



Azymuth Acoustics UK

Professional Acoustic Services

Acoustic Testing

Ref: 98415.6

Happi Block

Bowes Street,
Manchester

On behalf of

Rowlinson Construction Limited

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1.0 Introduction

Azymuth Acoustics UK (henceforth Azymuth) were appointed by Rowlinson Construction Limited to undertake acoustic testing at the development site located at Happi Block, Bowes Street, Manchester. The development site consists of 40no. dwellings.

Acoustic testing has been instructed in order to assist with the discharge of a planning condition in relation to internal noise levels. The planning application refers to a noise impact assessment that was carried out on site by noise.co.uk in November 2019. The purpose of the testing is to confirm that the mitigation advice issued in this assessment is accurate and that the internal noise levels are of an acceptable level. NB at the time of these tests most rooms were unfurnished or partly furnished (curtains), the internal sound levels will be elevated relative to the levels that would be present when the dwellings are fully furnished and occupied.

1.1 Measurement Procedure

The instrumentation used for the acoustic testing consisted of a SvanTek 977, 2no. Svantek 971's and a NTi XL2-TA type 1 precision sound level meter. The equipment was calibrated before and after measurements. The sound level meters measured A-weighted (fast response) noise levels as well as octave bands noise levels for all measurement record.

Measurements were taken ~1m from all windows in each test room. The instrumentation measured the internal noise levels to be experienced by each apartment over a continuous time period taking into account rush-hour as well as night-time.

Plot	Measurement Location	Date Start	Date End
8	Kitchen/Living Room	11/1/23	12/1/23
22	Bedroom	30/4/24	1/5/24
22	Kitchen/Living Room	30/4/24	1/5/24
31	Bedroom	30/4/24	1/5/24
31	Kitchen/Living Room	30/4/24	1/5/24
40	Bedroom	29/4/24	30/4/24
40	Kitchen/Living Room	29/4/24	30/4/24

Table 1 – Summary of Happi Block noise monitoring

2.0 Assessment Criteria

In order to assess the extent of any measures required in order to comply with suitable conditions relating to potential noise sources, Azymuth has reviewed various guidance documents and standards, these include:

- British Standard 8233:2014
- World Health Organisation Guidelines on Community Noise
- Manchester City Council – Planning Application No: 125776/FO/2019

2.1 British Standard 8233: 2014

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise. It provides recommendations for control of noise in and around buildings and suggests appropriate internal ambient noise level criteria / limits for a variety of different situations including residential properties.

The following table summarises the noise limits suggested by BS 8233 applying to residential properties:

Activity	Room	Good Design Range $L_{Aeq, T}$ dB	
		07:00-23:00hrs	23:00-07:00hrs
Resting	Living Room	35	-
Dining	Dining Room / Area	40	-
Sleeping (daytime resting)	Bedroom (at night)	35	30

Table 1 – Noise Limits for Residential Properties Suggested in BS 8233

2.2 World Health Organisation Environmental Noise Guidelines (ENG) 2018

The main purpose of the 2018 WHO guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from the following sources: transportation (road traffic, railway and aircraft), wind turbines and leisure activities.

The guidelines set out to define recommended exposure levels for environmental noise in order to protect population health. Exposure limits are average levels defined over a period of one year, measured outdoors in free field at the most exposed façade. It should be noted that the document does not provide guideline limit values for multiple noise sources in combination.

The 2018 guidelines supersede the Community Noise Guidelines from 1999. Nevertheless, the document recommends that all CNG indoor guideline values and any values not covered by the current guidelines should remain valid. As such, the following guidance would remain appropriate:

For protection against sleep disturbance inside dwellings, night-time noise levels should not exceed 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for typical single sound events (which are exceeded 15 times or more per night – see ProPG Appendix A.12 for more details).

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise (interpreted as noise from all sources combined) should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas.



It should be noted that exposure levels defined in ENG and CNG are for guidance purposes as relates potential adverse health impacts and should not be interpreted as absolute limits or regulations.

2.3 Manchester City Council - Planning Application No: 125776/FO/2019

The following has been issued by the council in relation to discharging the planning condition:

'Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Princess Road and the adjacent Health Hub shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data must include measurements taken during a rush-hour period and night-time to determine the appropriate sound insulation measures necessary. The following noise criteria will be required to be achieved:

Bedrooms (night-time - 23.00 - 07.00) 30dB L_{Aeq} (individual noise events shall not exceed 45 dB $L_{Amax,F}$ by more than 15 times)

Living Rooms (daytime - 07.00 - 23.00) 35dB L_{Aeq}

Gardens and terraces (daytime) 55dB L_{Aeq}

Upon completion of the development and before first occupation of the residential units, a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the internal noise criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the internal noise criteria'



3.0 Assessment of Results

3.1 Plot 8: Kitchen/Living Room (11/1/23 to 12/1/23)

The following table summarises the noise measurement data for the Kitchen/Living Room of Plot 8 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Plot 8: Kitchen/Living Room	Day	44.0	31.3	30.6	26.9	24.9
Plot 8: Kitchen/Living Room	Night	32.7	23.1	24.0	22.5	21.8

Table 2 – Summary of daytime and night-time noise levels Plot 8 Kitchen/Living Room

3.2 Plot 40: Bedroom (29/4/24 to 30/4/24)

The following table summarises the noise measurement data for the Bedroom of Plot 40 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Plot 40: Bedroom	Day	42.1	30.8	32.1	30.5	28.9
Plot 40: Bedroom	Night	39.2	29.3	30.5	28.8	27.6

Table 3 – Summary of daytime and night-time noise levels Plot 40 Bedroom

- 15th highest night-time L_{Amax} value = 42.4dB

3.3 Plot 40: Kitchen/Living Room (29/4/24 to 30/4/24)

The following table summarises the noise measurement data for the Kitchen/Living Room of Plot 40 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Plot 40: Kitchen/Living Room	Day	45.0	31.6	33.6	31.0	27.6
Plot 40: Kitchen/Living Room	Night	41.4	27.9	30.6	25.6	21.8

Table 4 – Summary of daytime and night-time noise levels Plot 40 Kitchen/Living Room

3.4 Plot 31: Bedroom (30/4/24 to 1/5/24)

The following table summarises the noise measurement data for the Bedroom of Plot 31 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Plot 31: Bedroom	Day	44.1	27.5	29.2	26.5	23.0
Plot 31: Bedroom	Night	38.9	23.8	26.6	21.4	17.8

Table 5 – Summary of daytime and night-time noise levels Plot 31 Bedroom



- 15th highest night-time L_{Amax} value = 44.4dB

3.5 Plot 31: Kitchen/Living Room (30/4/24 to 1/5/24)

The following table summarises the noise measurement data for the Kitchen/Living Room of Plot 31 over the measurement period.

Location	Period	L_{Amax}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
Plot 31: Kitchen/Living Room	Day	48.4	33.1	35.2	32.1	28.0
Plot 31: Kitchen/Living Room	Night	43.5	29.5	32.7	26.0	20.2

Table 6 – Summary of daytime and night-time noise levels Plot 31 Kitchen/Living Room

3.6 Plot 22: Bedroom (30/4/24 to 1/5/24)

The following table summarises the noise measurement data for the Bedroom of Plot 22 over the measurement period.

Location	Period	L_{Amax}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
Plot 22: Bedroom	Day	44.0	31.2	32.8	30.5	28.0
Plot 22: Bedroom	Night	39.2	28.2	30.2	27.3	25.4

Table 7 – Summary of daytime and night-time noise levels Plot 22 Bedroom

- 15th highest night-time L_{Amax} value = 42.2dB

3.7 Plot 22: Kitchen/Living Room (30/4/24 to 1/5/24)

The following table summarises the noise measurement data for the Kitchen/Living Room of Plot 22 over the measurement period.

Location	Period	L_{Amax}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
Plot 22: Kitchen/Living Room	Day	49.6	34.5	34.3	32.2	30.3
Plot 22: Kitchen/Living Room	Night	42.5	31.0	32.7	30.0	28.6

Table 8 – Summary of daytime and night-time noise levels Plot 22 Kitchen/Living Room

Graphs of the noise measurement data are included in Appendix C of this report.



