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VIA E-Mail: CAsbagh@ci.berkeley.ca.us

SUBJECT: AT&T equipment at 2095 Rose Street, Berkeley, California – Acoustical Study

Dear Claudine:

This letter presents the results of an acoustical study conducted for the proposed wireless telecommunications equipment at 2095 Rose Street in Berkeley, California. The report includes a brief description of the fundamentals of environmental noise and applicable regulatory criteria, documentation of the existing ambient noise environment at nearby noise sensitive areas and an assessment of future noise levels generated by the proposed equipment with respect to the City of Berkeley's Municipal Code.

Fundamentals of Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 1.

Most of the sounds that we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the facts that human hearing is less sensitive at low frequencies and extreme high frequencies than in the frequency mid-range. This is called "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in Table 2 for different types of noise.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1%, 10%, 50%, and 90% of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, L_{dn} (day/night average sound level), was developed. The L_{dn} divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average, which includes both an evening and nighttime weighting.

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Table 1 Definitions of Acoustical Terms Used in this Report

Term	Definitions
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

Table 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), Caltrans, November 2009.

City of Berkeley Noise Ordinance

Noise from the different sources in downtown Berkeley would be subject to Section 13.40 (Community Noise) of the City of Berkeley's Municipal Code. Section 13.40.050 (Exterior Noise Standards) provides the exterior noise limits not to be exceeded more than 30 minutes out of any hour (see **Table 5**). If the measured ambient noise level exceeds these limits, the allowable noise exposure standard would be the ambient noise level.

Table 5: Exterior Noise Limits

Zoning District	Time Period	Noise Level, dBA
R-1, R-2, R-1A, R-2A, and ESR	7:00 a.m. - 10:00 p.m. 10:00 p.m. - 7:00 a.m.	55 45

Existing Noise Environment

The project proposes to install an unmanned wireless telecommunications facility on the roof of an existing commercial office building at 2095 Rose Street, in Berkeley, California. The nearest noise sensitive receiver is a residentially zoned multi-family apartment building north of and adjacent to the property. The ambient noise environment at the site results primarily from traffic along local roadways: Shattuck Street, Henry Street, and Rose Street.

A noise monitoring survey was conducted from February 25, 2013 to February 27, 2013 to quantify the existing noise environment at existing nearby noise sensitive receivers. The noise monitoring survey included one long-term noise measurement (LT-1) and one short-term noise measurement (ST-1), as shown in Figure 1. LT-1 was located approximately 30 feet from the center of Shattuck Avenue and 180 feet from the center of Rose Street. Noise levels measured at this site were primarily the result of traffic along Shattuck Avenue. Hourly average noise levels typically ranged from 55 to 60 dBA L_{eq} during the day, and from 43 to 51 dBA L_{eq} at night. The calculated day-night average noise level at this location ranged from 60 to 61 dBA L_{dn}. Appendix 1 summarizes the data collected at the long-term measurement site.

Short-term noise measurement ST-1 was approximately 125 feet from the center of Shattuck Avenue and 190 feet from the center of Henry Street. The ten-minute average noise level was 57 dBA L_{eq} at this location, which was representative of the southernmost portion of residential receivers located north of 2095 Rose Street. Table 4 summarizes the results of this short-term measurement.

Table 4 Summary of Short-Term Noise Measurement

Noise Measurement Location	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	L_{dn}
ST-1: Façade of nearest neighbor, northern project site property line. (2/27/2013, 14:40-14:50)	58	56	56	53	52	54	57

Note: Ldn approximated by correlating to corresponding period at long-term site.

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Figure 1. Noise Measurement Locations

Future Noise Environment

Trillium Consulting provided manufacturer specifications that were reviewed. There is no noise level data for the 12 proposed panel antennas located on the rooftop. Noise level data was unavailable for the RBS 2106 and RBS 3106 base stations to be located at the rear of the building. Based on a recent noise analysis of similar equipment, conducted by Illingworth and Rodkin Inc., it is assumed the new equipment uses a dehumidifier as compared to the traditional fan system used in units of wireless equipment systems. This newer technology generates much lower noise levels than the existing cabinet cooling systems that require the operation of fans. As a result, noise levels with proposed equipment installed would be anticipated to be no different than ambient noise levels at the nearest receiver.

