



Azymuth Acoustics UK

Professional Acoustic Services

Noise Break-in Testing Report Ref: Z43286RevB

Stockport Road
Longsight,
Manchester

On behalf of

Rowlinson Constructions Limited

Gardale House,
118b Gatley Road,
Gatley,
Cheadle,
SK8 4AU

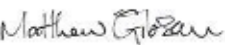


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1.0 Introduction

Azymuth Acoustics UK (henceforth AAUK) were appointed by Rowlinson Construction Ltd. in December 2020 to undertake acoustic (noise break-in) testing on the new build development site located on Stockport Road, Longsight, Manchester. The site is situated beside the busy A6/Stockport Road and is therefore susceptible to noise from traffic.

Additional 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 another acoustic consultancy (Hann Tucker Associates) in February 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.

1.1 Measurement Procedure

The instrumentation used for the acoustic testing consisted of a SvanTek 945/SvanTek 977 type 1 precision noise monitoring system. 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 the first-floor bedroom window in Apartment 109 as well as ~1m from the living room window in this same apartment. This apartment was chosen as it faces directly onto Stockport Road and would be deemed to be one of the worst dwellings affected by the traffic noise. Measurements were also undertaken ~1m from the fourth-floor bedroom window in Apartment 401. The instrumentation measured the internal noise levels to be experienced by the apartment over a continuous time period taking into account rush-hour as well as the night-time.

Measurements in the bedroom of Apartment 109 were undertaken over a continuous period between 14:56hrs on Friday 16th December and 03:56hrs on Sunday 18th December 2022.

Measurements in the living room of Apartment 109 were undertaken over a continuous period between 16:00hrs on Friday 16th December and 08:00hrs on Monday 19th December 2022.

Measurements in the bedroom of Apartment 401 were undertaken over a continuous period between 15:05hrs on Friday 16th December and 08:00hrs on Monday 19th December 2022.

Full results of the noise levels recorded during the course of the survey are included in Appendix B of this report.



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, AAUK 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, Condition 16

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 Condition 16 Discharge

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

The acoustic insulation of the development hereby approved shall be carried out in accordance with the noise impact assessment (ref. 26196/NIAI (Rev 2)) prepared by Hann Tucker Associates stamped as received by the City Council, as Local Planning Authority, on the 8th March 2019.

Prior to the first occupation of the residential element a post construction survey (including appropriate mitigation measures and timescales for implementation if necessary) shall be submitted for approval in writing by the City Council, as Local Planning Authority. The measures agreed thereafter shall be retained and maintained in situ.

Reason: To secure a reduction in noise from traffic or other sources in order to protect future residents from noise disturbance pursuant to policies SPI, HI and DMI of the core strategy (2007) and saved policy DC26 of the Unitary Development Plan for the City of Manchester (1995).

2.3.1 Noise Impact Assessment Recommendations

The following table details the recommend glazing specification as set out in the initial noise impact assessment from February 2019.

Facade	Preliminary Minimum Sound Reduction Specification		Example Configurations (For Guidance Only)
	Window, R_W+C_{tr}	Ventilator, $D_{new}+C_{tr}$	
Façade facing A6	36dB	42dB	10 / 16 / 8.4mm laminated double glazing. - No trickle ventilators in window heads - Specialist acoustic wall in vent or MVHR (MVHR rec)

Table 2 – Glazing recommendation

The glazing specification that was installed to the scheme consists of 10 / 16 / 8.8mm laminated double glazing which shall achieve 38dB R_W+C_{tr} .



3.0 Assessment of Results

3.1 Apartment 109: Bedroom

The following table summarises the noise measurement data for the bedroom of Apartment 109 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Apartment 109: Bedroom	Day	45.6	33.2	36.0	32.2	27.7
Apartment 109: Bedroom	Night	42.1	31.4	34.5	29.3	26.4

Table 3 – Summary of daytime and night-time noise levels Apartment 109 (bedroom)

- 15th highest night-time L_{Amax} value = 42.6dB inside Bedroom of Apartment 109

3.2 Apartment 109: Living Room

The following table summarises the noise measurement data for the living room of Apartment 109 over the measurement period.

Location	Period	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Apartment 109: Living Room	Day	48.0	33.4	35.9	32.2	29.4
Apartment 109: Living Room	Night	47.5	31.8	34.0	30.3	28.6

Table 4 – Summary of daytime and night-time noise levels Apartment 109 (living room)

- 15th highest night-time L_{Amax} value = 47.3dB inside Living Room of Apartment 109 (however, the L_{Amax} target is only applicable for bedrooms so this is listed here just for information)

3.3 Apartment 401: Bedroom

The following table summarises the noise measurement data for the Bedroom of Apartment 401 over the measurement period.

Location	Period	L _{Aeq}
Apartment 401: Living Room	Day	32.9
Apartment 401: Living Room	Night	29.6

Table 5 – Summary of daytime and night-time noise levels Apartment 401 (bedroom)

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



4.0 Summary and Conclusions

4.1 Summary of test results

AAUK were appointed by Rowlinson Construction Ltd. in December 2020 to undertake some acoustic testing at the Stockport Road Site.