4.0 Summary

Azymuth were appointed by Rowlinson Construction Limited to undertake acoustic testing at Happi Block, Bowes Street, Manchester. A planning condition was issued by Manchester City Council, this condition stated that a verification report would have to be completed in order to validate that the relevant internal noise level targets had been met.

The internal noise level targets are as follows:

- Bedrooms (night-time - 23.00 - 07.00) 30dB L_{Aeq} (individual noise events shall not exceed 45dB $L_{Amax,F}$ by more than 15 times)
- Living Rooms (daytime - 07.00 - 23.00) 35dB L_{Aeq}
- Gardens and terraces (daytime) 55dB L_{Aeq}

Below is a summary of the results for each test. The results are colour coded based on their compliance with the relevant targets.

Plot	Location	Daytime L_{Aeq} (dB)	Night-time L_{Aeq} (dB)	15 th Highest L_{Amax} (dB)
8	Kitchen/Living Room	31.3	23.1	-
40	Bedroom	30.8	29.3	42.4
40	Kitchen/Living Room	31.6	27.9	-
31	Bedroom	27.5	23.8	44.4
31	Kitchen/Living Room	33.1	29.5	-
22	Bedroom	31.2	28.2	42.2
22	Kitchen/Living Room	34.5	31.0	-

Table 8 – Summary of noise monitoring results

The results in Table 8 indicate that all internal noise level targets have been met. The overall sound insulation provided by the façade of the development (external wall and glazing) has successfully mitigated the effects of all environmental noise to dwellings.

NB when dwelling are fully furnished and occupied it would be estimated that the levels that would be present would be ~1-2dB lower than the results presented in this report.

It should also be noted that night-time L_{Amax} values are often controlled by singular sound events such as police sirens, brakes screeching, car horns, people shouting etc. These instances are sporadic in nature and often widely vary from night-to-night.

Appendix A – Glossary of Acoustic Terms

Decibel (dB)

This is the unit used to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro Pascal to 100 Pascal).

dB (A)

This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. A-weighting) to compensate for the sensitivity of the human ear to sound of different frequencies. The A-weighting curve is implemented in sound level meters using an electronic filter that approximately corresponds to the frequency response of the ear.

Octave Band Noise Level

The human ear is sensitive to sound over a range of frequencies between approximately 20Hz to 20kHz. The ear is also generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum can be divided into frequency bands. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it.

L_{Aeq}

This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over a given time period.

Reverberation Time (RT or sometimes T₃₀ or T₆₀)

This is the time taken for the reverberant sound energy in an enclosure to decay one millionth of its equilibrium value, i.e. by 60dB, after the source has been switched off. The reverberation time is frequency dependent and it is customary to measure its value in octave or one-third octave bands. Reverberation occurs when sound waves are repeatedly reflected from each surface of the room.

Sound Reduction Index (SRI)

Difference measured between the amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room (usual range 100 - 3150Hz for one third octave band values). The SRI varies with frequency and is measured in a laboratory in either octave or one-third octave bands.

$SRI = L_1 - L_2 + 10 \log (S/A)$, where:

L1 = Noise level in the source room

L2 = Noise levels in the receiving room

S = Surface area of test specimen

A = Equivalent acoustic absorption area in the receiving room

Weighted Sound Reduction Index (R_w)

This is a weighted single figure descriptor of the sound insulation performance of a partition measured under laboratory conditions. The procedure used to quantify the R_w is to compare the sound reduction index (SRI) in each of the one-third octave bands from 100Hz to 3150Hz against a set of standard reference curves.



Appendix B – Noise Survey Data

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Wednesday 11 th January 2023							
08:37:38	8 K/L	00:22:22	57.7	39.1	37.1	26.2	24.9
09:00:00	8 K/L	00:30:00	69	38.2	37.3	30.3	26
09:30:00	8 K/L	00:30:00	65.9	46.6	48.9	41.4	31.2
10:00:00	8 K/L	00:30:00	64.7	43.9	44.3	32.8	28.7
10:30:00	8 K/L	00:30:00	51.2	34.7	37.1	33.9	29.1
11:00:00	8 K/L	00:30:00	64.8	36.1	39.9	32.3	31
11:30:00	8 K/L	00:30:00	60.9	39.1	41.7	35.2	33.5
12:00:00	8 K/L	00:30:00	68.7	46	44.6	36.6	32.2
12:30:00	8 K/L	00:30:00	67	49.6	52.4	48.2	35.2
13:00:00	8 K/L	00:30:00	68	48.6	52.4	41.2	36.5
13:30:00	8 K/L	00:30:00	61.2	46.1	50.9	41.4	31.5
14:00:00	8 K/L	00:30:00	63.4	43	42.2	34.3	30.8
14:30:00	8 K/L	00:30:00	52.9	36.4	39.8	33.4	30.4
15:00:00	8 K/L	00:30:00	56.8	36.9	39.1	34.1	31.6
15:30:00	8 K/L	00:30:00	62.2	43.9	47.4	39.1	33.5
16:00:00	8 K/L	00:30:00	59.7	36.8	39.4	30.4	28.7
16:30:00	8 K/L	00:30:00	53.2	32.2	35.6	30.1	25.6
17:00:00	8 K/L	00:30:00	44.6	31	34.7	28.8	24.9
17:30:00	8 K/L	00:30:00	51.6	26.4	27.1	25.1	23.2
18:00:00	8 K/L	00:30:00	35.2	24.5	25.9	24.1	22.8
18:30:00	8 K/L	00:30:00	33.8	24.1	25.3	23.6	22.6
19:00:00	8 K/L	00:30:00	33.8	23.6	24.6	23.2	22.4
19:30:00	8 K/L	00:30:00	48.8	29.7	28.3	23.9	22.8
20:00:00	8 K/L	00:30:00	33.6	25.2	26.9	24.4	23.5
20:30:00	8 K/L	00:30:00	48.6	31.4	34.7	25.9	23.8
21:00:00	8 K/L	00:30:00	41.1	25	26.1	24.2	23.2
21:30:00	8 K/L	00:30:00	34	25	26.2	24.6	23.7
22:00:00	8 K/L	00:30:00	37	27.6	29.4	27.5	24.8
22:30:00	8 K/L	00:30:00	33.6	26.1	27.8	25.7	24.6
23:00:00	8 K/L	00:30:00	32.7	25.2	26.4	25	23.8
23:30:00	8 K/L	00:30:00	38.1	25.2	26.7	24.7	23.6
Thursday 12 th January 2023							
00:00:00	8 K/L	00:30:00	32.2	24.3	25.7	24	22.9
00:30:00	8 K/L	00:30:00	32.6	22.9	24	22.5	21.8
01:00:00	8 K/L	00:30:00	30.6	22.1	23	21.8	21.2
01:30:00	8 K/L	00:30:00	30.9	21.6	22.3	21.3	20.9
02:00:00	8 K/L	00:30:00	36.4	21.9	22.5	21.4	21
02:30:00	8 K/L	00:30:00	29.1	21.6	22.4	21.3	21
03:00:00	8 K/L	00:30:00	33.5	22.3	23.2	21.9	21.3
03:30:00	8 K/L	00:30:00	32.5	22.1	22.8	21.7	21.2
04:00:00	8 K/L	00:30:00	30.7	22	23.2	21.4	20.9
04:30:00	8 K/L	00:30:00	29	21.6	22.4	21.3	20.9
05:00:00	8 K/L	00:30:00	31.4	22.2	23.5	21.6	21
05:30:00	8 K/L	00:30:00	31.4	23.2	24.8	22.6	21.7
06:00:00	8 K/L	00:30:00	41.6	24.5	25.8	23.6	22.4



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
06:30:00	8 K/L	00:30:00	31	24.2	25.8	23.8	22.4
07:00:00	8 K/L	00:30:00	32.3	24.7	25.9	24.5	23.3
07:30:00	8 K/L	00:30:00	41	25.4	26.9	24.6	23.5
08:00:00	8 K/L	00:30:00	57	28.7	30.3	25.1	23.8

Table B1 – Fully tabulated internal noise measurement results for Plot 8 Kitchen/Living Room

Results in **GREY** were affected by external noise from a cherry picker for the construction of the Plots and have been excluded from the summary of results.

