**Vertical Bridge • Site No. US-CA-7268**
**T-Mobile West LLC • Proposed Base Station (Site No. SV14231B)**
**Public Right-of-Way on Mulholland Drive • Los Angeles, California**

## Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained by Vertical Bridge, a wireless telecommunications facilities provider, to evaluate the T-Mobile West LLC base station (Site No. SV14231B) proposed to be located in the public right-of-way on Mulholland Drive in Los Angeles, California, for compliance with appropriate guidelines limiting human exposure to radio frequency ("RF") electromagnetic fields.


## Executive Summary

T-Mobile proposes to install antennas on a tall pole, configured to resemble a pine tree, to be sited near a hilltop on Mulholland Drive in Los Angeles. The proposed operation will comply with the FCC guidelines limiting public exposure to RF energy.


## Prevailing Exposure Standard

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. A summary of the FCC's exposure limits is shown in Figure 1. 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. The most restrictive limit for exposures of unlimited duration at several wireless service bands are as follows:

| Wireless Service Band | Transmit Frequency | "Uncontrolled" Public Limit | Occupational Limit (5 times Public) |
|---|---|---|---|
| Microwave (point-to-point) | 1–80 GHz | 1.0 $mW/cm^2$ | 5.0 $mW/cm^2$ |
| Millimeter-wave | 24–47 | 1.0 | 5.0 |
| Part 15 (WiFi & other unlicensed) | 2–6 | 1.0 | 5.0 |
| C-Band | 3,700 MHz | 1.0 | 5.0 |
| CBRS (Citizens Broadband Radio) | 3,550 | 1.0 | 5.0 |
| BRS (Broadband Radio) | 2,490 | 1.0 | 5.0 |
| WCS (Wireless Communication) | 2,305 | 1.0 | 5.0 |
| AWS (Advanced Wireless) | 2,110 | 1.0 | 5.0 |
| PCS (Personal Communication) | 1,930 | 1.0 | 5.0 |
| Cellular | 869 | 0.58 | 2.9 |
| SMR (Specialized Mobile Radio) | 854 | 0.57 | 2.85 |
| 700 MHz | 716 | 0.48 | 2.4 |
| 600 MHz | 617 | 0.41 | 2.05 |
| [most restrictive frequency range] | 30–300 | 0.20 | 1.0 |

## General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called "radios") that are connected to the traditional wired telephone lines, and the antennas that send the wireless signals created by the radios out to be received by individual subscriber units. The transceivers are often located at ground level and are connected to the antennas by coaxial cables. Because of the short wavelength of the frequencies assigned by the FCC for wireless services, the antennas require line-of-sight paths for their signals to propagate well and so are installed at some height above ground. The antennas are designed to concentrate their energy toward the horizon, with very little energy wasted toward the sky or the ground. This means that it is generally not possible for exposure conditions to approach the maximum permissible exposure limits without being physically very near the antennas.

## Computer Modeling Method

The FCC provides direction for determining compliance in its office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation," dated August 1997. Figure 2 describes the calculation methodologies, reflecting the facts that a directional antenna's radiation pattern is not fully formed at locations very close by (the "near-field" effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the "inverse square law"). This methodology is an industry standard for evaluating RF exposure conditions and has been demonstrated through numerous field tests to be a conservative prediction of exposure levels.

## Site and Facility Description

Based upon information provided by T-Mobile, including drawings by Assurance Development, dated February 16, 2023, it is proposed to install six directional panel antennas – three each RFS Model APXVAALL24_43-U-NA20 and Ericsson Model AIR6419 – on a 60-foot pole, configured to resemble a pine tree,* to be sited on a hilltop in the public right-of-way on Mulholland Drive in Los Angeles, about 260 feet† south of the residence located at 20133 Greenbriar Drive. The RFS and Ericsson antennas would employ up to 12° and up to 19° downtilt, respectively, would be mounted at effective heights of about 56 feet and 58½ above ground, respectively, and would be oriented in identical pairs toward 60°T, 180°T, and 320°T. The maximum effective radiated power

* Foliage atop the pole puts the overall height at about 65 feet.

† Based on the drawings.

in any direction would be 35,020 watts, representing simultaneous operation at 14,230 watts for BRS,[‡] 6,960 watts for AWS, 9,570 watts for PCS, 880 watts for 700 MHz, and 3,380 watts for 600 MHz service. Also proposed to be located on the pole at an effective height of about 54 feet above ground is a 2-foot microwave "dish" antenna, for interconnection of this site with others in the T-Mobile network. There are reported no other wireless telecommunications base stations at the site or nearby.

## Study Results

For a person anywhere at ground, the maximum RF exposure level due to the proposed T-Mobile operation, including the contribution of the microwave dish, is calculated to be 0.35 mW/cm$^2$, which is 44% of the applicable public exposure limit. The maximum calculated level at the second-floor elevation of any nearby building[§] is 33% of the public exposure limit. The maximum calculated level at the second-floor elevation of any nearby residence is 11% of the public exposure limit. It should be noted that these results include several "worst-case" assumptions and therefore are expected to overstate actual power density levels from the proposed operation.

## RF Safety Plan

Due to their mounting location and height, the T-Mobile antennas would not be accessible to unauthorized persons, and so no measures are necessary to comply with the FCC public exposure guidelines. It is presumed that T-Mobile will, as an FCC licensee, take adequate steps to ensure that its employees or contractors receive appropriate training and comply with FCC occupational exposure guidelines whenever work is required near the antennas themselves.

