

NCE TECH MEMO 2020-023



***AT&T Small Cell Noise Analysis for
416 Main Street West Dennis, MA
Revision 1***

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0.0 SUMMARY

Noise Control Engineering, LLC (NCE) has conducted a noise study of a proposed AT&T Small Cell installation at 416 Main Street in West Dennis, Massachusetts. The Town of Dennis, MA zoning bylaws limit the noise from telecommunications facilities to 50 dB(A) at the property line and require that an assessment of existing and future Day-Night Level (L_{dn}) is calculated for the proposed site. Unattended ambient noise monitoring was performed from July 6th to July 10th, 2020 near the northern property line of the site. The lowest calculated ambient (existing) L_{dn} for the site was found to be 49 dB(A).

The site is proposed to include two Ericsson 4402 radios and one Ericsson 2205 radio. Vendor provided sound levels were used for both units. Predictions were performed at five nearby potentially sensitive abutters: a pedestrian walking immediately adjacent to the existing pole and the nearest property lines to the north, east, south, and west.

Noise levels at all evaluated locations are predicted to meet the town criteria of 50 dB(A) for temperatures of 104 °F or less. Existing plus proposed equipment L_{dn} for the site does not show a meaningful change from the ambient L_{dn} as the predicted equipment noise levels at the property lines are well below the 49 dB(A) ambient L_{dn} .

Revision 1 of this document corrects an error which was included in the previous Section 0.0 Summary. Revision 0 noted that vendor data was unavailable for one of the radios. This was the case in some previous studies as data for the model 4402 unit was not available when the unit first came to market. However, this statement was included in error for this study. Sound levels for the Ericsson 4402 radio used for this assessment are provided within the vendor radio specification, reference [3].

1.0 INTRODUCTION

Noise Control Engineering, LLC (NCE) has conducted a noise study of a proposed AT&T Small Cell installation in West Dennis, MA. This report presents a noise study for the planned installation of small cell radio units at 416 Main Street in West Dennis, reference [1]. Predicted noise levels produced by the radio units have been evaluated for compliance with noise regulations within the Town Ordinance.

2.0 NOISE LIMITS

The Town of Dennis, Massachusetts Zoning Bylaws, reference [2], Section 7.2.4.3 states the maximum allowable noise level from ground mounted communication facilities is 50 dB¹ at the property line. Additionally, Section 7.3.5 provides the following noise filing requirements for communication facilities, measured in decibels L_{dn}.

- Existing, or ambient: the measurements of existing noise.
- Existing plus proposed communication facilities: Maximum estimate of noise from the proposed communication facility plus the existing noise environment.

L_{dn} (Day-Night Average Sound Level) is a calculated average equivalent sound level over a 24-hour period which includes a penalty for noise during the nighttime hours of 10 p.m. to 7 a.m. During this period, 10 dB is added to the measured/calculated sound levels to account for the higher sensitivity to noise at night.

There is an additional requirement to calculate the projected future noise during emergency generator operations. However, the proposed facility will not include an emergency generator.

3.0 AMBIENT NOISE MEASUREMENTS

To determine the existing (ambient) noise levels at the proposed site, NCE collected background noise measurements using an unattended noise monitor secured to a tree near the northern property line of 416 Main Street. A map showing the location of the sound level meter and the proposed small cell equipment installation location is provided in Figure 1.

Measured noise data were collected from the evening of July 6, 2020 to the morning of July 10, 2020. Average measured daytime and nighttime sound pressure levels for each full day of measurement are provided in Table 1; the ‘daytime’ was defined as 7AM-10PM and ‘nighttime’ was defined as 10PM-7AM as required by the L_{dn} metric. Daytime averages are about generally higher than nighttime averages, which is to be expected, though high ambient levels during the morning hours of July 7th caused slightly higher ‘nighttime’ average levels on that day. Per the requirements of the L_{dn} calculation, 10 dB is added to all sound levels measured during the nighttime period, provided in the 4th column of the table. Finally, the 24-hour L_{dn} is calculated for each full day. Note that this is not a simple arithmetic average of daytime and nighttime (+10 dB) levels as the L_{dn} is a logarithmic metric and the daytime period is longer (15 hours) than the nighttime period (9 hours). The lowest calculated ambient L_{dn} (July 9th) of 49 dB(A) will be

¹ It is assumed the 50 db stated within the bylaws refers to 50 dB(A) overall A-weighted sound pressure level referenced to 20 μPa. This is the industry standard and would be consistent with nearly all other city, town, and state noise ordinances in Massachusetts.

used for the remainder of this assessment. This conservative approach ensures that the largest potential difference in L_{dn} between the ambient and ‘existing plus proposed communications facilities’ conditions will be found.