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}

The daytime noise levels in the bedroom of Apartment 109 were measured to be 33.2dB $L_{Aeq, 16hr}$, the night-time noise levels in the bedroom were measured to be 31.4dB $L_{Aeq, 8hr}$.

The daytime noise levels in the living room of Apartment 109 were measured to be 33.4dB $L_{Aeq, 16hr}$, the night-time noise levels in the bedroom were measured to be 31.8dB $L_{Aeq, 8hr}$.

The daytime noise levels in the bedroom of Apartment 401 were measured to be 32.9dB $L_{Aeq, 16hr}$, the night-time noise levels in the bedroom were measured to be 29.6dB $L_{Aeq, 8hr}$.

4.2 Conclusions and Compliance

The noise levels in Apartment 109 are compliant with the planning condition during the daytime however they are slightly uncompliant (exceeding by 1-1.5dB) with the target criteria for night-time periods.

The noise levels in Apartment 401 are compliant with the noise target criteria.



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 T_{30} or T_{60})

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:

L_1 = Noise level in the source room

L_2 = 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}
Friday 16 th December 2022							
14:56:44	109 BD	00:30:00	58.9	35.2	36.7	33	28.5
15:26:44	109 BD	00:30:00	50.2	33.5	36.2	32.8	28
15:56:44	109 BD	00:30:00	45.7	33.1	35.6	32.3	28.3
16:26:44	109 BD	00:30:00	42.8	33	35.6	32.4	27.8
16:56:44	109 BD	00:30:00	42	33.5	35.9	33	28.7
17:26:44	109 BD	00:30:00	44.9	33.3	36	32.5	28
17:56:44	109 BD	00:30:00	43.6	33.8	36.7	33	27.9
18:26:44	109 BD	00:30:00	42.8	33.5	35.9	33	28.2
18:56:44	109 BD	00:30:00	41.9	33	36.1	32.1	27.5
19:26:44	109 BD	00:30:00	45.2	33.4	36.1	32.7	28.2
19:56:44	109 BD	00:30:00	43.2	32.8	35.6	31.9	27.7
20:26:44	109 BD	00:30:00	42	33.2	36.1	32.2	27.6
20:56:44	109 BD	00:30:00	44.4	33.1	36.4	31.9	27.1
21:26:44	109 BD	00:30:00	41.9	32.5	35.4	31.6	27.3
21:56:44	109 BD	00:30:00	41.7	32.7	35.8	31.8	27
22:26:44	109 BD	00:30:00	44.9	33.2	35.9	32.4	28
22:56:44	109 BD	00:30:00	42.2	32.8	35.8	31.9	27.4
23:26:44	109 BD	00:30:00	40.4	32.5	35.4	31.5	27.1
23:56:44	109 BD	00:30:00	41.8	32.8	35.8	31.9	27.1
Saturday 17 th December 2022							
00:26:44	109 BD	00:30:00	43.1	32.3	35.4	31.2	26.6
00:56:44	109 BD	00:30:00	41.9	32	35.4	30.5	26.5
01:26:44	109 BD	00:30:00	44.9	31.9	35.4	29.8	26.3
01:56:44	109 BD	00:30:00	40.1	31.8	35.1	30.4	26.3
02:26:44	109 BD	00:30:00	39.9	31.1	34.6	28.7	26.2
02:56:44	109 BD	00:30:00	41.1	30.4	33.8	27.9	26.1
03:26:44	109 BD	00:30:00	50.9	30.5	33.7	27.6	26
03:56:44	109 BD	00:30:00	41.6	30	33.4	27.5	26.1
04:26:44	109 BD	00:30:00	39.9	29.7	33.1	27.3	26
04:56:44	109 BD	00:30:00	40	29.2	32.4	27	26
05:26:44	109 BD	00:30:00	41.1	30.3	33.8	27.7	26.1
05:56:44	109 BD	00:30:00	46.8	30.1	33.5	27.5	26
06:26:44	109 BD	00:30:00	42.6	30.5	33.9	27.8	26.1
06:56:44	109 BD	00:30:00	40.3	30.2	33.7	27.7	26.1
07:26:44	109 BD	00:30:00	41.9	31.6	35.1	29.6	26.3
07:56:44	109 BD	00:30:00	45.2	31.3	34.6	29.3	26.3
08:26:44	109 BD	00:30:00	49.6	32.2	35.6	30.6	26.8
08:56:44	109 BD	00:30:00	46.3	32.8	35.9	31.7	27.2
09:26:44	109 BD	00:30:00	42.9	33	36.1	31.9	27.5
09:56:44	109 BD	00:30:00	42.2	33.3	36.1	32.6	27.9
10:26:44	109 BD	00:30:00	52.3	33.6	36.3	32.6	27.7
10:56:44	109 BD	00:30:00	52.6	33.8	36.4	33.1	28.1
11:26:44	109 BD	00:30:00	42.5	33.2	35.8	32.6	28.7
11:56:44	109 BD	00:30:00	44.6	33.4	36.2	32.6	28.5



