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Non-Ionizing Radiation (NIER) Study

Site Number:

415310

Site Name:

Camino Diablo Vasco CA

Location:

Brentwood, California

Tenants:

Verizon Wireless

Prepared For:

American Tower, Inc.
Woburn, Massachusetts

December 27th, 2024

83097 P-455826

Prepared By:

Gautam J. Sopal, EIT.

Tower Engineering Professionals

Approved By:

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Non-Ionizing Electromagnetic Radiation (NIER) Study

415310 Camino Diablo Vasco CA
Brentwood, California

INTRODUCTION

Tower Engineering Professionals RF Design & Services Division (TEP-RF) of Raleigh, North Carolina, has been retained by American Tower, Inc. (ATC), of Woburn, Massachusetts to evaluate the RF emissions compared to the Maximum Permissible Exposure (MPE) limit for facilities at this location. This evaluation uses compliance standards as outlined in Federal Communications Commission (FCC) document OET-65.

SITE AND FACILITY CONSIDERATIONS

Site 415310 Camino Diablo Vasco CA is located at 3698 Vasco Rd. in Brentwood, California at coordinates 37.87649, -121.68834. The support structure is a 47' water tank. An aerial view of the water tank can be found in Appendix 1, Site Photos. The only tenant is Verizon Wireless (VZW). A table listing all antennae and effective radiated power (ERP) levels that were used in this study may be found in Appendix 2, Antenna Inventory.

POWER DENSITY CALCULATIONS

Power densities were calculated based on FCC MPE limits for both General Population/Uncontrolled and Occupational/Controlled environments.

For the purpose of this study, a radius of 100' from the base of the water tank with a height of 6' above ground level was used, beyond 100' the MPE levels become *di minimus*. This study utilized FCC recognized and accepted software programs using the maximum ERP levels for the antenna models provided by ATC. Diagrams depicting the predicted spatial average power density level at any specific location may be found in Appendix 3, MPE Limit Study. Descriptions of RF signage can be found in Appendix 4, Barrier & Sign Types. A discussion regarding the FCC limits may be found in Appendix 5, Information Pertaining to MPE Studies. Prediction Models used in this study may be found in Appendix 6, MPE Standards Methodology.

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All data used in this study was collected from one or more of the following sources:

- ATC furnished data and does not include other unidentified communication facilities.
- Load List at 415310 Camino Diablo Vasco CA. RF NIER Study 12/17/2024.
- FCC databases.
- Carrier standard configurations.
- Empirical data collected by TEP.

SITE MITIGATION & CONTROL

In order to comply with FCC, tenant, & ATC requirements, TEP recommends the placement of signage at the following points:

Site Entrance

1. Site ID Sign (tower owner defined)
2. RF Information Sign (Green)
3. RF Notice Sign (Blue)

Tower Access Point

1. RF Exposure Sign (Red)

Alpha Sector
No additional mitigation is required.

Beta Sector
No additional mitigation is required.

Gamma Sector
No additional mitigation is required

COMPLIANCE DETERMINATION

With the above mitigation implemented, this installation *WILL BE* in compliance with current FCC MPE limits as described in FCC OET-65.

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Appendix 1 Site Photos

Aerial View of the Site

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Appendix 2 Antenna Inventory

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Antenna Inventory							
Antenna #	Carrier	Antenna Manufacturer	Antenna Model	Frequency Band (MHz)	Azmiuth (°)	Effective Radiated Power (W)	Radiation Center (ft)
1	VZW	Ericsson	Air6419	3700-3980	000	69206	33.7
2	VZW	Ericsson	Air6419	3700-3980	120	69206	33.7
3	VZW	Ericsson	Air6419	3700-3980	240	69206	33.7
4	VZW	Commscope	NHH-65C-R2B	880-890	130	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	
5	VZW	Commscope	NHH-65C-R2B	880-890	260	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	
6	VZW	Commscope	NHH-65C-R2B	880-890	330	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	
7	VZW	Commscope	NHH-65C-R2B	880-890	130	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	
8	VZW	Commscope	NHH-65C-R2B	880-890	260	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	
9	VZW	Commscope	NHH-65C-R2B	880-890	330	9932	31.0
				891-894		9932	
				1980-1985		14423	
				1985-1990		14423	

