Verizon Wireless • Proposed Base Station (Site No. 384476 "Soda Springs")
10244 Soda Springs Road • Nevada County, 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 telecommunications carrier, to evaluate the base station (Site No. 384476 "Soda Springs") proposed to be located on 10244 Soda Springs Road in the Soda Springs area of unincorporated Nevada County, California, for compliance with appropriate guidelines limiting sound levels from the installation.

Executive Summary

Verizon proposes to install a new base station, consisting of equipment cabinets, a back-up generator, and antennas on an existing tall pole, at 10244 Soda Springs Road in the Soda Springs area of unincorporated Nevada County, California. Noise levels from the equipment operations will be below the County's permitted limits.

Prevailing Standard

The County of Nevada sets forth limits on sound levels in Chapter 11 of its Land Use and Development Code. Table L-11 4.1.7 ("Noise") gives the following maximum average noise levels applying for the time periods and identified land use categories:

Land Use Category	Zoning Districts	Daytime *7 am to 7 pm*	Evening *7 pm to 10 pm*	Night *10 pm to 7 am*
Rural	AG, TPZ, AE, OS, FR, IDR	55 dBA	50 dBA	40 dBA
Residential/Public	RA, R1, R2, R3, P	55	50	45
Commercial/Recreation	C1, CH, CS, C2, C3, OP, REC	70	65	65
Business Park	BP	65	60	60
Industrial	M1, M2	80	80	80

If measured ambient noise already exceeds these levels, then the allowable noise level is set at 5 dBA above that ambient, according to §4.1.7.D.6. Section 4.1.7.D.8 exempts from the above standard those activities associated with the provision of emergency services or functions, such as the operation of the back-up power generator during an emergency, when commercial power is unavailable; for the purpose of this study, the generator's operation during periodic, no-load testing is evaluated for compliance.

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 MT2 Telecom, dated December 8, 2015, that carrier proposes to place equipment cabinets on a new raised platform to be constructed adjacent to the north side of the existing T-Mobile equipment compound located on the property (zoned "Forest, Recreation") located at 10244 Soda Springs Road in the Soda Springs area of unincorporated Nevada County, next to Soda Springs ski area. For the purpose of this study, the four equipment cabinets with active cooling fans are assumed to be one Charles Model CUBE-SS4C215XC1, one Charles Model CUBE-PM63912JF1, and two Ericsson Model RBS6101.

A Generac Model SD030 back-up diesel generator, configured with the manufacturer's Level 2A* sound enclosure, is to be installed on the platform, for emergency use in the event of an extended commercial power outage. The generator is typically operated with no load for a single 15-minute period once a week during daytime hours on a weekday, to maintain its readiness for emergency operation.

Several directional panel antennas are proposed to be installed on an existing tall pole, configured to resemble a pine tree, sited within the T-Mobile compound; this portion of the base station is passive, generating no noise. The nearest parcel is located to the east, across Soda Springs Road, about 105 feet away, and is zoned "Forest, Recreational"; the most restrictive noise limits for any land use category are assumed to apply. Parcels in other directions are much farther away.

* A custom version for Verizon's use.

Study Results

Information provided by the manufacturers gives the following maximum noise levels from the proposed equipment:

Equipment	Maximum Noise Level	Reference Distance
CUBE-SS4C215XC1	67.3 dBA	1.5 meters
CUBE-PM63912KN1	62 dBA	1.5 meters
Ericsson RBS6101	53 dBA	1 meter
Generac SD030	63.0 dBA	23 feet

The maximum calculated noise level at the nearest parcel, for continuous operation of all fans in all four cabinets, is 40.9 dBA, well below the County's most restrictive daytime and evening limits of 55 dBA and 50 dBA, respectively. On the day on which the generator is tested, the maximum calculated cumulative average noise level is 41.4 dBA, still well below the County's daytime limit. The maximum calculated average noise level for the operation of the fans at a 75% duty cycle during the night, when ambient temperatures are lower, is 39.6 dBA, below the County's most restrictive nighttime limit of 40 dBA.

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 10244 Soda Springs Road in the Soda Springs area of unincorporated Nevada County, California, will comply with the County's requirements for limiting acoustic noise emission levels.

Authorship

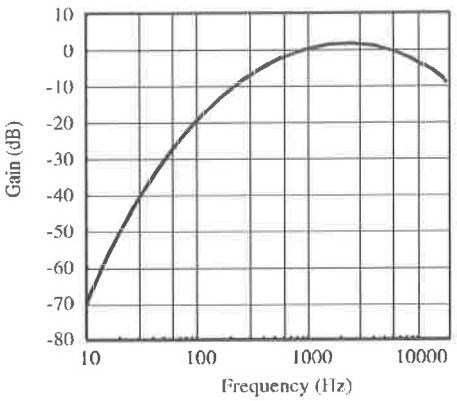
The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2017. This work has been carried out under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.

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

May 2, 2016

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.