Summary

Since measured ambient noise levels exceed the limits in the City of Berkeley's Noise Ordinance, the allowable noise exposure standard is the current ambient noise level. The proposed equipment is not anticipated to generate audible noise levels and would not contribute to the ambient noise environment.

This concludes the acoustical study for the telecommunications equipment proposed at 2095 Rose Street in Berkeley, California. If you have any questions, or if we can be of further assistance, please do not hesitate to call.

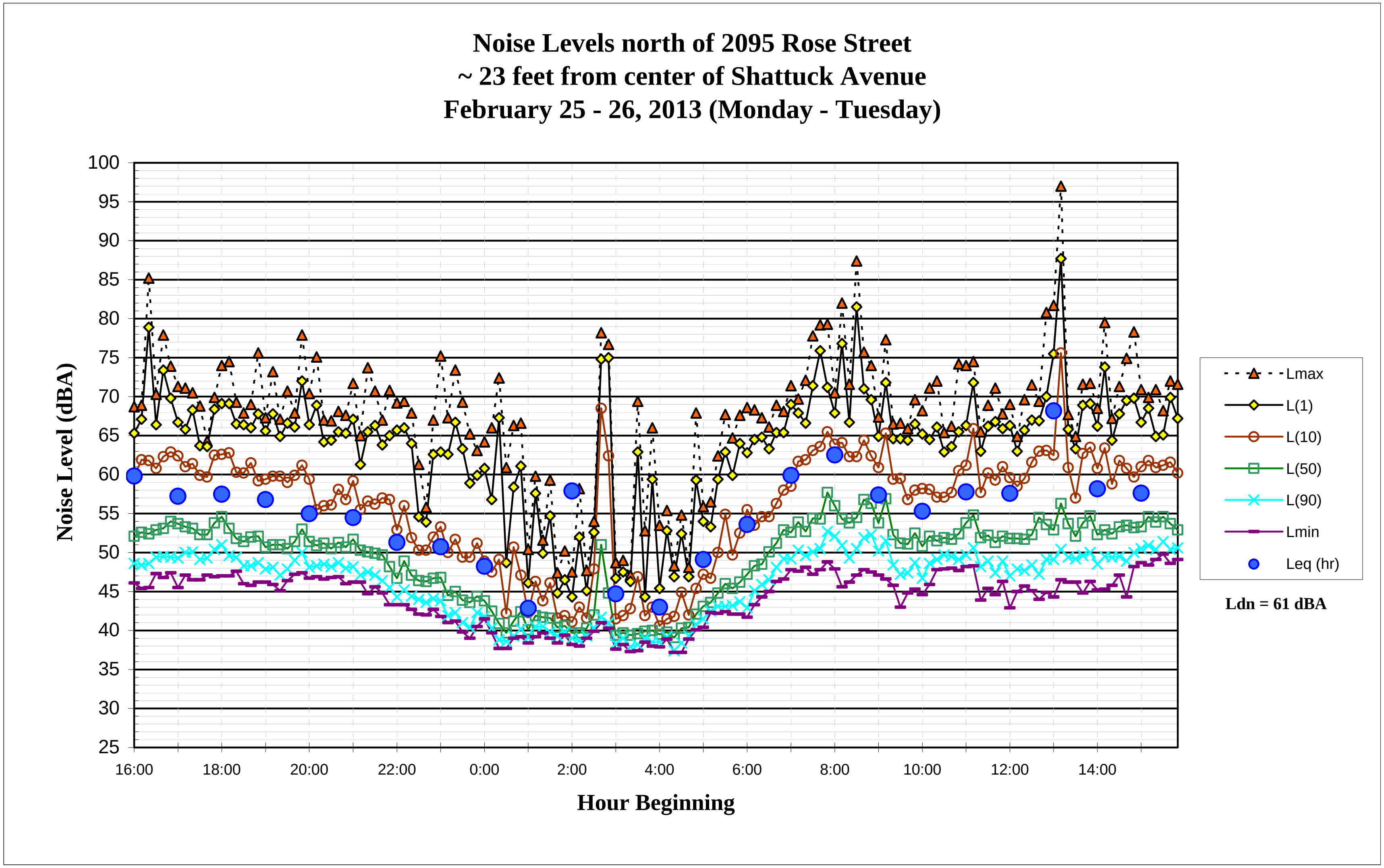
Sincerely,

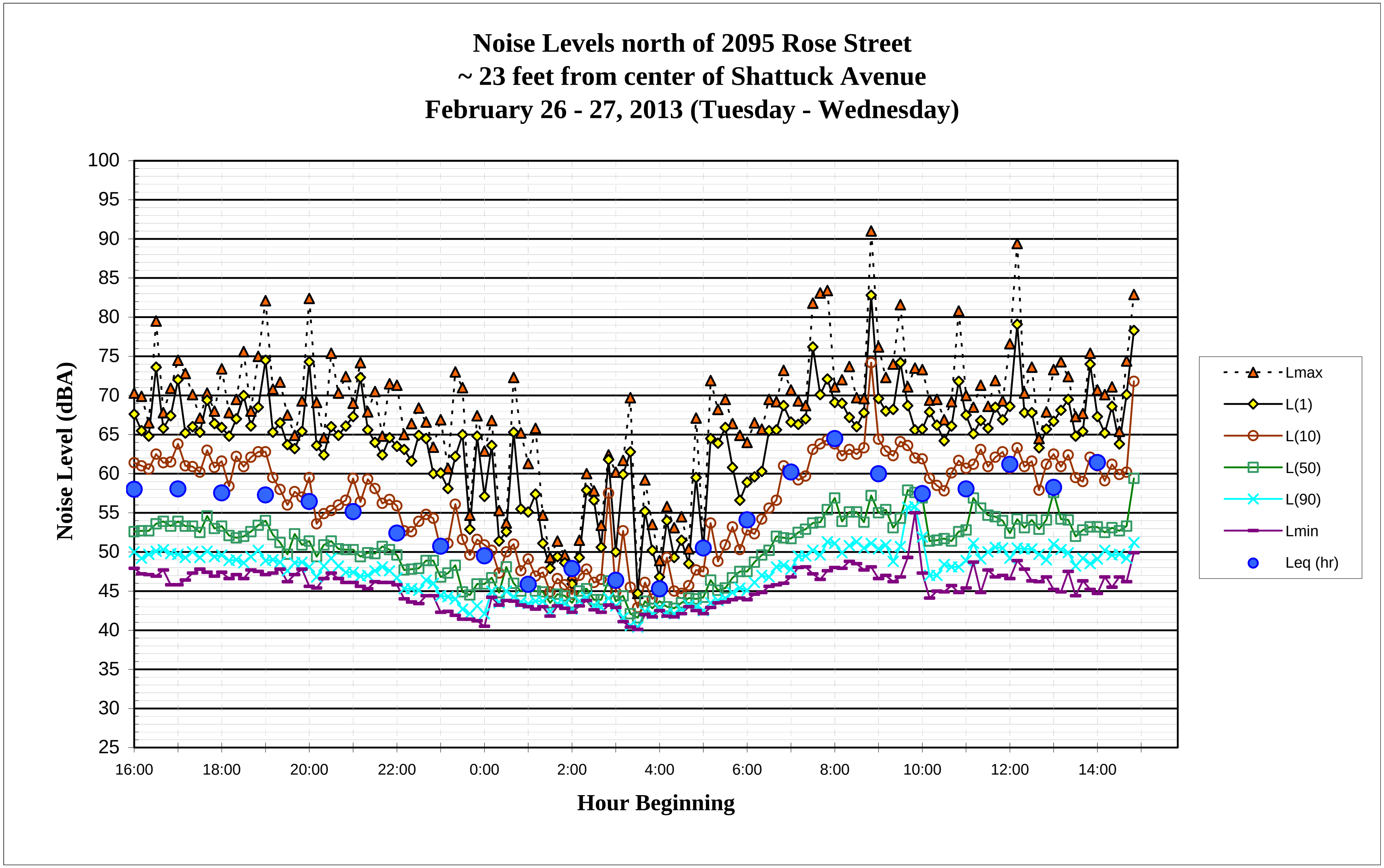
Jordan L. Roberts
Illingworth and Rodkin, Inc

(13-029)

Claudine Asbagh
April 2, 2013

Appendix 1: Daily Trend in Noise Levels




Noise Levels north of 2095 Rose Street
~ 23 feet from center of Shattuck Avenue
February 26 - 27, 2013 (Tuesday - Wednesday)
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)