Table 1: Summary of Ambient Noise Data

Date	Sound Pressure Level, dB(A) re 20 μ Pa			
	Daytime	Nighttime	Night + 10 dB	24-hour L_{dn}
July 6, 2020, Monday	-	39	49	-
July 7, 2020, Tuesday	47	49	59	55
July 8, 2020, Wednesday	50	45	55	53
July 9, 2020, Thursday	49	39	49	49
July 10, 2020, Friday	47	-	-	-

4.0 NOISE PREDICTION

The noise prediction was performed using spherical spreading methods to predict noise levels at the locations outlined in Table 2 and noted in Figure 1. NCE believes all other potentially relevant prediction locations are farther from the equipment, resulting in lower levels.

Table 2: Noise Prediction Locations

Location	Location Description	Horizontal Distance	Vertical Distance
Pedestrian	1-meter from pole	1 m	-
Property to the north	Nearest property line to the north	55 m	-
Property to the east	Nearest property line to the east	25 m	-
Property to the south	Nearest property line to the south	20 m	-
Property to the west	Nearest property line to the west	48 m	-

4.1 Source Levels

The installation layout of the small cell site is shown in Figure 2. The noise source is located with an enclosure which spans approximately 5-10 feet off the ground, per reference [1]. To be conservative, a height of 5 feet was used for this assessment. The only item of the proposed equipment that produces significant noise is a cooling fan included in each radio unit. The proposed site will have 3 radio units:

Table 3: Proposed Radio Units

Type	QTY
Ericsson 4402	2
Ericsson 2205	1

Source levels for the radios were obtained from documentation published by the manufacturer of the radio units (Ericsson). Two different models of radio will be used: the 4402 [3], and the 2205 [4].

Source levels for each radio unit and for the 2x 4402 + 1x 2205 configuration are provided in Table 4 for a distance of 1 meter. Note that the noise levels increase with temperature as the cooling load increases. NCE assumes the temperatures provided within the sound levels sections of the radio specifications refers to ambient temperature.

Table 4: Acoustic source levels for Ericsson Model 4402 & 2205 radio units

Temperature °F	A-weighted SPL, dB re 20 µPa at one meter		
	Single Unit 4402 (vendedor)	Individual Unit 2205 (vendedor)	2x 4402 & 1x 2205
68	38	34	42
86	41	40	45
104	44	44	49

4.2 Sound Pressure Level at Distance

A spherical spreading method was used to predict noise levels at various distances from the radio units installed on the telephone poles, as this is a standard method to predict sound dissipation over distance from a point sound source. This acoustic spreading is expressed by the following equation from reference [5]:

$$L_{pr_2} = L_{pr_1} - 20 * \log_{10} \left(\frac{r_2}{r_1} \right)$$

where,

L_{pr_2} = sound pressure level at distance, r_2

L_{pr_1} = sound pressure level at distance, r_1

Using the source levels from Table 4, number of units from Table 3, and the spherical spreading equation, sound pressure levels produced by the radio units were predicted at the locations outlined in Table 2. Predictions are provided for all proposed radios at each temperature up to 104 °F and are summarized in Table 5.

Table 5: Predicted Sound Levels

Location	Distance	Property Line Limit	Predicted A-weighted SPL, dB(A) re 20 µPa		
			68 °F	86 °F	104 °F
	m	dB(A)			
Pedestrian	1	-	42	45	49
Property to the north	55	50	7	11	14
Property to the east	25	50	14	18	21
Property to the south	20	50	16	19	23
Property to the west	48	50	8	12	15

Noise levels in Table 5 for all locations are predicted to meet the property line criteria of 50 dB(A) for temperatures of 104 °F or less.

4.3 Day-Night Level Calculations

Per the calculation provided in Section 3.0, the ambient L_{dn} is 49 dB(A). Table 6 provides the calculated ‘existing plus proposed communications facilities’ for each of the four nearest property line locations.

