendix B presents a site safety plan that provides a plan view of the utility pole with antenna locations.

**3.0 FEDERAL COMMUNICATIONS COMMISSION (FCC) REQUIREMENTS**

The FCC has established Maximum Permissible Exposure (MPE) limits for human exposure to Radiofrequency Electromagnetic (RF-EME) energy fields, based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) and, over a wide range of frequencies, the exposure limits developed by the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and adopted by the American National Standards Institute (ANSI) to replace the 1982 ANSI guidelines. Limits for localized absorption are based on recommendations of both ANSI/IEEE and NCRP.

The FCC guidelines incorporate two separate tiers of exposure limits that are based upon occupational/controlled exposure limits (for workers) and general public/uncontrolled exposure limits for members of the general public.

**Occupational/controlled exposure limits** apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general public/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**General public/uncontrolled exposure limits** apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment-related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Table I and Figure I (below), which are included within the FCC's OET Bulletin 65, summarize the MPE limits for RF emissions. These limits are designed to provide a substantial margin of safety. They vary by frequency to take into account the different types of equipment that may be in operation at a particular facility and are "time-averaged" limits to reflect different durations resulting from controlled and uncontrolled exposures.

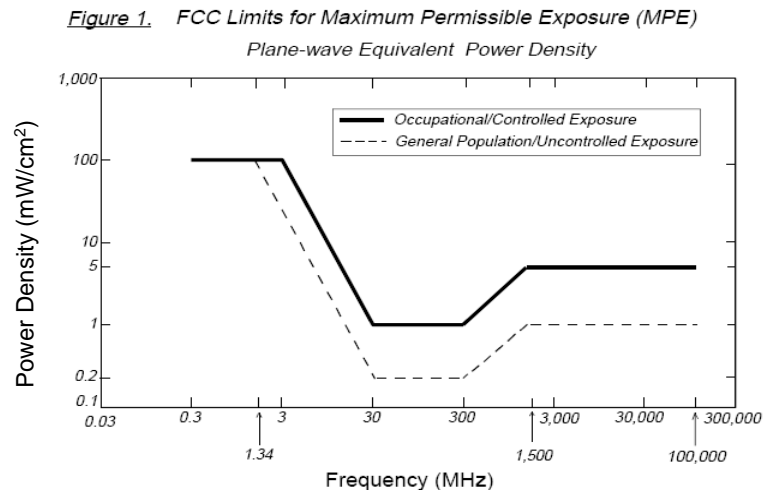
The FCC's MPEs are measured in terms of power (mW) over a unit surface area (cm<sup>2</sup>). Known as the power density, the FCC has established an occupational MPE of 5 milliwatts per square centimeter (mW/cm<sup>2</sup>) and an uncontrolled MPE of 1 mW/cm<sup>2</sup> for equipment operating in the 1900 MHz frequency range. For the Verizon equipment operating at 700 MHz or 850 MHz, the FCC's occupational MPE is 2.83 mW/cm<sup>2</sup> and an uncontrolled MPE of 0.57 mW/cm<sup>2</sup>. These limits are considered protective of these populations.

<b>Table I: Limits for Maximum Permissible Exposure (MPE)</b>				
<b>(A) Limits for Occupational/Controlled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (E) (V/m)</b>	<b>Magnetic Field Strength (H) (A/m)</b>	<b>Power Density (S) (mW/cm<sup>2</sup>)</b>	<b>Averaging Time [E]<sup>2</sup>, [H]<sup>2</sup>, or S (minutes)</b>
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f <sup>2</sup> )*	6
30-300	61.4	0.163	1.0	6

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 <sup>2</sup> )	Averaging Time [E] <sup>2</sup> , [H] <sup>2</sup> , or S (minutes)
300-1,500	--	--	f/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Public/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time [E] <sup>2</sup> , [H] <sup>2</sup> , or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30-300	27.5	0.073	0.2	30
300-1,500	--	--	f/1,500	30
1,500-100,000	--	--	1.0	30

f = Frequency in (MHz)