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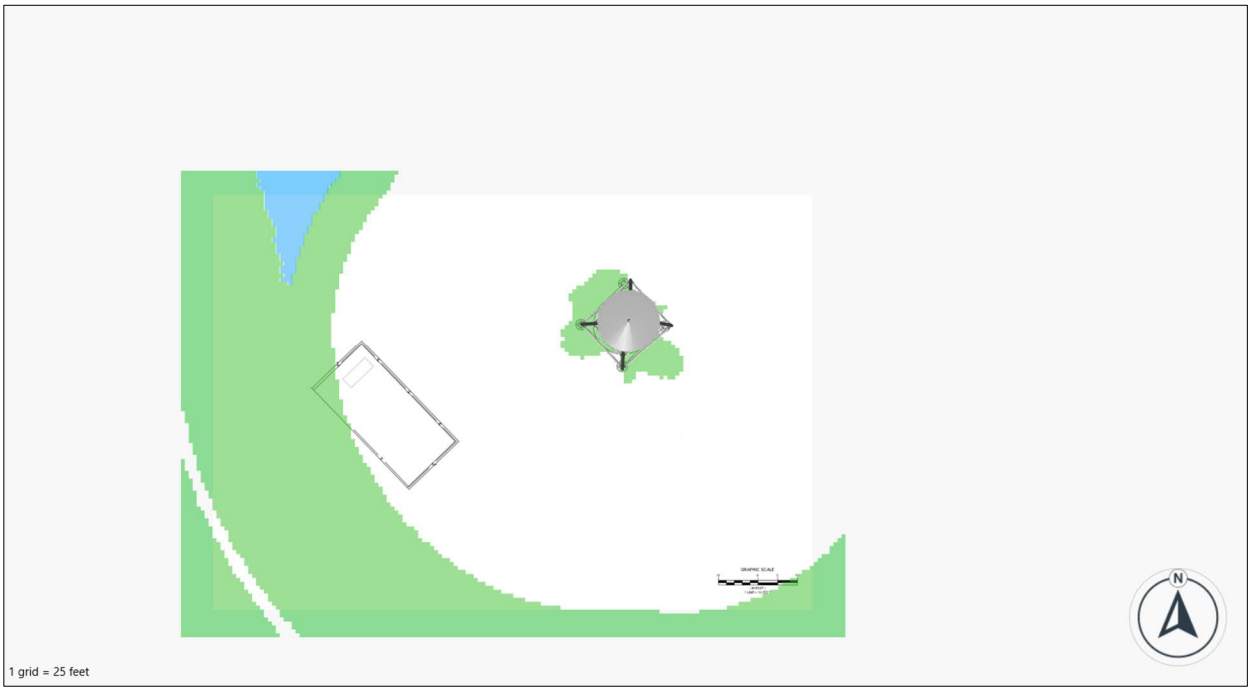
Appendix 3.1 MPE Limit Study General Population



Legend

Study Zone	Elev. (ft)	Type	Exposure Profile	Max MPE	Att	Carriers
Floor Study Zone	0.0	Floor	2D Sula9 0.25 res. General...	157.97%	0.00	VZW

5%-100%	100%-500%	500%-5000%	5000%+

Exposure Profile Name	Model	Exposure Area	Standard	Resolution	RCF
2D Sula9 0.25 res. General Public	Sula 9	Spatial Average (6 ft)	FCC General Population		1.0