## Conclusion

Based on the information and analysis above, it is the undersigned's professional opinion that operation of the base station proposed by T-Mobile West LLC in the public right-of-way on Mulholland Drive in Los Angeles, California, will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment. The highest calculated level in publicly accessible areas is much less than the prevailing standards allow for exposures of unlimited duration. This finding is consistent with measurements of actual exposure conditions taken at other operating base stations.

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‡ T-Mobile reports maximum effective radiated power in this band of 59,310 watts, to which a duty cycle of 75% is applied; a statistical factor of 32% is also included, to account for spatial distribution of served users, based on the United Nations International Telecommunication Union ITU-T Series K, Supplement 16, dated May 20, 2019.

§ Located at least 180 feet away, based on photographs from Google Maps.

## Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2025. This work has been carried out under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.


William F. Hammett, P.E.
707/996-5200

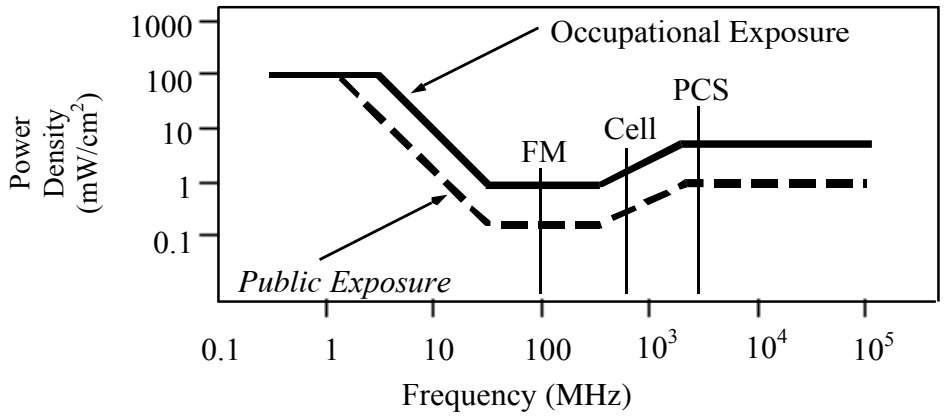
March 13, 2024

## FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers IEEE C95.1-2019, "Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz," includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

| Frequency | Electromagnetic Fields (f is frequency of emission in MHz) | | | | | |
|---|---|---|---|---|---|---|
| Applicable Range (MHz) | Electric Field Strength (V/m) | | Magnetic Field Strength (A/m) | | Equivalent Far-Field Power Density ($mW/cm^2$) | |
| 0.3 – 1.34 | 614 | *614* | 1.63 | *1.63* | 100 | *100* |
| 1.34 – 3.0 | 614 | *823.8/ f* | 1.63 | *2.19/ f* | 100 | *180/ $f^2$* |
| 3.0 – 30 | 1842/ f | *823.8/ f* | 4.89/ f | *2.19/ f* | 900/ $f^2$ | *180/ $f^2$* |
| 30 – 300 | 61.4 | *27.5* | 0.163 | *0.0729* | 1.0 | *0.2* |
| 300 – 1,500 | $3.54\sqrt{f}$ | *$1.59\sqrt{f}$* | $\sqrt{f}/106$ | *$\sqrt{f}/238$* | f/300 | *f/1500* |
| 1,500 – 100,000 | 137 | *61.4* | 0.364 | *0.163* | 5.0 | *1.0* |




Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. Hammett & Edison has incorporated conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels in a computer program capable of calculating, at thousands of locations on an arbitrary grid, the total expected power density from any number of individual radio frequency sources. The program allows for the inclusion of uneven terrain in the vicinity, as well as any number of nearby buildings of varying heights, to obtain more accurate projections.

## RFE.CALC™ Calculation Methodology

### Assessment by Calculation of Compliance with FCC Exposure Guidelines

Hammett & Edison has incorporated the FCC Office of Engineering and Technology Bulletin No. 65 ("OET-65") formulas (see Figure 1) in a computer program that calculates, at millions of locations on a grid, the total expected power density from any number of individual radio frequency sources. The program uses the specific antenna patterns from the manufacturers and allows for the inclusion of uneven terrain in the vicinity, as well as any number of nearby buildings of varying heights, to obtain accurate projections of RF exposure levels. The program can account for spatial-averaging when antenna patterns are sufficiently narrow, and time-averaging is typically considered when operation is in single-frequency bands, which require time-sharing between the base station and the subscriber devices.

OET-65 provides this formula for calculating power density in the far-field from an individual RF source:

$$\text{power density} \qquad S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2} \quad \text{in } mW/cm^2$$

where ERP = total Effective Radiated Power (all polarizations), in kilowatts,
RFF = three-dimensional relative field factor toward point of calculation, and
D = distance from antenna effective height to point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to reflections, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). This factor is typically used for all sources unless specific information from FCC filings by the manufacturer indicate that a different reflection coefficient would apply. The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density.

Because antennas are not true "point sources," their signal patterns may not be fully formed at close distances and so exposure levels may be lower than otherwise calculated by the formula above. OET-65 recommends the cylindrical model formula below to account for this "near-field effect":

$$\text{power density} \qquad S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D \times h} \quad \text{in } mW/cm^2$$

where $P_{net}$ = net power input to antenna, in watts,
$\theta_{BW}$ = half-power beamwidth of antenna, in degrees,
D = distance from antenna effective height to point of calculation, in meters, and
h = aperture height of antenna, in meters.

The factor of 0.1 in the numerator converts to the desired units of power density.

OET-65 confirms that the "crossover" point between the near- and far-field regions is best determined by finding where the calculations coincide from the two different formulas, and the program uses both formulas to calculate power density.