\* Plane-wave equivalent power density



Based on the above, the most restrictive thresholds for exposures of unlimited duration to RF energy for several personal wireless services are summarized below:

Personal Wireless Service	Approximate Frequency	Occupational MPE	Public MPE
Personal Communication (PCS)	1,950 MHz	5.00 mW/cm <sup>2</sup>	1.00 mW/cm <sup>2</sup>
Cellular Telephone	870 MHz	2.90 mW/cm <sup>2</sup>	0.58 mW/cm <sup>2</sup>
Specialized Mobile Radio	855 MHz	2.85 mW/cm <sup>2</sup>	0.57 mW/cm <sup>2</sup>
Most Restrictive Freq. Range	30-300 MHz	1.00 mW/cm <sup>2</sup>	0.20 mW/cm <sup>2</sup>

MPE limits are designed to provide a substantial margin of safety. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

Personal Communication (PCS) facilities used by Verizon in this area operate within a frequency range of 700-2100 MHz. Facilities typically consist of: 1) electronic transceivers (the radios or cabinets) connected to wired telephone lines; and 2) antennas that send the wireless signals created by the transceivers to be received by individual subscriber units (PCS telephones). Transceivers are typically connected to antennas by coaxial cables.

Because of the short wavelength of PCS services, the antennas require line-of-site paths for good propagation, and are typically installed above ground level. Antennas are constructed to concentrate energy towards the horizon, with as little energy as possible scattered towards the ground or the sky. This design, combined with the low power of PCS facilities, generally results in no possibility for exposure to approach Maximum Permissible Exposure (MPE) levels, with the exception of areas directly in front of the antennas.

#### **4.0 WORST-CASE PREDICTIVE MODELING**

EBI has performed theoretical modeling using RoofView® software to estimate the worst-case power density at the site ground-level and nearby roof-tops resulting from operation of the antennas. RoofView® is a widely-used predictive modeling program that has been developed by Richard Tell Associates to predict both near field and far field RF power density values for roof-top and tower telecommunications sites produced by vertical collinear antennas that are typically used in the cellular, PCS, paging and other communications services. The models utilize several operational specifications for different types of antennas to produce a plot of spatially-averaged power densities that can be expressed as a percentage of the applicable exposure limit.

The modeling is based on worst-case assumptions for the number of antennas and transmitter power. The modeling assumes a maximum 10-radio configuration for the antenna with a power level of 40 watts per transmitter for 700, 2100, and 1900 MHz frequencies, in order to provide a worst-case evaluation of predicted MPE levels. The assumptions used in the modeling are based upon information provided by Verizon, and information gathered from other sources. The parameters used for the modeling are summarized in the RoofView® export files presented in Appendix C.

There are no other wireless carriers with equipment installed at this site.

Based on worst-case predictive modeling, there are no modeled areas on any accessible ground-level walking/working surface related to the proposed Verizon antennas that exceed the FCC's occupational or general public exposure limits at this site. At the nearest walking/working surfaces to the Verizon antennas, the maximum power density generated by the Verizon antennas is approximately 2.50 percent of the FCC's general public limit (0.50 percent of the FCC's occupational limit).

The Site Safety Plan also presents areas where Verizon Wireless antennas contribute greater than 5% of the applicable MPE limit for a site. A site is considered out of compliance with FCC regulations if there are areas that exceed the FCC exposure limits and there are no RF hazard mitigation measures in place. Any carrier which has an installation that contributes more than 5% of the applicable MPE must participate in mitigating these RF hazards.

The inputs used in the modeling are summarized in the RoofView® export file presented in Appendix C. A graphical representation of the RoofView® modeling results is presented in Appendix B. It should be noted that RoofView is not suitable for modeling microwave dish antennas; however, these units are designed for point-to-point operations at the elevations of the installed equipment rather than ground level coverage.