VZW

Mitigation Existing Proposed Installed To Remove **Max MPE**

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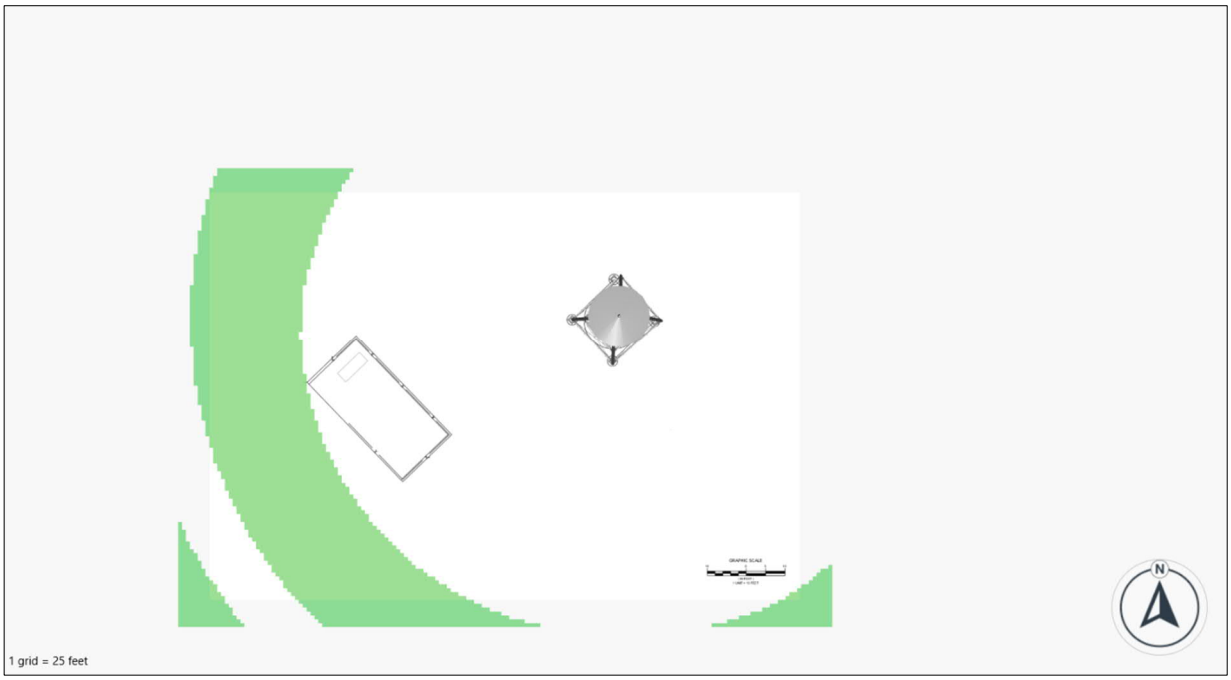
Appendix 3.2 MPE Limit Study Occupational Limit



Legend

Study Zone	Elev. (ft)	Type	Exposure Profile	Max MPE	Att	Carriers
Floor Study Zone	0.0	Floor	2D Sula9 0.25 res....	31.59%	0.00	VZW

5%-100%	100%-500%	500%-5000%	5000%+

Exposure Profile Name	Model	Exposure Area	Standard	Resolution	RCF
2D Sula9 0.25 res. Occupational	Sula 9	Spatial Average (6 ft)	FCC Occupational		1.0