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Monday 29 th April 2024							
09:00:00	40 BD	00:30:00	50.3	31.1	32.2	30.2	28.6
09:30:00	40 BD	00:30:00	38.3	30.4	31.9	30	28.4
10:00:00	40 BD	00:30:00	43.3	30.6	32.1	30.2	28.6
10:30:00	40 BD	00:30:00	38.2	31	32.5	30.7	29
11:00:00	40 BD	00:30:00	41.6	31.1	32.3	30.8	29.4
11:30:00	40 BD	00:30:00	45.3	31.1	32.5	30.7	29.1
12:00:00	40 BD	00:30:00	49.5	31.5	32.7	31	29.6
12:30:00	40 BD	00:30:00	38.3	30.8	32.1	30.5	28.9
13:00:00	40 BD	00:30:00	38.3	31.3	32.6	31	29.5
13:30:00	40 BD	00:30:00	39.5	31	32.3	30.7	29.2
14:00:00	40 BD	00:30:00	38.2	31.1	32.3	30.8	29.3
14:30:00	40 BD	00:30:00	45.6	31.3	32.6	30.8	29.3
15:00:00	40 BD	00:30:00	41.4	31.2	32.6	30.9	29.3
15:30:00	40 BD	00:30:00	44.8	30.6	31.8	30.4	28.8
16:00:00	40 BD	00:30:00	39.4	30.6	31.9	30.3	28.8
16:30:00	40 BD	00:30:00	38.5	30.6	31.9	30.4	28.8
17:00:00	40 BD	00:30:00	44.9	30.3	31.4	30	28.5
17:30:00	40 BD	00:30:00	38	30.3	31.5	30.1	28.8
18:00:00	40 BD	00:30:00	39.7	30.7	32	30.4	28.8
18:30:00	40 BD	00:30:00	46.1	31.1	32.2	30.6	29.1
19:00:00	40 BD	00:30:00	54.6	31.5	32.1	30.5	29
19:30:00	40 BD	00:30:00	53.4	31	31.9	30.4	28.9
20:00:00	40 BD	00:30:00	36.9	30.5	31.8	30.3	28.7
20:30:00	40 BD	00:30:00	44.5	30.5	31.7	30.2	28.7
21:00:00	40 BD	00:30:00	40	30.3	31.6	30	28.5
21:30:00	40 BD	00:30:00	37.4	30.1	31.3	29.9	28.4
22:00:00	40 BD	00:30:00	39.9	30.1	31.5	29.8	28.4
22:30:00	40 BD	00:30:00	44.6	30.2	31.5	29.8	28.2
23:00:00	40 BD	00:30:00	35.9	29.7	31.1	29.4	28
23:30:00	40 BD	00:30:00	38.8	29.7	31.2	29.4	27.9
Tuesday 30 th April 2024							
00:00:00	40 BD	00:30:00	40.9	29.5	30.9	29.1	27.7
00:30:00	40 BD	00:30:00	48.7	29.4	30.7	28.8	27.5
01:00:00	40 BD	00:30:00	42.9	29.1	30.2	28.6	27.3
01:30:00	40 BD	00:30:00	36.9	28.6	29.8	28.3	27.2
02:00:00	40 BD	00:30:00	35.6	28.8	30	28.4	27.3
02:30:00	40 BD	00:30:00	35.1	28.6	29.7	28.3	27.3
03:00:00	40 BD	00:30:00	35.5	28.7	29.8	28.3	27.2
03:30:00	40 BD	00:30:00	38	28.8	29.9	28.4	27.3



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
04:00:00	40 BD	00:30:00	37	28.9	30.1	28.6	27.4
04:30:00	40 BD	00:30:00	55.6	29.6	30	28.5	27.4
05:00:00	40 BD	00:30:00	34	29.1	30.4	28.7	27.5
05:30:00	40 BD	00:30:00	37.4	29.5	31	28.9	27.7
06:00:00	40 BD	00:30:00	38.8	29.8	31.5	29.2	27.8
06:30:00	40 BD	00:30:00	36.4	30.6	32.2	30.2	28.5
07:00:00	40 BD	00:30:00	38.2	31.4	33	31.1	29
07:30:00	40 BD	00:30:00	35.6	31.3	32.6	31.1	29.3
08:00:00	40 BD	00:30:00	41	30.9	32.2	30.5	28.9

Table B2 – Fully tabulated internal noise measurement results for Plot 40 Bedroom

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Monday 29 th April 2024							
09:00:00	40 K/L	00:30:00	49.2	31.7	33.7	30.4	26.5
09:30:00	40 K/L	00:30:00	39.9	30.7	33.2	30	26.5
10:00:00	40 K/L	00:30:00	44.4	31.4	33.7	30.7	26.7
10:30:00	40 K/L	00:30:00	40.5	32.1	34.3	31.6	28.1
11:00:00	40 K/L	00:30:00	45.5	32.1	33.8	31.7	29.1
11:30:00	40 K/L	00:30:00	46.7	32.1	34.1	31.7	28.6
12:00:00	40 K/L	00:30:00	53.3	32.8	34.6	32	29.6
12:30:00	40 K/L	00:30:00	41.6	31.5	33.7	31	27.9
13:00:00	40 K/L	00:30:00	40.1	32.6	34.5	32.2	29.6
13:30:00	40 K/L	00:30:00	45.5	32	33.9	31.5	28.7
14:00:00	40 K/L	00:30:00	42.6	32	34	31.6	28.5
14:30:00	40 K/L	00:30:00	48.8	32.3	34.1	31.6	28.7
15:00:00	40 K/L	00:30:00	39.7	31.9	34	31.4	28.2
15:30:00	40 K/L	00:30:00	48.1	31.1	33.1	30.6	27.5
16:00:00	40 K/L	00:30:00	41.5	31.2	33.2	30.8	27.4
16:30:00	40 K/L	00:30:00	43	31.3	33.3	30.8	27.2
17:00:00	40 K/L	00:30:00	48.3	30.9	32.6	30	26.7
17:30:00	40 K/L	00:30:00	42.1	30.8	32.7	30.3	27.2
18:00:00	40 K/L	00:30:00	42.9	31.3	33.4	30.9	27.4
18:30:00	40 K/L	00:30:00	50	32.1	33.7	31.4	28.4
19:00:00	40 K/L	00:30:00	57.4	32.8	33.8	31.2	28.2
19:30:00	40 K/L	00:30:00	54.9	31.8	33.4	30.9	28.1
20:00:00	40 K/L	00:30:00	44.1	31.3	33.4	30.8	27.5
20:30:00	40 K/L	00:30:00	47	31.2	33	30.7	27.5
21:00:00	40 K/L	00:30:00	39.6	30.6	32.8	30	26.8
21:30:00	40 K/L	00:30:00	49.6	30.3	32.4	29.8	26.2
22:00:00	40 K/L	00:30:00	41.6	30.3	32.6	29.6	26
22:30:00	40 K/L	00:30:00	44.7	30.3	32.6	29.5	25.1
23:00:00	40 K/L	00:30:00	37.8	29.4	32	28.6	24.6
23:30:00	40 K/L	00:30:00	40	29.5	32.2	28.7	24.2
Tuesday 30 th April 2024							
00:00:00	40 K/L	00:30:00	43.7	28.7	31.6	27.5	23
00:30:00	40 K/L	00:30:00	47.9	28.5	31.3	26.5	21.6
01:00:00	40 K/L	00:30:00	44.5	27.5	30.3	25.8	21.1
01:30:00	40 K/L	00:30:00	42.7	26.3	29.3	24.2	20.7
02:00:00	40 K/L	00:30:00	37	26.3	29.5	24.4	20.8