## **5.0 MITIGATION/SITE CONTROL OPTIONS**

EBI's modeling indicates that there are no areas in front of the Verizon antennas that exceed the FCC standards for occupational or general public exposure at ground level. All exposures above the FCC's safe limits require that individuals be elevated above the ground. In order to alert people accessing the utility pole, CAUTION signs are recommended to be installed on opposite sides of the pole, 8' below the bottom of the antenna.

There are no barriers recommended on this site.

These protocols and recommended control measures have been summarized and included with a graphic representation of the antennas and associated signage and control areas in a RF-EME Site Safety Plan, which is included as Appendix B. Individuals and workers accessing the roof should be provided with a copy of the attached Site Safety Plan, made aware of the posted signage, and signify their understanding of the Site Safety Plan.

Implementation of the signage recommended in the Site Safety Plan and in this report will bring this site into compliance with the FCC's rules and regulations.

## **6.0 SUMMARY AND CONCLUSIONS**

EBI has prepared a Radiofrequency – Electromagnetic Energy (RF-EME) Compliance Report for telecommunications equipment installed by Verizon Site Number 427812 located at 1055 Dunford Way in Sunnyvale, California to determine worst-case predicted RF-EME exposure levels from wireless communications equipment installed at this site. This report summarizes the results of RF-EME modeling in relation to relevant Federal Communications Commission (FCC) RF-EME compliance standards for limiting human exposure to RF-EME fields.

As presented in the sections above, based on the FCC criteria, there are no modeled areas on any accessible ground-level walking/working surface related to the proposed antennas that exceed the FCC's occupational or general public exposure limits at this site. Workers should be informed about the presence and locations of antennas and their associated fields. Recommended control measures are outlined in Section 5.0 and within a Site Safety Plan (attached); this plan includes procedures to shut down and lockout/tagout this wireless equipment in accordance with Verizon's standard operating protocol.

## **7.0 LIMITATIONS**

This report was prepared for the use of Verizon Wireless. It was performed in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same locale under like circumstances. The conclusions provided by EBI are based solely on the information provided by the client. The observations in this report are valid on the date of the investigation. Any additional information that becomes available concerning the site should be provided to EBI so that our conclusions may be revised and modified, if necessary. This report has been prepared in accordance with Standard Conditions for Engagement and authorized proposal, both of which are integral parts of this report. No other warranty, expressed or implied, is made.



## **Appendix A**

### **Certifications**

RF-EME Compliance Report  
EBI Project No. 6217004561

Site No. 427812  
1055 Dunford Way, Sunnyvale, California

Reviewed and Approved by:



sealed 17oct2017

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Michael McGuire  
Electrical Engineer

Note that EBI's scope of work is limited to an evaluation of the Radio Frequency – Electromagnetic Energy (RF-EME) field generated by the antennas and broadcast equipment noted in this report. The engineering and design of the building and related structures, as well as the impact of the antennas and broadcast equipment on the structural integrity of the building, are specifically excluded from EBI's scope of work.

## Preparer Certification

I, Christopher Ilgenfritz, state that:

- I am an employee of EnviroBusiness Inc. (d/b/a EBI Consulting), which provides RF-EME safety and compliance services to the wireless communications industry.
- I have successfully completed RF-EME safety training, and I am aware of the potential hazards from RF-EME and would be classified “occupational” under the FCC regulations.
- I am familiar with the FCC rules and regulations as well as OSHA regulations both in general and as they apply to RF-EME exposure.
- I have reviewed the data provided by the client and incorporated it into this Site Compliance Report such that the information contained in this report is true and accurate to the best of my knowledge.