VZW

Mitigation Existing Proposed Installed To Remove **Max MPE**

Grid Size: 25.00 feet **Floor = Elevation +6' | Mid-Level = Elevation +/- 3'**

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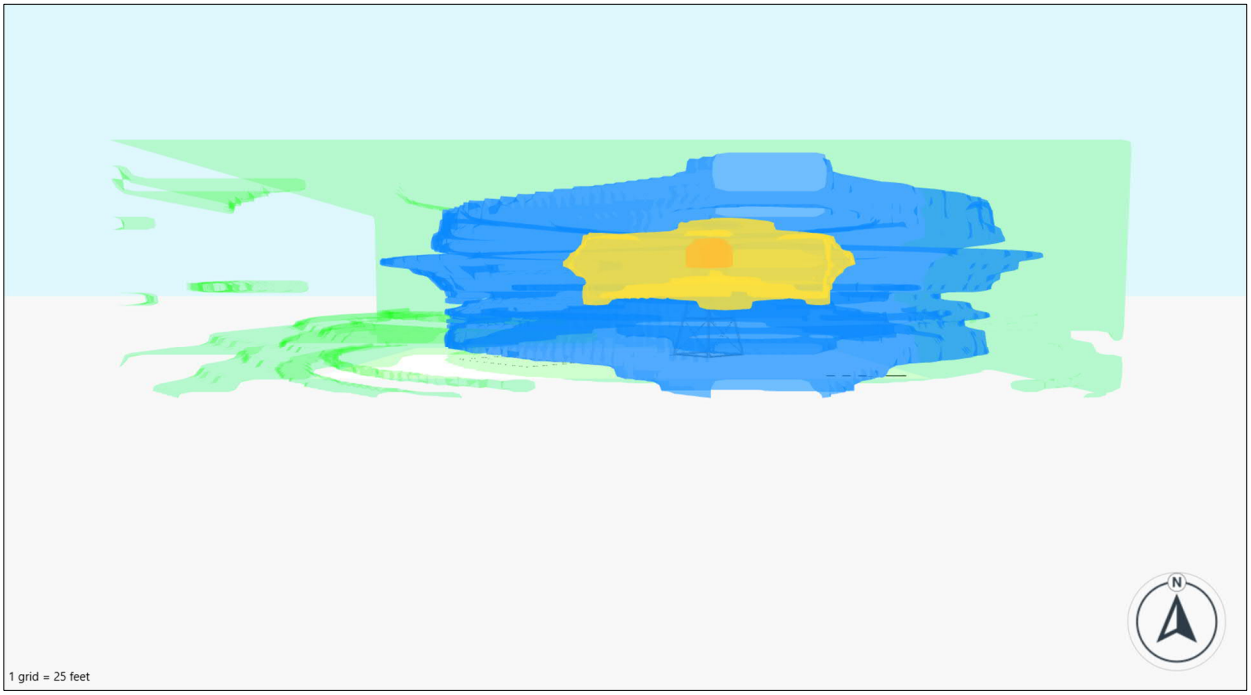
Appendix 3.3 MPE Limit Study General Population



Legend

Study Zone	Elev. (ft)	Type	Exposure Profile	Max MPE	Att	Carriers
3D Study Zone	0.0 - 50.0	3D Area	3D Sula9 2.5 res. General...	21864.45%	0.00	VZW

5%-100%	100%-500%	500%-5000%	5000%+

Exposure Profile Name	Model	Exposure Area	Standard	Resolution	RCF
3D Sula9 2.5 res. General Public	Sula 9	Spatial Average (6 ft)	FCC General Population	2.5	1.0

VZW

Mitigation Existing Proposed Installed To Remove **Max MPE**

Grid Size: 25.00 feet **Floor = Elevation +6' | Mid-Level = Elevation +/- 3'**

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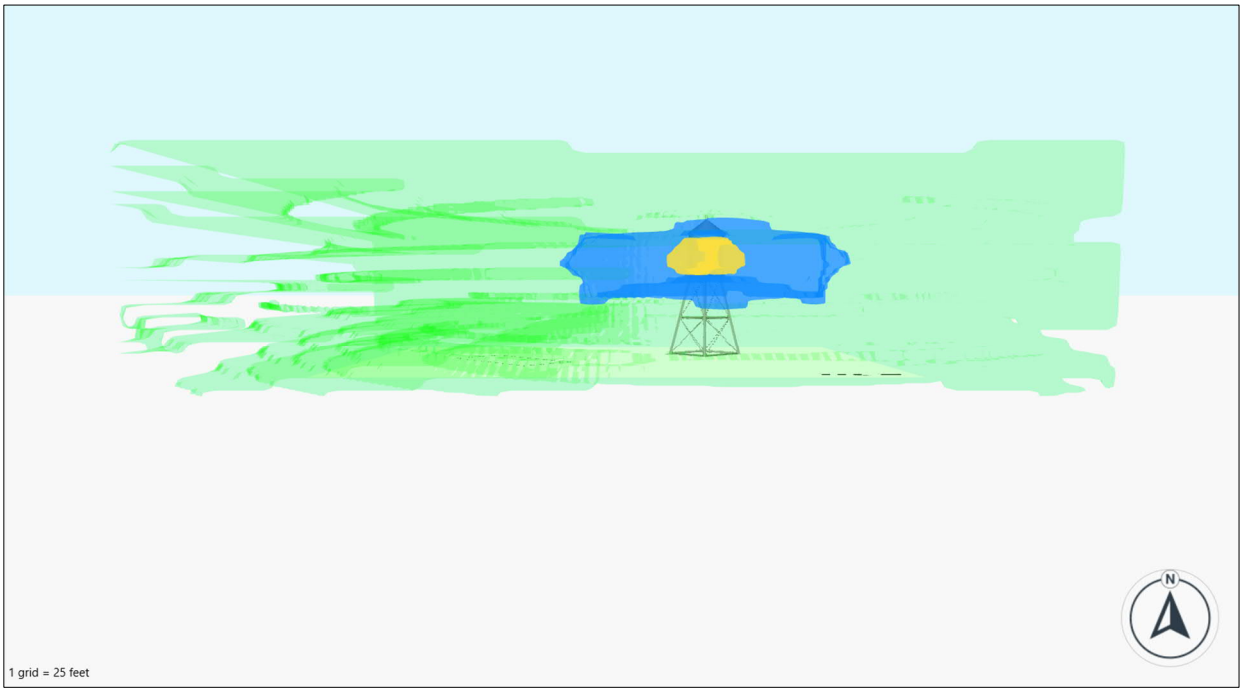
Appendix 3.4 MPE Limit Study Occupational