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
02:30:00	40 K/L	00:30:00	37.8	25.3	28.5	22.6	20.3
03:00:00	40 K/L	00:30:00	38.4	25.7	28.9	22.5	20.3
03:30:00	40 K/L	00:30:00	41	25.7	29	22.9	20.4
04:00:00	40 K/L	00:30:00	40.6	26.2	29.4	23.8	20.6
04:30:00	40 K/L	00:30:00	54.3	27.8	29.2	23.9	20.7
05:00:00	40 K/L	00:30:00	35.8	26.8	30.1	25	21.1
05:30:00	40 K/L	00:30:00	39.6	27.9	31.6	25.6	21.2
06:00:00	40 K/L	00:30:00	42.4	29.2	32.7	27.4	21.9
06:30:00	40 K/L	00:30:00	39.3	31	33.8	30.1	25.7
07:00:00	40 K/L	00:30:00	40	32.4	34.9	32	26.9
07:30:00	40 K/L	00:30:00	37.8	32.4	34.3	32.2	28.4
08:00:00	40 K/L	00:30:00	43.2	31.6	33.8	31	27.6

Table B3 – Fully tabulated internal noise measurement results for Plot 40 Kitchen/Living Room

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Tuesday 30 th April 2024							
09:30:00	31 BD	00:30:00	65.4	31	28.7	25.7	22
10:00:00	31 BD	00:30:00	40.5	27.3	29.9	26.4	22.5
10:30:00	31 BD	00:30:00	39.8	28.2	30.6	27.4	23.3
11:00:00	31 BD	00:30:00	47.5	27.3	29.5	26.7	23.2
11:30:00	31 BD	00:30:00	44.2	27.9	29.9	27.2	23.7
12:00:00	31 BD	00:30:00	42.1	28.2	30	27	23.8
12:30:00	31 BD	00:30:00	43.5	28.1	29.8	27.2	24.3
13:00:00	31 BD	00:30:00	43.2	27.7	29.5	27.1	24.2
13:30:00	31 BD	00:30:00	39.7	27.8	29.7	27.2	24.7
14:00:00	31 BD	00:30:00	43.4	27.4	29.5	26.8	23.6
14:30:00	31 BD	00:30:00	38.3	27.4	29.3	26.7	24.2
15:00:00	31 BD	00:30:00	42.5	27.3	29.2	26.8	23.7
15:30:00	31 BD	00:30:00	53.6	27.1	28.2	25.7	22.8
16:00:00	31 BD	00:30:00	54.7	27.8	28.8	26	22.9
16:30:00	31 BD	00:30:00	46.6	25.9	27.8	25.2	22.1
17:00:00	31 BD	00:30:00	37.8	26	28	25.5	22
17:30:00	31 BD	00:30:00	47.7	27.5	28.7	25.9	22
18:00:00	31 BD	00:30:00	48.9	27.2	29.4	26.5	22.6
18:30:00	31 BD	00:30:00	56.8	27.6	28.7	26.2	22.7
19:00:00	31 BD	00:30:00	42.4	27.3	29.3	26.7	23.1
19:30:00	31 BD	00:30:00	43.7	27.3	29	26.6	23.2
20:00:00	31 BD	00:30:00	34.8	26.8	29	26.3	22.7
20:30:00	31 BD	00:30:00	41.8	27.1	29.1	26.6	22.6
21:00:00	31 BD	00:30:00	36.8	26.2	28.5	25.7	22
21:30:00	31 BD	00:30:00	45.1	26.2	28.4	25.6	21.8
22:00:00	31 BD	00:30:00	43.2	26.1	28.3	25.2	21.5
22:30:00	31 BD	00:30:00	35.9	26.4	28.8	25.7	21.8
23:00:00	31 BD	00:30:00	35.4	25.7	28.2	24.9	20.3
23:30:00	31 BD	00:30:00	37.1	25.1	27.7	24.2	19.8
Wednesday 1 st May 2024							
00:00:00	31 BD	00:30:00	55.5	25.3	27.6	23	18.5
00:30:00	31 BD	00:30:00	33.6	23.8	26.8	22.5	18.1
01:00:00	31 BD	00:30:00	39.4	23.4	26.7	21.4	17.2



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
01:30:00	31 BD	00:30:00	35	22.1	25.2	19.8	16.9
02:00:00	31 BD	00:30:00	44.8	21.6	24.6	18.8	16.7
02:30:00	31 BD	00:30:00	34.7	21.6	25	18.7	16.8
03:00:00	31 BD	00:30:00	33.4	20.7	23.6	18.3	16.8
03:30:00	31 BD	00:30:00	47.9	22.6	25.3	19	16.8
04:00:00	31 BD	00:30:00	43.1	22.6	25.9	19.2	16.8
04:30:00	31 BD	00:30:00	38.1	22.4	26.1	19.3	16.9
05:00:00	31 BD	00:30:00	34.4	23.3	26.8	21.1	17.3
05:30:00	31 BD	00:30:00	35.8	24.2	27.5	22.2	17.8
06:00:00	31 BD	00:30:00	37.8	25.1	28.4	23.8	18.4
06:30:00	31 BD	00:30:00	35.8	26.7	29.4	25.8	20.2
07:00:00	31 BD	00:30:00	42	28.3	30.7	27.7	23
07:30:00	31 BD	00:30:00	38.1	28.2	30.2	27.8	24.7

Table B4 – Fully tabulated internal noise measurement results for Plot 31 Bedroom

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Tuesday 30 th April 2024							
09:30:00	31 K/L	00:30:00	64.1	33.6	34.9	31.1	26.2
10:00:00	31 K/L	00:30:00	46.6	33	35.8	31.8	27.3
10:30:00	31 K/L	00:30:00	46.8	34.3	36.7	33.4	28.8
11:00:00	31 K/L	00:30:00	42.2	33.2	35.7	32.6	28.5
11:30:00	31 K/L	00:30:00	47.9	33.9	36	33.2	29.2
12:00:00	31 K/L	00:30:00	49.6	33.8	36.1	32.9	29.2
12:30:00	31 K/L	00:30:00	50.1	34	36	33.1	29.7
13:00:00	31 K/L	00:30:00	51.5	33.6	35.6	32.9	29.4
13:30:00	31 K/L	00:30:00	48.8	33.9	35.9	33.1	30.2
14:00:00	31 K/L	00:30:00	48.1	33.4	35.5	32.7	29
14:30:00	31 K/L	00:30:00	44.9	33.3	35.3	32.5	29.4
15:00:00	31 K/L	00:30:00	49.9	33.2	35.3	32.6	29.1
15:30:00	31 K/L	00:30:00	55	32.4	34.1	31.1	27.3
16:00:00	31 K/L	00:30:00	52.2	33	34.3	31.4	27.8
16:30:00	31 K/L	00:30:00	49.1	31.1	33.1	30.3	26.6
17:00:00	31 K/L	00:30:00	43.4	31	33.2	30.4	26.3
17:30:00	31 K/L	00:30:00	51.9	32.6	34.2	31	26.6
18:00:00	31 K/L	00:30:00	46.7	31.4	33.6	30.9	26.6
18:30:00	31 K/L	00:30:00	59.9	33.1	34.8	32	27.9
19:00:00	31 K/L	00:30:00	43.8	33	35.2	32.4	28.3
19:30:00	31 K/L	00:30:00	53.8	33.3	35.1	32.4	28.3
20:00:00	31 K/L	00:30:00	40.5	32.8	35.2	32.3	28.1
20:30:00	31 K/L	00:30:00	48.5	33.1	35.3	32.5	27.8
21:00:00	31 K/L	00:30:00	44.1	32.2	34.7	31.6	27.2
21:30:00	31 K/L	00:30:00	45.5	32.1	34.6	31.4	26.8
22:00:00	31 K/L	00:30:00	49.4	31.9	34.5	30.9	26.4
22:30:00	31 K/L	00:30:00	42.9	32.4	35	31.6	26.7
23:00:00	31 K/L	00:30:00	40.5	31.6	34.4	30.6	24.6
23:30:00	31 K/L	00:30:00	41.5	30.9	33.9	29.8	23.6
Wednesday 1 st May 2024							
00:00:00	31 K/L	00:30:00	42.5	30.2	33.7	28.3	21.8
00:30:00	31 K/L	00:30:00	39.8	29.5	33	27.9	21.1



