**Verizon Wireless • Proposed Base Station (Site No. 625883 "San Domenico")**
**1500 Butterfield Road • San Anselmo, California**

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

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Verizon Wireless, a personal wireless telecommunications carrier, to evaluate the base station (Site No. 625883 "San Domenico") proposed to be located at 1500 Butterfield Road near San Anselmo, California, for compliance with appropriate guidelines limiting sound levels from the installation.

## Executive Summary

Verizon proposes to install antennas and equipment at the San Domenico School located at 1500 Butterfield Road near San Anselmo, in Marin County. Noise levels from the equipment operations will comply with the County's permitted limits.

## Prevailing Standard

The proposed site is in unincorporated Marin County about 1½ miles outside the City of San Anselmo. The County regulates noise in its Countywide Plan, adopted November 6, 2007. Figure 3-43 lists the following allowable noise levels at the property lines of the receiving land use:

| | Daytime | Nighttime |
|---|---|---|
| | *7 am to 10 pm* | *10 pm to 7 am* |
| Hourly Average | 50 dBA | 45 dBA |
| Maximum Level | 70 | 65 |

Nighttime standards apply only when the receiving land use operates or is occupied at night. The allowable noise level is tightened by 5 dB if the measured existing ambient hourly average is at least 10 dB lower than the pertinent noise limit above. Goal NO-1.a states that these standards shall apply for any new stationary noise-generating developments proposed near existing residential or other noise-sensitive land uses.

Figure 1 attached describes the calculation methodology used to determine applicable noise levels for evaluation against the prevailing standard.

## General Facility Requirements

Wireless telecommunications facilities ("cell sites") typically consist of two distinct parts: the electronic base transceiver stations ("BTS" or "cabinets") that are connected to traditional wired telephone lines, and the antennas that send wireless signals created by the BTS out to be received by individual subscriber units. The BTS are often located outdoors at ground level and are connected to the antennas by coaxial cables. The BTS typically require environmental units to cool the electronics inside. Such cooling is often integrated into the BTS, although external air conditioning may be installed, especially when the BTS are housed within a larger enclosure.

Most cell sites have back-up battery power available, to run the base station for some number of hours in the event of a power outage. Many sites have back-up power generators installed, to run the station during an extended power outage.

## Site & Facility Description

Based upon information provided by Verizon, including zoning drawings by Cellsite Concepts, dated August 27, 2020, that carrier proposes to install three equipment cabinets and a 30 kW back-up diesel generator – assumed to be three Ericsson Model 6160 and a Generac Model RD030, respectively, for the limited purpose of this study – within a new fenced enclosure on the northeast side of Butterfield Road, on the southeast area of the San Domenico School at 1500 Butterfield Road, whose main campus is about 1,300 feet to the northwest. The nearest edge of that property is about 500 feet from the proposed equipment to the west.

Verizon also proposes to install nine antennas and six radios within a 30-foot tall structure, configured to resemble a water tank, to be constructed about 350 feet to the northeast of the equipment. The antennas are passive, generating no noise, and due to the distance and terrain between the sites, any noise from the radios would not contribute significantly to cumulative noise levels at the equipment enclosure or at property lines farther away.

## Study Results

The manufacturers report the following maximum noise levels from their equipment:

| Equipment | Maximum Noise Level | Reference Distance |
|---|---|---|
| 6160 cabinet | 64.3 dBA | 5 ft |
| RD030 generator | 65 | 23 |

The maximum calculated noise level at the nearest property line, for the everyday, simultaneous operation of all three equipment cabinets, is 29.1 dBA, well below the County's most restrictive, nighttime limit of 40 dBA (45 dBA nighttime limit minus the potential 5 dBA penalty). When the generator is exercised for testing or during its continuous operation in the event of an extended outage of commercial power, the noise level at that location is calculated to rise to 38.8 dBA, still meeting the County's limit. Noise levels at property lines farther away would be lower.

## Conclusion

Based on the information and analysis above, it is the undersigned's professional opinion that the operation of the Verizon Wireless base station proposed to be located at 1500 Butterfield Road near San Anselmo, California, will comply with that County's requirements for limiting acoustic noise emission levels.

## 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, 2023. 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.


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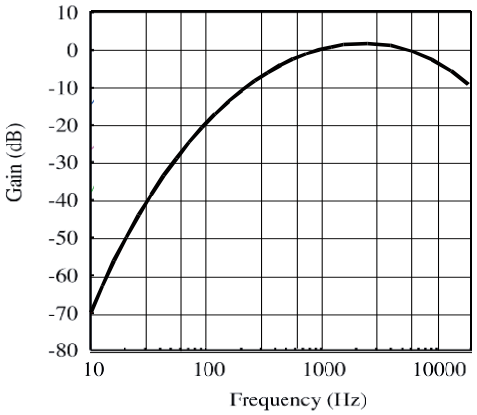
# Noise Level Calculation Methodology

Most municipalities and other agencies specify noise limits in units of dBA, which is intended to mimic the reduced receptivity of the human ear to Sound Pressure ("$L_P$") at particularly low or high frequencies. This frequency-sensitive filter shape, shown in the graph to the right as defined in the International Electrotechnical Commission Standard No. 179, the American National Standards Institute Standard No. 5.1, and various other standards, is also incorporated into most calibrated field test equipment for measuring noise levels.




| | |
|---|---|
| 30 dBA | library |
| 40 dBA | rural background |
| 50 dBA | office space |
| 60 dBA | conversation |
| 70 dBA | car radio |
| 80 dBA | traffic corner |
| 90 dBA | lawnmower |

The dBA units of measure are referenced to a pressure of 20 µPa (micropascals), which is the threshold of normal hearing. Although noise levels vary greatly by location and noise source, representative levels are shown in the box to the left.

Manufacturers of many types of equipment, such as air conditioners, generators, and telecommunications devices, often test their products in various configurations to determine the acoustical emissions at certain distances. This data, normally expressed in dBA at a known reference distance, can be used to determine the corresponding sound pressure level at any particular distance, such as at a nearby building or property line. The sound pressure drops as the square of the increase in distance, according to the formula:

$$L_P = L_K + 20 \log(D_K/D_P),$$

where $L_P$ is the sound pressure level at distance $D_p$ and $L_K$ is the known sound pressure level at distance $D_K$.

Individual sound pressure levels at a particular point from several different noise sources cannot be combined directly in units of dBA. Rather, the units need to be converted to scalar sound intensity units in order to be added together, then converted back to decibel units, according to the formula:

where $L_T$ is the total sound pressure level and $L_1$, $L_2$, etc are individual sound pressure levels.

$$L_T = 10 \log \left(10^{L_1/10} + 10^{L_2/10} + \ldots\right),$$

Certain equipment installations may include the placement of barriers and/or absorptive materials to reduce transmission of noise beyond the site. Noise Reduction Coefficients ("NRC") are published for many different materials, expressed as unitless power factors, with 0 being perfect reflection and 1 being perfect absorption. Unpainted concrete block, for instance, can have an NRC as high as 0.35. However, a barrier's effectiveness depends on its specific configuration, as well as the materials used and their surface treatment.