Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Royal Street Communications, LLC, a personal wireless telecommunications carrier, to evaluate the base station (Site No. LA0366A) proposed to be located at 315 4th Avenue in Venice, California, for compliance with appropriate guidelines limiting human exposure to radio frequency ("RF") electromagnetic fields.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in 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 Institute of Electrical and Electronics Engineers ("IEEE") Standard C95.1-2005, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar exposure limits. 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 FCC limit for exposures of unlimited duration to radio frequency energy for several personal wireless services are as follows:

Personal Wireless Service	Approx. Frequency	Occupational Limit	Public Limit
Personal Communication ("PCS")	1,950 MHz	5.00 mW/cm^2	1.00 mW/cm^2
Cellular Telephone	870	2.90	0.58
Specialized Mobile Radio	855	2.85	0.57
[most restrictive frequency range]	30–300	1.00	0.20

The FCC exposure limits are not intended to protect against interference to implanted medical devices. The Food and Drug Administration has worked with the Association for the Advancement of Medical Instrumentation to develop immunity testing standards for such devices. While power density levels in compliance with the FCC public exposure limit are considered low enough not to interfere with the operation of implanted medical devices, persons who work in controlled environments are expected to have been informed by the appropriate medical personnel of any necessary precautions they should follow to protect the operation of their particular devices.

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called "radios" or "channels") that are connected to the traditional wired telephone lines, and the passive 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 about 1 inch thick. 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. Along with the low power of such facilities, 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 attached 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"). The conservative nature of this method for evaluating exposure conditions has been verified by numerous field tests.

Site and Facility Description

Based upon information provided by Royal Street, including zoning drawings by Trussnet USA, Inc., dated January 18, 2006, it is proposed to mount three Andrew Model UMWD-06516-XDH directional panel PCS antennas behind view screens to be installed above the roof of the commercial building located at 315 4th Avenue in Venice. The antennas would be mounted with up to 3° downtilt at an effective height of about 37 feet above ground and would be oriented at about 120° spacing, to provide service in all directions. The maximum effective radiated power in any direction would be 1,614 watts, representing the simultaneous operation of three channels at 538 watts each. Also proposed to be mounted above the roof is a 2-foot microwave "dish" antenna, for interconnection of this site with others in the Royal Street network.

Presently installed above the roof are similar antennas for use by T-Mobile,[*] and reported to be installed above the roof of a separate building on the same property, about 80 feet to the southeast, are

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[*] Formerly Cingular Wireless.

similar antennas for use by Verizon Wireless. For the limited purpose of this study, transmitting facilities of those carriers are assumed to be as follows:

Carrier	Antenna Model	Height	Service	Maximum ERP
T-Mobile	EMS RR6515-02DPL	37 ft	PCS	1,500 watts
Verizon	Andrew 731DG65	37	$\left\{ \begin{array}{l} \text{Cellular} \\ \text{PCS} \end{array} \right.$	1,500 1,500

Study Results

For a person anywhere at ground, the maximum ambient RF exposure level due to the proposed Royal Street operation by itself is calculated to be 0.0036 mW/cm^2, which is 0.36% of the applicable public exposure limit. The maximum calculated cumulative level at ground, for the simultaneous operation of all three carriers, is 2.8% of the public exposure limit. The maximum calculated cumulative level at the second-floor elevation of any building off the premises[†] is 18% of the public limit. It should be noted that these results include several "worst-case" assumptions and therefore are expected to overstate actual power density levels.

Recommended Mitigation Measures

Due to their mounting locations, the antennas are not accessible to the general public, and so no mitigation measures are necessary to comply with the FCC public exposure guidelines. To prevent occupational exposures in excess of the FCC guidelines, no access within 2 feet directly in front of the Royal Street antennas themselves, such as might occur during building maintenance work, should be allowed while the base station is in operation, unless other measures can be demonstrated to ensure that occupational protection requirements are met. Posting explanatory warning signs[‡] at the roof access hatch and at the antennas, such that the signs would be readily visible from any angle of approach to persons who might need to work within that distance, would be sufficient to meet FCC-adopted guidelines. Similar measures should already be in place for the other carriers at the site; applicable keep-back distances have not been determined as part of this study.

Conclusion

Based on the information and analysis above, it is the undersigned's professional opinion that the base station proposed by Royal Street Communications, LLC at 315 4th Avenue in Venice, California, will

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[†] Located at least 115 feet away, based on aerial photographs from Terraserver.

[‡] Warning signs should comply with OET-65 color, symbol, and content recommendations. Contact information should be provided (*e.g.*, a telephone number) to arrange for access to restricted areas. The selection of language(s) is not an engineering matter, and guidance from the landlord, local zoning or health authority, or appropriate professionals may be required.

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. Posting of explanatory signs is recommended to establish compliance with occupational exposure limitations.

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, 2007. This work has been carried out by him or 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.
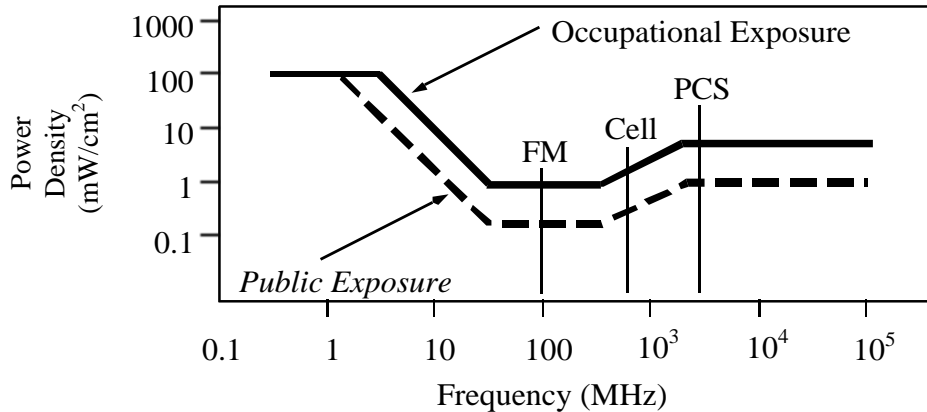
William F. Hammett, P.E.

December 26, 2006

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, which are similar to the more recent Institute of Electrical and Electronics Engineers Standard C95.1-2005, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." 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√f	*1.59√f*	√f /106	*√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. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

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 maximum permissible exposure limits adopted by the FCC (see Figure 1) 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. 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.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications cell sites. The near field zone is defined by the distance, D, from an antenna beyond which the manufacturer's published, far field antenna patterns will be fully formed; the near field may exist for increasing D until some or all of three conditions have been met:

$$1)\ D > \frac{2h^2}{\lambda} \qquad\qquad 2)\ D > 5h \qquad\qquad 3)\ D > 1.6\lambda$$

where h = aperture height of the antenna, in meters, and
λ = wavelength of the transmitted signal, in meters.

The FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives this formula for calculating power density in the near field zone about an individual RF source:

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

where θ_{BW} = half-power beamwidth of antenna, in degrees, and
P_{net} = net power input to the antenna, in watts.

The factor of 0.1 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates distances to FCC public and occupational limits.

Far Field.

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

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

where ERP = total ERP (all polarizations), in kilowatts,
RFF = relative field factor at the direction to the actual point of calculation, and
D = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). 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. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.