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
01:00:00	31 K/L	00:30:00	44.1	28.9	32.7	26.2	19.1
01:30:00	31 K/L	00:30:00	41.9	27.5	31.1	24.1	18.6
02:00:00	31 K/L	00:30:00	48.2	26.8	30.4	22.3	18.2
02:30:00	31 K/L	00:30:00	40.5	26.9	31	22.1	18.2
03:00:00	31 K/L	00:30:00	40.5	25.6	29.5	21.2	17.8
03:30:00	31 K/L	00:30:00	53.8	28	31.2	22.5	18.2
04:00:00	31 K/L	00:30:00	43.8	28.1	32.1	22.9	18
04:30:00	31 K/L	00:30:00	44.8	28.1	32.3	23.1	18.4
05:00:00	31 K/L	00:30:00	41.7	29.1	33.1	25.7	19.2
05:30:00	31 K/L	00:30:00	42.4	30.1	33.8	27.3	20.3
06:00:00	31 K/L	00:30:00	46.3	31.2	34.7	29.4	21.6
06:30:00	31 K/L	00:30:00	43.9	32.9	35.8	31.8	24.4
07:00:00	31 K/L	00:30:00	44.9	34.5	37.2	33.8	28.4
07:30:00	31 K/L	00:30:00	41.3	34.5	36.6	33.9	30.3

Table B5 – Fully tabulated internal noise measurement results for Plot 31 Kitchen/Living Room

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Tuesday 30 th April 2024							
09:30:00	22 BD	00:30:00	51.4	31	32.6	30.1	27.8
10:00:00	22 BD	00:30:00	50.5	31.3	33.5	30.5	28.1
10:30:00	22 BD	00:30:00	40.8	32.1	34.2	31.5	28.5
11:00:00	22 BD	00:30:00	37.6	31.3	33.3	30.9	28.4
11:30:00	22 BD	00:30:00	46.3	31.8	33.5	31.2	28.7
12:00:00	22 BD	00:30:00	43.4	31.5	33.4	31	28.6
12:30:00	22 BD	00:30:00	45.4	31.8	33.4	31.1	28.8
13:00:00	22 BD	00:30:00	42.7	31.4	33.1	30.9	28.6
13:30:00	22 BD	00:30:00	40.3	31.5	33.3	31	29
14:00:00	22 BD	00:30:00	41.8	31.3	33.2	30.9	28.4
14:30:00	22 BD	00:30:00	43.3	31.2	32.8	30.7	28.6
15:00:00	22 BD	00:30:00	41	31.2	32.9	30.8	28.4
15:30:00	22 BD	00:30:00	49.6	30.9	32.4	30.1	27.8
16:00:00	22 BD	00:30:00	46.8	31.7	33.3	30.8	28.2
16:30:00	22 BD	00:30:00	43	30.7	32.5	30.2	27.9
17:00:00	22 BD	00:30:00	44.2	32.1	34.3	31.6	28.5
17:30:00	22 BD	00:30:00	57.5	34.3	35.5	32.5	28.8
18:00:00	22 BD	00:30:00	43.2	33.6	36.3	32.8	28.7
18:30:00	22 BD	00:30:00	60	30.4	30.9	29.1	27
19:00:00	22 BD	00:30:00	42	29.8	31.4	29.3	27.1
19:30:00	22 BD	00:30:00	45.9	29.8	31.3	29.3	27.2
20:00:00	22 BD	00:30:00	40.8	29.7	31.5	29.3	27.1
20:30:00	22 BD	00:30:00	43.3	29.9	31.6	29.5	27.2
21:00:00	22 BD	00:30:00	40.3	29.5	31.2	29.1	27
21:30:00	22 BD	00:30:00	40.5	29.5	31.3	29	26.8
22:00:00	22 BD	00:30:00	42.3	29.4	31.1	28.8	26.7
22:30:00	22 BD	00:30:00	36.1	29.6	31.6	29.2	26.9
23:00:00	22 BD	00:30:00	40.5	29.2	31.2	28.7	26.3
23:30:00	22 BD	00:30:00	38.2	28.8	30.8	28.3	26.1
Wednesday 1 st May 2024							
00:00:00	22 BD	00:30:00	36.8	28.4	30.6	27.7	25.6



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
00:30:00	22 BD	00:30:00	35.9	28.2	30.3	27.5	25.4
01:00:00	22 BD	00:30:00	44	28	30.1	27	25.1
01:30:00	22 BD	00:30:00	46.3	27.4	29.3	26.6	24.9
02:00:00	22 BD	00:30:00	41.4	27	28.8	26.4	24.8
02:30:00	22 BD	00:30:00	36	27.2	29.2	26.4	24.8
03:00:00	22 BD	00:30:00	36.5	26.8	28.5	26.3	24.8
03:30:00	22 BD	00:30:00	42.5	27.4	29.3	26.5	24.9
04:00:00	22 BD	00:30:00	38.3	27.6	29.7	26.5	25
04:30:00	22 BD	00:30:00	37.6	27.6	29.8	26.6	25
05:00:00	22 BD	00:30:00	36.9	28.1	30.3	27.2	25.2
05:30:00	22 BD	00:30:00	37.2	28.6	31	27.6	25.5
06:00:00	22 BD	00:30:00	40.6	29.2	31.7	28.3	25.9
06:30:00	22 BD	00:30:00	39.1	30.3	32.5	29.6	26.5
07:00:00	22 BD	00:30:00	37.8	31.4	33.6	31	27.8
07:30:00	22 BD	00:30:00	38.5	31.3	33	31	28.6

Table B6 – Fully tabulated internal noise measurement results for Plot 22 Bedroom

Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Tuesday 30 th April 2024							
09:00:00	22 K/L	00:30:00	68.2	40.9	35.6	32	29.8
09:30:00	22 K/L	00:30:00	50.6	32.5	34	31.7	29.8
10:00:00	22 K/L	00:30:00	46	33.3	35.3	32.4	30.2
10:30:00	22 K/L	00:30:00	46.4	34	35.8	32.9	30.5
11:00:00	22 K/L	00:30:00	41.2	32.9	34.5	32.4	30.4
11:30:00	22 K/L	00:30:00	50.1	33.5	34.8	32.7	30.7
12:00:00	22 K/L	00:30:00	50.8	33.4	34.9	32.6	30.7
12:30:00	22 K/L	00:30:00	48.8	33.4	34.7	32.7	30.9
13:00:00	22 K/L	00:30:00	51.1	33.3	34.5	32.6	30.8
13:30:00	22 K/L	00:30:00	48	33.2	34.5	32.6	31
14:00:00	22 K/L	00:30:00	46	32.9	34.3	32.4	30.5
14:30:00	22 K/L	00:30:00	45.9	32.9	34.1	32.3	30.7
15:00:00	22 K/L	00:30:00	45.6	32.8	34	32.3	30.5
15:30:00	22 K/L	00:30:00	57.3	32.8	33.4	31.7	30.1
16:00:00	22 K/L	00:30:00	53.1	33	33.8	31.9	30.2
16:30:00	22 K/L	00:30:00	51.2	31.9	33	31.4	29.9
17:00:00	22 K/L	00:30:00	47.7	31.7	32.7	31.3	29.8
17:30:00	22 K/L	00:30:00	72.4	35.1	33.2	31.4	29.8
18:00:00	22 K/L	00:30:00	44.2	31.8	33.1	31.5	29.7
18:30:00	22 K/L	00:30:00	61.6	33.1	33.6	31.9	30.1
19:00:00	22 K/L	00:30:00	44.5	32.8	34.1	32.3	30.2
19:30:00	22 K/L	00:30:00	50.3	33	34.1	32.4	30.5
20:00:00	22 K/L	00:30:00	41	32.9	34.4	32.4	30.3
20:30:00	22 K/L	00:30:00	43.5	33	34.6	32.6	30.3
21:00:00	22 K/L	00:30:00	40.3	32.4	34	32	29.9
21:30:00	22 K/L	00:30:00	43.4	32.4	33.9	31.9	30
22:00:00	22 K/L	00:30:00	50.1	32.4	33.8	31.7	29.8
22:30:00	22 K/L	00:30:00	40.7	32.5	34.3	31.9	29.8
23:00:00	22 K/L	00:30:00	39.5	32	33.8	31.5	29.4
23:30:00	22 K/L	00:30:00	41.1	31.7	33.4	31.1	29.2