Legend

Study Zone	Elev. (ft)	Type	Exposure Profile	Max MPE	Att	Carriers
3D Study Zone	0.0 - 50.0	3D Area	3D Sula9 2.5 res....	4372.89%	0.00	VZW

5%-100%	100%-500%	500%-5000%	5000%+

Exposure Profile Name	Model	Exposure Area	Standard	Resolution	RCF
3D Sula9 2.5 res. Occupational	Sula 9	Spatial Average (6 ft)	FCC Occupational	2.5	1.0

VZW

Mitigation Existing Proposed Installed To Remove **Max MPE**

Grid Size: 25.00 feet **Floor = Elevation +6' | Mid-Level = Elevation +/- 3'**

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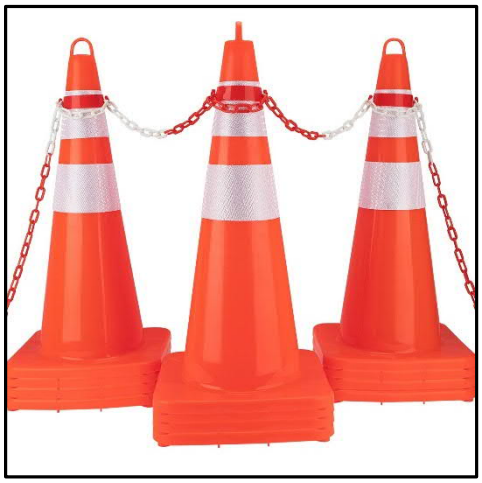
Appendix 4.1 Barrier & Sign Types

Stanchion Type



Cone Type

A-Frame Type

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Appendix 4.2 Barrier & Sign Types