Table 6: Predicted Sound Levels, L_{dn} dB(A) re: 20 μ Pa

Location	Distance m	Ambient L_{dn} dB(A)	Existing + Proposed L_{dn}		
			68 °F	86 °F	104 °F
Property to the north	55	49	49	49	49
Property to the east	25	49	49	49	49
Property to the south	20	49	49	49	49
Property to the west	48	49	49	49	49

As the predicted noise levels for the proposed equipment are all well below the calculated ambient L_{dn} of 49 dB(A) at the property lines, the ‘existing plus proposed communications facilities’ L_{dn} remains at 49 dB(A). This is due to the logarithmic nature of the L_{dn} metric and all decibel sound levels. Generally speaking, the combined sound level from two noise sources (or a noise source and existing noise) which are more than 10 dB apart do not meaningfully add to the louder source.

5.0 REFERENCES

- [1] Centerline Communications, “Site Plan: CRAN_RCTB_MCAP_003 - 416 Main Street West Dennis, MA, Rev. A.” 2020.
- [2] “Town of Dennis Zoning Bylaw.” 2017.
- [3] Ericsson, “Radio Description - Radio 4402 250/1551-LZA 701 6001/1 Uen E.” p. 14, 2019.
- [4] Ericsson, “Radio Description - Radio 2205 88/1551-LZA 701 6001/1 Uen C.” p. 2017.
- [5] M. Long, *Architectural Acoustics, Second Edition*. 2014.

Figure 1: Map with monitoring, equipment, and prediction locations

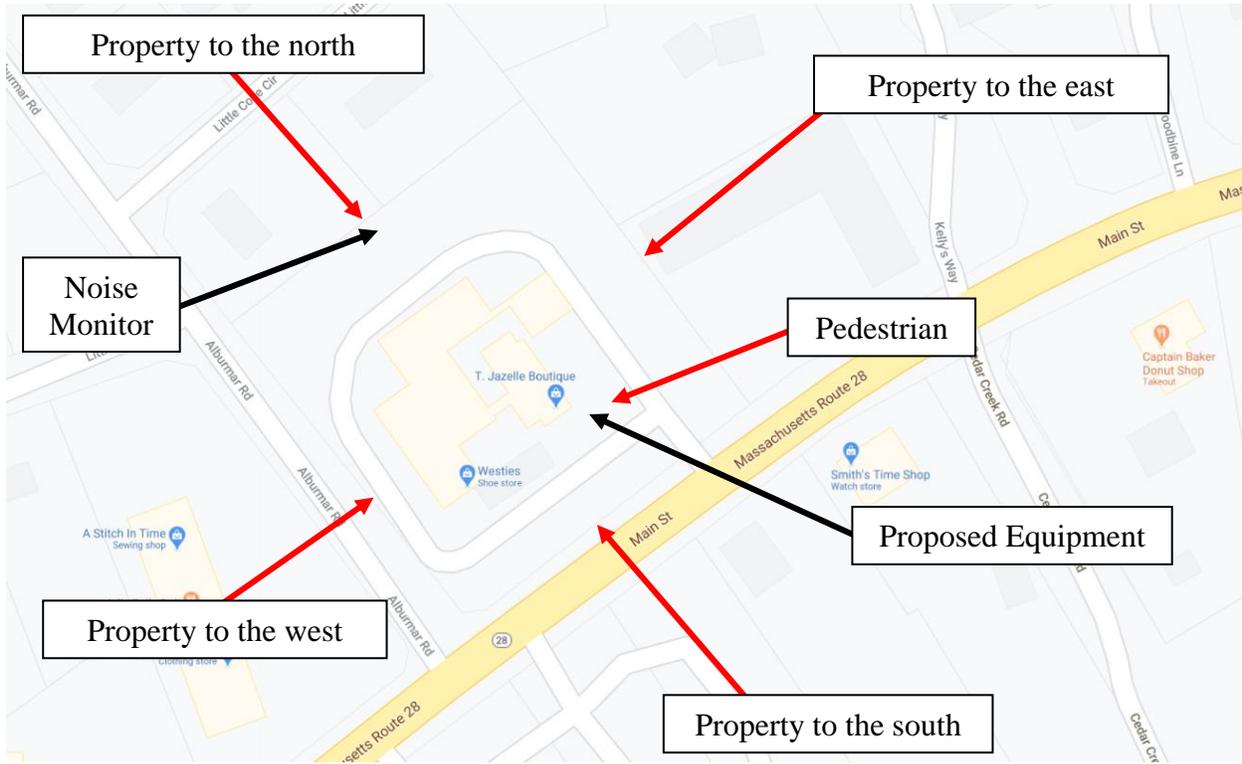


Figure 2: Proposed Pole Layout, [1]