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Wednesday 1 st May 2024							
00:00:00	22 K/L	00:30:00	40.5	31.3	33.3	30.5	28.8
00:30:00	22 K/L	00:30:00	39.3	31	32.8	30.3	28.8
01:00:00	22 K/L	00:30:00	45.1	30.7	32.6	29.7	28.5
01:30:00	22 K/L	00:30:00	39.8	30.2	31.8	29.3	28.3
02:00:00	22 K/L	00:30:00	45.5	29.9	31.3	29.1	28.2
02:30:00	22 K/L	00:30:00	47.1	30.2	31.7	29	28.2
03:00:00	22 K/L	00:30:00	39.7	29.7	30.9	29	28.3
03:30:00	22 K/L	00:30:00	47.7	30.4	31.9	29.2	28.3
04:00:00	22 K/L	00:30:00	45.7	30.5	32.2	29.2	28.3
04:30:00	22 K/L	00:30:00	40.6	30.4	32.4	29.2	28.3
05:00:00	22 K/L	00:30:00	39.5	30.9	32.9	29.8	28.6
05:30:00	22 K/L	00:30:00	42.8	31.3	33.5	30.2	28.7
06:00:00	22 K/L	00:30:00	43.6	31.8	34	30.9	28.8
06:30:00	22 K/L	00:30:00	42.5	32.8	34.7	32.1	29.4
07:00:00	22 K/L	00:30:00	41.3	33.8	35.7	33.3	30.4
07:30:00	22 K/L	00:30:00	43	33.7	35.3	33.3	31.2
08:00:00	22 K/L	00:30:00	72.4	42	34.7	32.4	30

Table B7 – Fully tabulated internal noise measurement results for Plot 22 Kitchen/Living Room