RF Safety Exposure Categorization

Exposure Conditions	Control Measures	Signage
• Operational of the source(s) or locations where RF fields are too weak to cause exposures greater than General Public limit. Cat. | Occupational Worker | General Public 1 | <20% | <100% • Green zone is where the time and spatial-average is below 20% of Occupational Worker limit or <100% of General Public limit.	• RF Safety Guideline/NIER report must be submitted to RFSO for approval. • No special EME safety practices required in these areas. • No signage required except Information sign.	 *the antenna owner information and Antenna Structure Registration Number and must be displayed on the sign. INFORMATION sign for access to rooftop/access door.
• Operational of the source(s) or locations where RF exposure could cause exposure greater than General Public limit but not the Occupational Worker limit to be exceeded in accessible areas. Cat. | Occupational Worker | General 2 | ≥20% but <100% | >100% • Blue zone is where the spatial average is between 20%-100% of Occupational Worker limit. This limit MUST be less than the Occupational limit.	• RF Safety Guideline/NIER report must be submitted to RFSO for approval. • *Recommended* RF safety awareness training for all workers in this area. • Controlled areas with barriers and/or signage required in these area. • Do not walk in front of the antenna face or no loitering in this controlled area. • Individual MUST have full control over any area where the exposure levels exceed the limit.	 NOTICE signage shall be posted on the barriers/stanchion to prevent anyone from entering into the area (must be cordon off around the antennas - 4 posts /3 signs). Or must be posted in location that can be easily viewed by individuals that enter the areas of concerns.
• Operational of the source(s) or locations where RF exposure exceeded the Occupational Worker limit in accessible areas. Cat. | Occupational Worker | General Public 3 | ≥100% | ≥500% • Yellow zone is where the spatial average is above 100% of Occupational Worker limit.	• RF Safety Guideline/NIER report must be submitted to RFSO for approval. • Individual **shall not** enter and work in these areas without RS approval • Required RF safety training and access area is restricted only for authorized worker. • Controlled areas with barriers and signage required in these area. • Do not walk in front of the antenna face. • Require reduction of RF power and approval from Radiation Safety prior any work on the antennas.	 CAUTION signage shall be posted on the barriers/stanchion to prevent anyone from entering into the area (must be cordon off around the antennas - 4 posts /3 signs).
• Exposure will exceed exposure limit in accessible areas. Cat. | Occupational Worker | General Public 4 | >500% | >1000% • Red zone is where the time and spatial-averaged levels fall above 500% of Occupational Worker limit or is not feasible to prevent exposures.	• RF Safety Guideline/NIER report must be submitted to RFSO for approval. • MUST re-engineer site to reduce the EME fields. • **No access allowed-Prohibited access!** There must be controls to detect any unauthorized enter and terminate the RF energy in the area. • Lock out tag out of transmitters during the maintenance of the antenna system. • PPE is not sufficient. • Special RF training and PPE are required. (Applies only to individuals trained by RS).	 RF WARNING & Pacemaker DANGER signage or appropriate DANGER sign shall be posted very near radiation RF sources or if appropriate DANGER sign.

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Appendix 5 Information Pertaining to MPE Studies

In 1985, the FCC first adopted guidelines to be used for evaluating human exposure to RF emissions. The FCC revised and updated these guidelines on August 1, 1996, as a result of a rule-making proceeding initiated in 1993. The new guidelines incorporate limits for Maximum Permissible Exposure (MPE) in terms of electric and magnetic field strength and power density for transmitters operating at frequencies between 300 kHz and 100 GHz.

The FCC's MPE limits are 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 were 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's limits, and the NCRP and ANSI/IEEE limits on which they are based, are derived from exposure criteria quantified in terms of specific absorption rate (SAR). The basis for these limits is a whole-body averaged SAR threshold level of 4 watts per kilogram (4 W/kg), as averaged over the entire mass of the body, above which expert organizations have determined that potentially hazardous exposures may occur. The MPE limits are derived by incorporating safety factors that lead, in some cases, to limits that are more conservative than the limits originally adopted by the FCC in 1985. Where more conservative limits exist, they do not arise from a fundamental change in the RF safety criteria for whole-body averaged SAR, but from a precautionary desire to protect subgroups of the general population who, potentially, may be more at risk.

The FCC exposure limits are also based on data showing that the human body absorbs RF energy at some frequencies more efficiently than at others. The most restrictive limits occur in the frequency range of 30-300 MHz where whole-body absorption of RF energy by human beings is most efficient. At other frequencies, whole-body absorption is less efficient, and consequently, the MPE limits are less restrictive.

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MPE limits are defined in terms of power density (units of milliwatts per centimeter squared: mW/cm^2), electric field strength (units of volts per meter: V/m) and magnetic field strength (units of amperes per meter: A/m). The far-field of a transmitting antenna is where the electric field vector (E), the magnetic field vector (H), and the direction of propagation can be considered to be all mutually orthogonal ("plane-wave" conditions).

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 population/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 population/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. Additional details can be found in FCC OET 65.

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Appendix 6 MPE Standards Methodology

This study predicts RF field strength and power density levels that emanate from communications system antennae. It considers all transmitter power levels (less filter and line losses) delivered to each active transmitting antenna at the communications site. Calculations are performed to determine power density and MPE levels for each antenna as well as composite levels from all antennas. The calculated levels are based on where a human (Observer) would be standing at various locations at the site. The point of interest where the MPE level is predicted is based on the height of the Observer.