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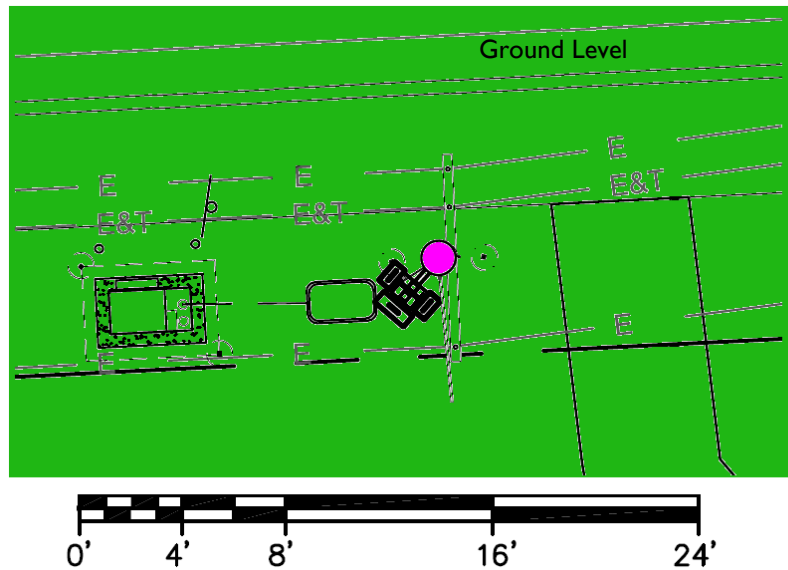
**Appendix B**


**Radio Frequency Electromagnetic Energy**

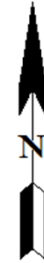
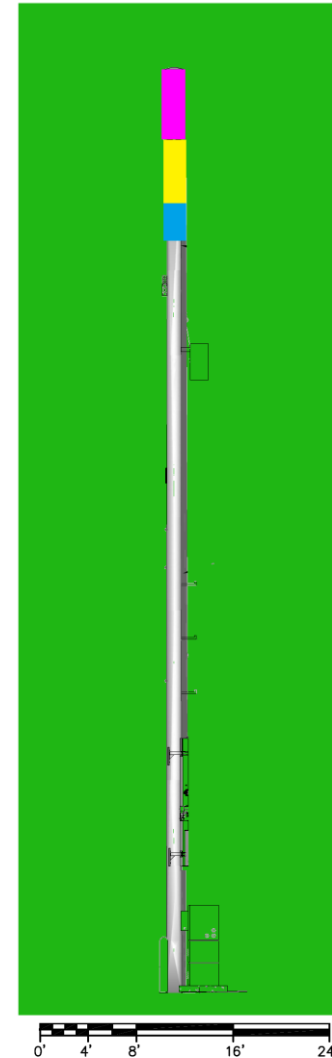
**Safety / Signage Plans**

**% FCC Public Exposure Limit**

	Exposure Level $\geq 5,000$
	$500 < \text{Exposure Level} \leq 5,000$
	$100 < \text{Exposure Level} \leq 500$
	Exposure Level $\leq 100$

**Ground Level**

 **Verizon Antennas**

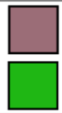
**Down Pole****Roofview: Composite Exposure Levels**