Appendix C – Graphed Results

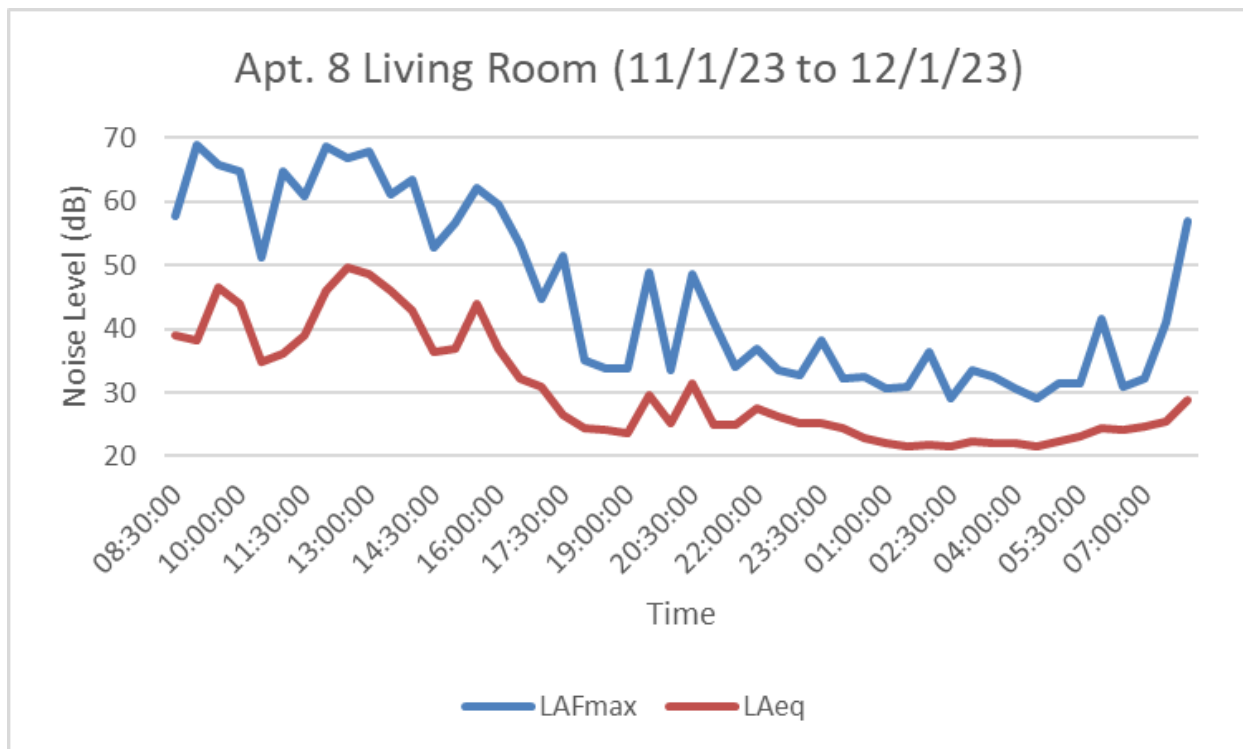


Figure C1 – Plot 8 Living Room graphed measurement data

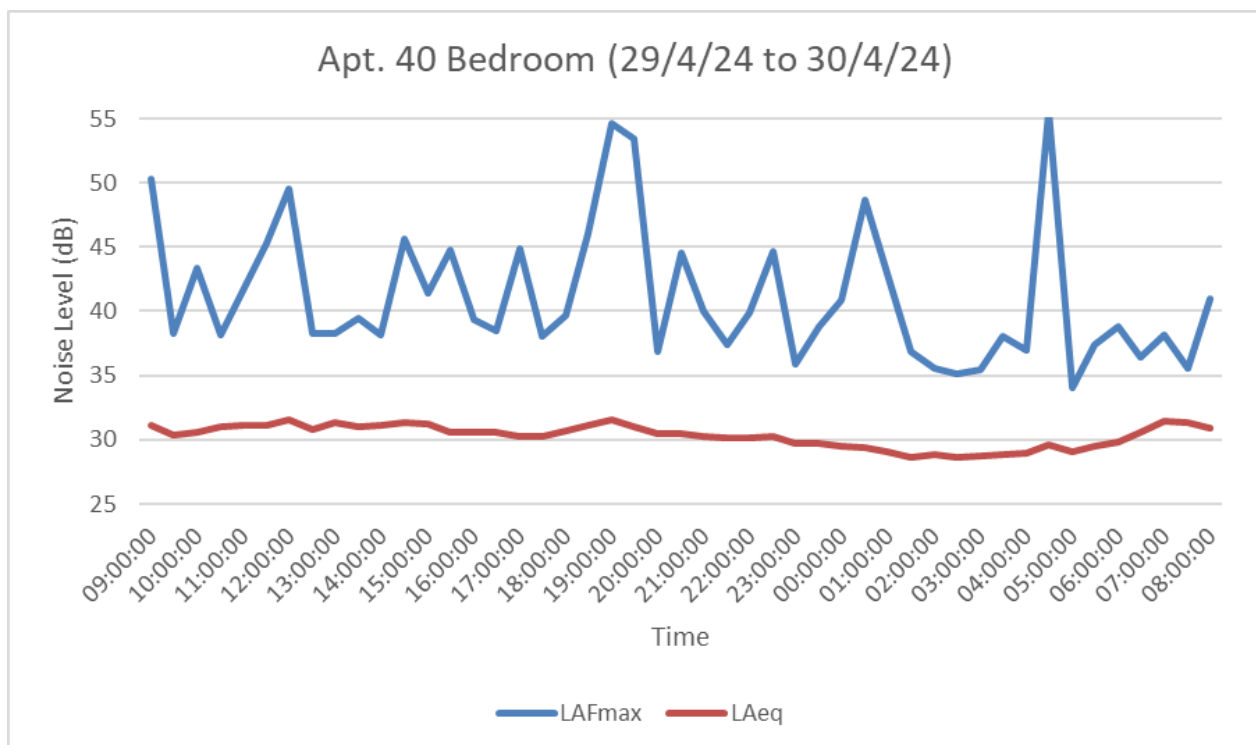


Figure C2 – Plot 40 Bedroom graphed measurement data

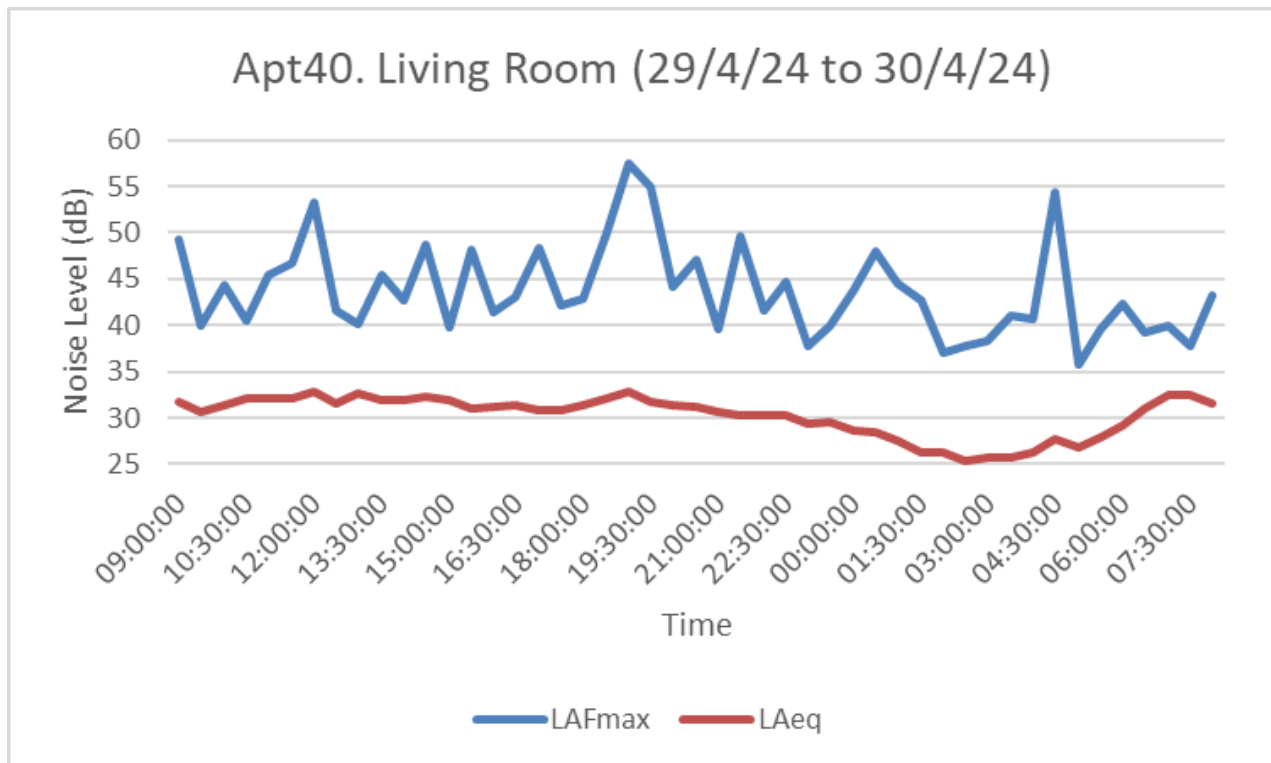


Figure C3 – Plot 40 Living Room graphed measurement data

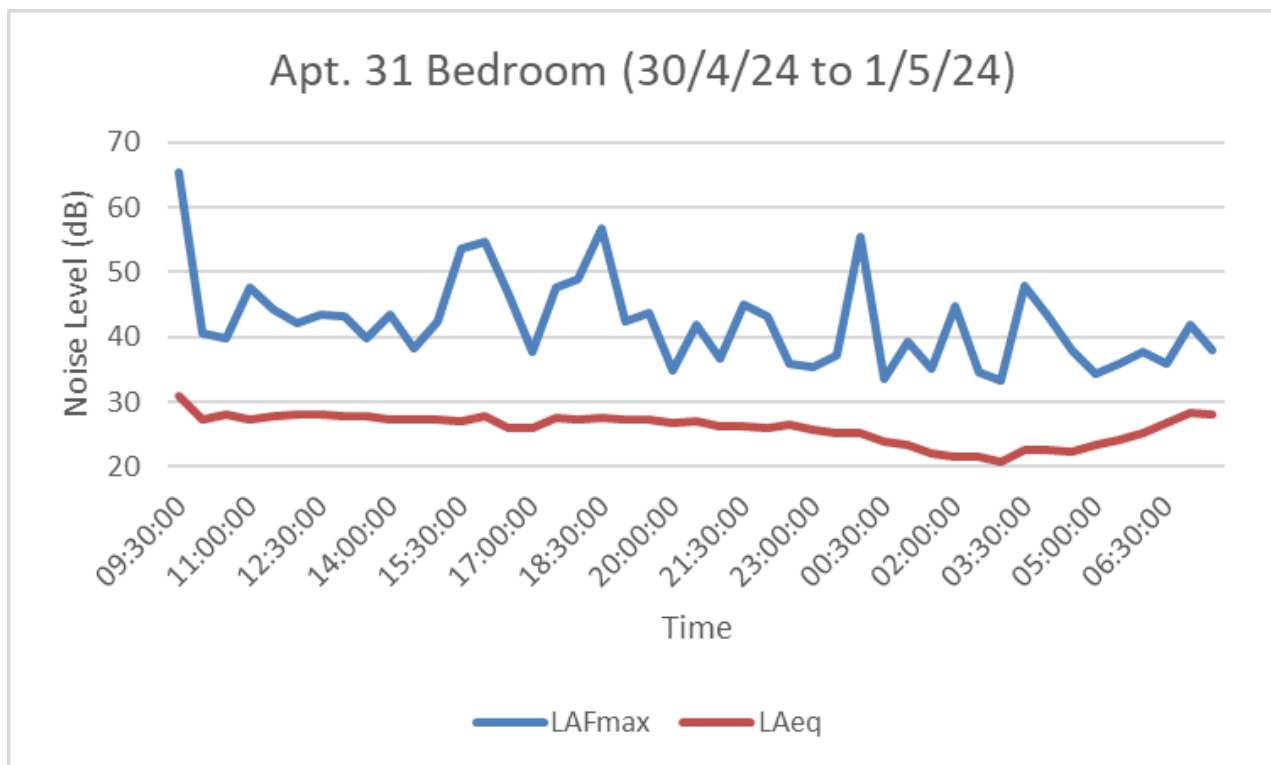