Compliance with the FCC limits on RF emissions are determined by spatially averaging a person's exposure over the projected area of an adult human body, that is approximately six-feet or two-meters, as defined in the ANSI/IEEE C95.1 standard. The MPE limits are specified as time-averaged exposure limits. This means that exposure is averaged over an identifiable time interval. It is 30 minutes for the general population/uncontrolled RF environment and 6 minutes for the occupational/controlled RF environment. However, in the case of the general public, time averaging should not be applied because the general public is typically not aware of RF exposure, and they do not have control of their exposure time. Therefore, it should be assumed that any RF exposure to the general public will be continuous.

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The FCC's limits for exposure at different frequencies are shown in the following Tables.

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)	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

f = frequency

* = Plane-wave equivalent power density

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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.

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)	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

* = Plane-wave equivalent power density

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.

It is important to understand that these limits apply cumulatively to all sources of RF emissions affecting a given area. For example, if several different communications system antennas occupy a shared facility such as a tower or rooftop, then the total exposure from all systems at the facility must be within compliance of the FCC guidelines.

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The field strength emanating from an antenna can be estimated based on the characteristics of an antenna radiating in free space. There are basically two field areas associated with a radiating antenna. When close to the antenna, the region is known as the Near Field. Within this region, the characteristics of the RF fields are very complex, and the wave front is extremely curved. As you move further from the antenna, the wave front has less curvature and becomes planar. The wave front still has a curvature, but it appears to occupy a flat plane in space (plane-wave radiation). This region is known as the Far Field.

Two models are utilized to predict Near and Far field power densities. They are based on the formulae in FCC OET 65.

Cylindrical Model (Near Field Predictions)

Spatially averaged plane-wave equivalent power densities parallel to the antenna may be estimated by dividing the antenna input power by the surface area of an imaginary cylinder surrounding the length of the radiating antenna. While the actual power density will vary along the height of the antenna, the average value along its length will closely follow the relation given by the following equation:

$$S = P \div 2\pi RL$$

Where:

S = Power Density

P = Total Power into antenna

R = Distance from the antenna

L = Antenna aperture length

For directional-type antennas, power densities can be estimated by dividing the input power by that portion of a cylindrical surface area corresponding to the angular beam width of the antenna.

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For example, for the case of a 120-degree azimuthal beam width, the surface area should correspond to 1/3 that of a full cylinder. This would increase the power density near the antenna by a factor of three over that for a purely omni-directional antenna. Mathematically, this can be represented by the following formula:

$$S = (180 / \theta_{BW}) P \div \pi RL$$

Where:

S = Power Density

θ_{BW} = Beam width of antenna in degrees (3 dB half-power point)

P = Total Power into antenna

R = Distance from the antenna

L = Antenna aperture length

If the antenna is a 360-degree omni-directional antenna, this formula would be equivalent to the previous formula.

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Spherical Model (Far Field Predictions)

Spatially averaged plane-wave power densities in the Far Field of an antenna may be estimated by considering the additional factors of antenna gain and reflective waves that would contribute to exposure.

The radiation pattern of an antenna has developed in the Far Field region and the power gain needs to be considered in exposure predictions. Also, if the vertical radiation pattern of the antenna is considered, the exposure predictions would most likely be reduced significantly at ground level, resulting in a more realistic estimate of the actual exposure levels.

Additionally, to model a truly "worst case" prediction of exposure levels at or near a surface, such as at ground-level or on a rooftop, reflection off the surface of antenna radiation power can be assumed, resulting in a potential four-fold increase in power density.

These additional factors are considered, and the Far Field prediction model is determined by the following equation:

$$S = EIRP \times Rc \div 4\pi R^2$$

Where:

S = Power Density

EIRP = Effective Radiated Power from antenna

Rc = Reflection Coefficient (2.56)

R = Distance from the antenna

The EIRP includes the antenna gain. If the antenna pattern is considered, the antenna gain is relative based on the horizontal and vertical pattern gain values at that particular location in space, on a rooftop or on the ground. However, it is recommended that the antenna radiation pattern characteristics not be considered to provide a conservative "worst case" prediction. This is the equation is utilized for the Far Field exposure predictions herein.