**Facility Operator:** Verizon Wireless

**Site Name:** Sunnyvale 007

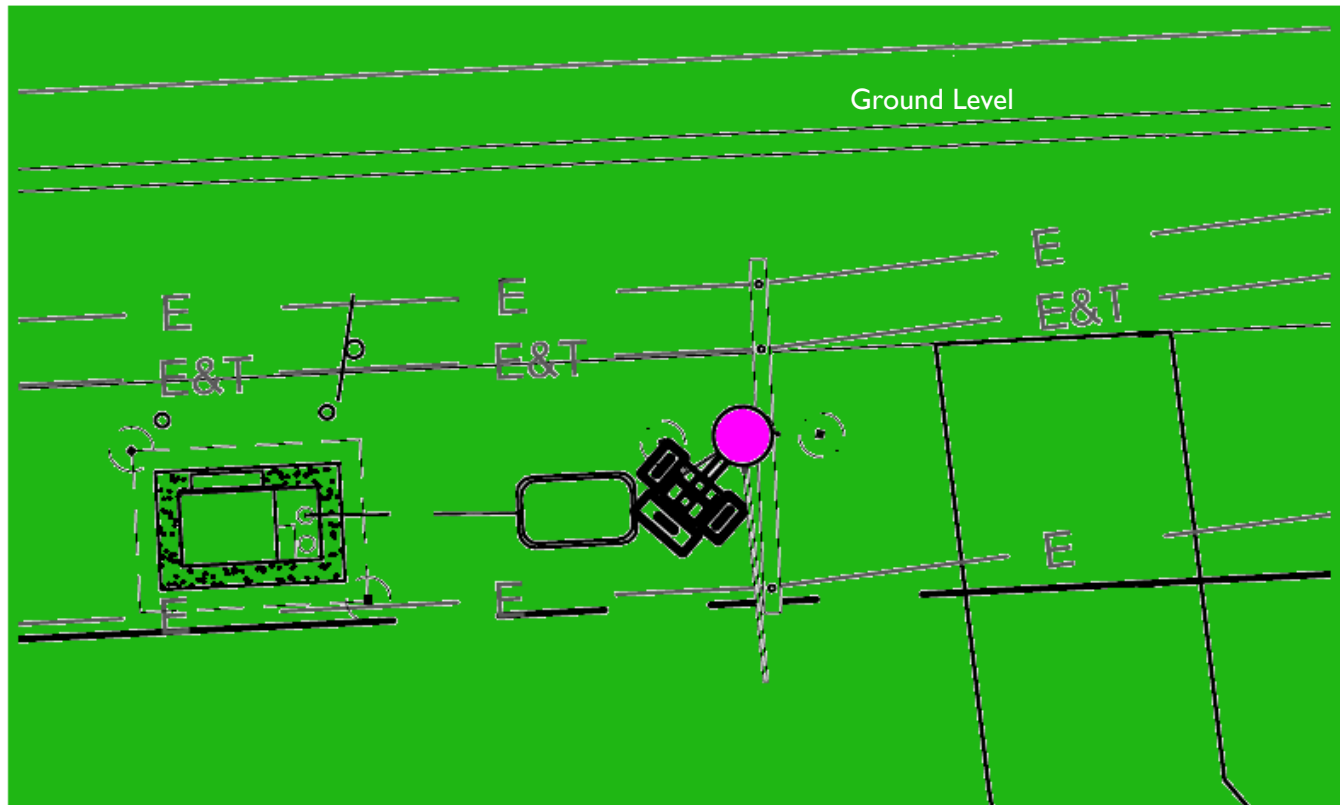
**Verizon Site Number:** 427812

**Report Date:** 10-17-17

**% FCC Public Exposure Limit**

Exposure Level &gt; 5

Exposure Level ≤ 5

**Verizon Antennas****Roofview: Verizon Exposure Levels**

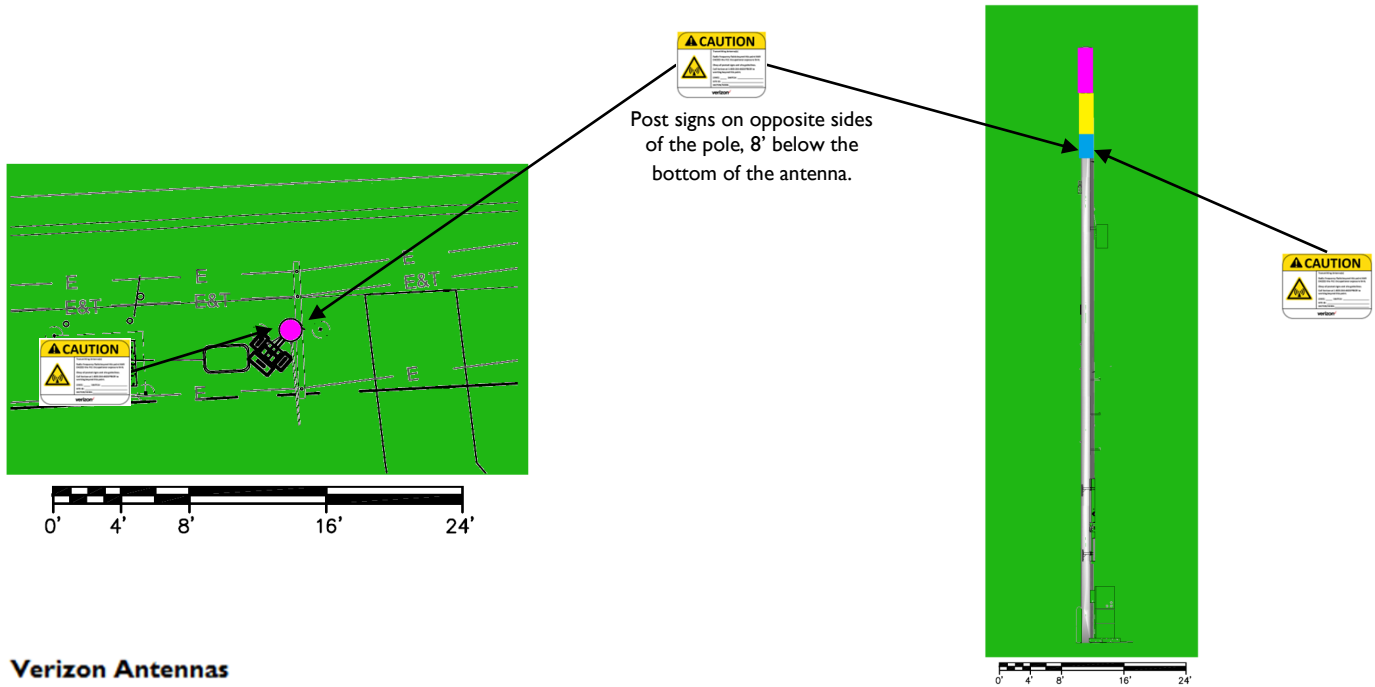
Facility Operator: Verizon Wireless


Site Name: Sunnyvale 007

Verizon Site Number: 427812

Report Date: 10-17-17

# Verizon Signage Plan



Sign Image	Description	Posting Instructions	Required Signage
	<b>Yellow Caution Sign</b> Used to alert individuals that they are entering an area where the power density emitted from transmitting antennas may exceed the FCC's maximum permissible exposure limit for the general public and the occupational exposure limit.	Securely post in a manner conspicuous to all individuals entering thereon as indicated in the signage plan.	Post signs on opposite sides of the pole, 8' below the bottom of the antenna.