Figure C4 – Plot 31 Bedroom graphed measurement data

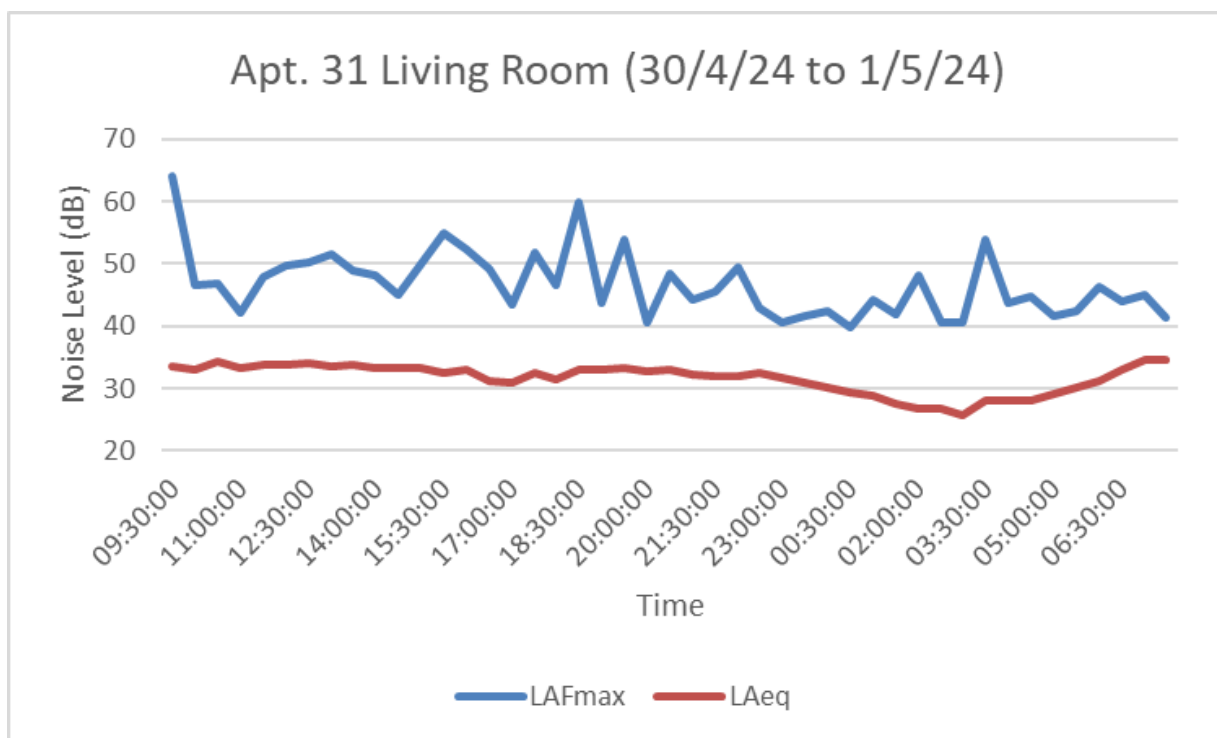


Figure C5 – Plot 31 Living Room graphed measurement data

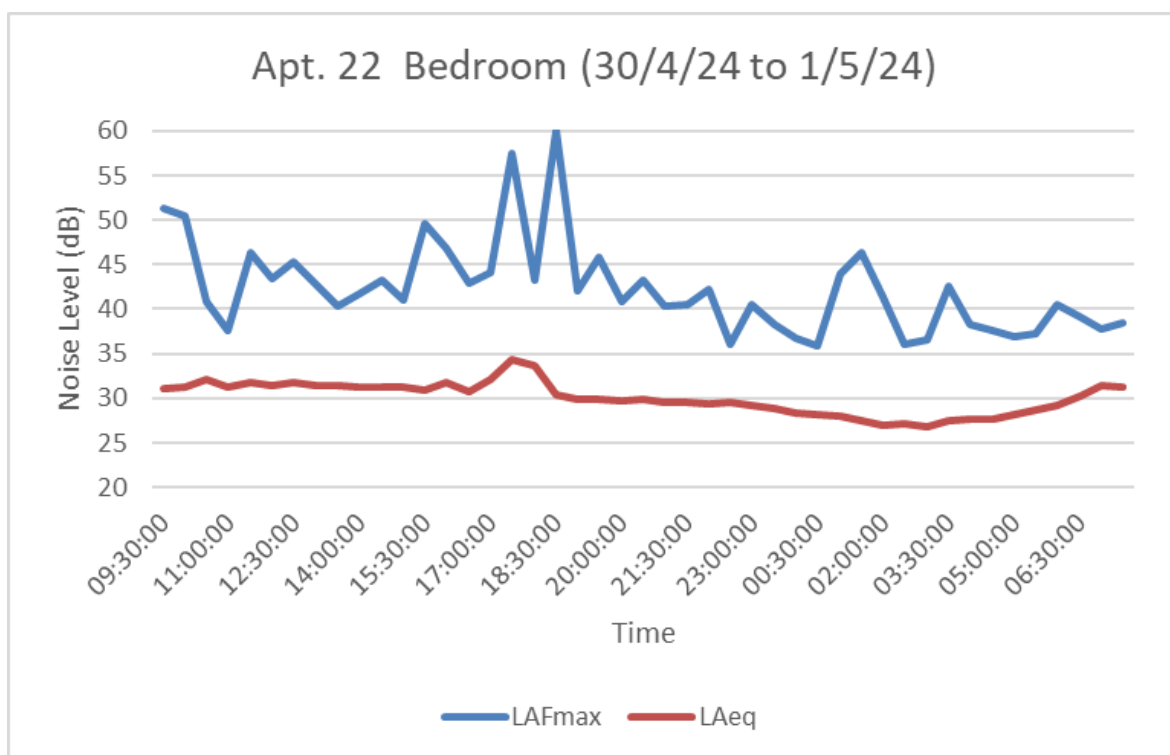


Figure C6 – Plot 22 Bedroom graphed measurement data

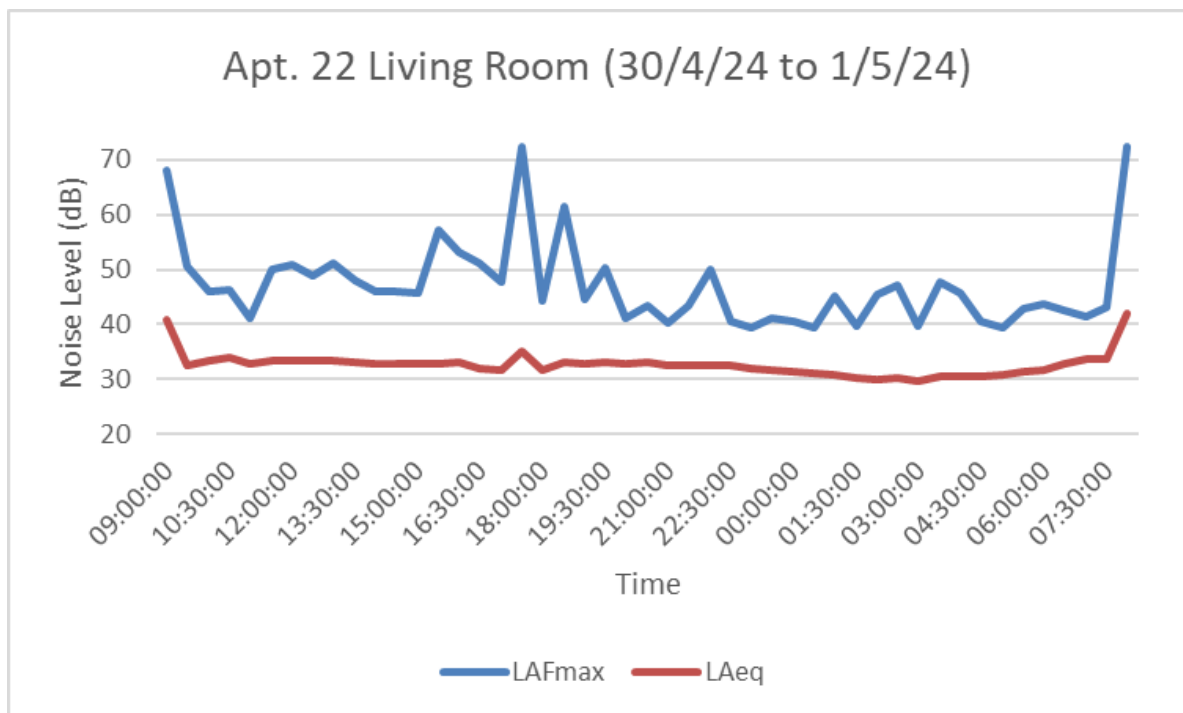


Figure C7 – Plot 22 Living Room graphed measurement data