## **Appendix C**

### **Roofview® Export File**



**StartMapDefinition**

Roof Max \Roof Max \ Map Max \ Map Max \ Y Offset X Offset Number of envelope  
 120 120 140 140 20 20 1 \$AE\$81:\$E \$AE\$81:\$E\$200

List Of Areas  
 \$AE\$81:\$E\$200

**StartSettingsData**

Standard Method Uptime Scale Factc Low Thr Low Color Mid Thr Mid Color Hi Thr Hi Color Over Color Ap Ht Mult Ap Ht Method  
 4 2 1 1 100 1 500 4 5000 2 3 1.5 1

**StartAntennaData** It is advisable to provide an ID (ant 1) for all antennas

ID	Name	Freq (MHz)	Power	Trans Count	Coax Len	Coax Type	Other Loss	Input Power	Calc Power	Mfg	Model	(ft) X	(ft) Y	(ft) Z	Type	(ft) Aper	dBd Gain	BWdth Pt Dir	Uptime Profile	ON flag
VZW A1	LTE	700	40	2	0	0	1			Amphenol	CUUT360X12F124	50	50	47.33		4	3.35	360;0		ON•
VZW A1	LTE	2100	40	4	0	0		1.5		Amphenol	CUUT360X12F124	50	50	47.33		4	7.85	360;0		ON•
VZW A1	LTE	1900	40	4	0	0		1.5		Amphenol	CUUT360X12F124	50	50	47.33		4	7.35	360;0		ON•

**StartSymbolData**

Sym	Map Mark	Roof X	Roof Y	Map Label	Description ( notes for this table only )
Sym		5	35	AC Unit	Sample symbols
Sym		14	5	Roof Access	
Sym		45	5	AC Unit	
Sym		45	20	Ladder	