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
12:26:44	109 BD	00:30:00	47.8	33.7	36.6	32.9	27.7
12:56:44	109 BD	00:30:00	57.9	33.9	36.3	33	28.7
13:26:44	109 BD	00:30:00	55.9	33.4	36	32.3	27.7
13:56:44	109 BD	00:30:00	41.9	33.3	36.3	32.5	27.7
14:26:44	109 BD	00:30:00	47.9	33.8	36.6	33.1	28
14:56:44	109 BD	00:30:00	48.9	33.6	36.5	32.6	27.5
15:26:44	109 BD	00:30:00	41.5	33.9	36.7	33.1	28.3
15:56:44	109 BD	00:30:00	42.3	33.6	36.7	32.8	27.6
16:26:44	109 BD	00:30:00	43.4	33.3	36.3	32.3	27.4
16:56:44	109 BD	00:30:00	44.4	33.4	36.2	32.7	28.2
17:26:44	109 BD	00:30:00	51.4	33.6	36.3	32.7	28
17:56:44	109 BD	00:30:00	51.6	33.3	35.9	32.3	27.9
18:26:44	109 BD	00:30:00	43.8	33.4	36	32.7	28.4
18:56:44	109 BD	00:30:00	42.9	33.2	36	32.3	27.5
19:26:44	109 BD	00:30:00	43.2	33.4	36.3	32.6	27.7
19:56:44	109 BD	00:30:00	42.2	33	35.8	32.2	27.5
20:26:44	109 BD	00:30:00	47	33.2	35.9	32.3	27.4
20:56:44	109 BD	00:30:00	40.6	32.6	35.5	31.7	27.2
21:26:44	109 BD	00:30:00	47.6	32.7	35.7	31.6	27.2
21:56:44	109 BD	00:30:00	49.7	32.6	35.6	31.6	26.9
22:26:44	109 BD	00:30:00	46.1	33.1	35.8	32.3	27.7
22:56:44	109 BD	00:30:00	43.6	32.9	36	31.6	27
23:26:44	109 BD	00:30:00	42.6	32.9	35.8	32	27.1
23:56:44	109 BD	00:30:00	41.9	33	36.4	31.5	27.1
Sunday 18 th December 2022							
00:26:44	109 BD	00:30:00	42.2	32.4	35.5	31.2	26.7
00:56:44	109 BD	00:30:00	42.7	32.1	35.6	30.3	26.5
01:26:44	109 BD	00:30:00	42.3	31.5	35	29.7	26.3
01:56:44	109 BD	00:30:00	40.2	31.5	34.9	29.7	26.2
02:26:44	109 BD	00:30:00	41.7	30.9	34.1	28.8	26.2
02:56:44	109 BD	00:30:00	41.4	30.5	33.6	28.3	26.1
03:26:44	109 BD	00:30:00	40.1	30.7	34	28.8	26.2
03:56:44	109 BD	00:30:00	41.7	30.5	33.9	27.8	26.1

Table B1 – Fully tabulated internal noise measurement results for Apartment 109 (bedroom)



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Friday 16 th December 2022							
16:00:00	109 LR	00:30:00	44.7	35.4	38.1	34.4	31
16:30:00	109 LR	00:30:00	51.2	34.8	37.2	34	31.1
17:00:00	109 LR	00:30:00	44.6	34.8	37.2	34.2	30.8
17:30:00	109 LR	00:30:00	43.9	34.9	37.3	34.2	31.1
18:00:00	109 LR	00:30:00	44.1	34.7	37.3	33.8	30.6
18:30:00	109 LR	00:30:00	47.2	34.9	37.7	33.7	30.2
19:00:00	109 LR	00:30:00	47.2	33.9	36.4	33.1	29.7
19:30:00	109 LR	00:30:00	43	33.7	36.4	32.8	29.6
20:00:00	109 LR	00:30:00	46.7	33.7	36.4	32.7	29.8
20:30:00	109 LR	00:30:00	46.9	33.5	36.2	32.3	29.3
21:00:00	109 LR	00:30:00	46.5	33.5	36.3	32.4	29.4
21:30:00	109 LR	00:30:00	46.7	33.5	36.6	32	29.1
22:00:00	109 LR	00:30:00	46.8	33.3	35.9	32.1	29.3
22:30:00	109 LR	00:30:00	46.6	33.5	36.2	32.5	29.3
23:00:00	109 LR	00:30:00	46.6	33.6	36.1	32.4	29.5
23:30:00	109 LR	00:30:00	53.9	33.3	35.9	32.1	29.3
Saturday 17 th December 2022							
00:00:00	109 LR	00:30:00	46.7	33.2	35.9	32.1	29.2
00:30:00	109 LR	00:30:00	46.6	33.4	36.1	32.1	29.2
01:00:00	109 LR	00:30:00	46.6	33	35.9	31.6	29.1
01:30:00	109 LR	00:30:00	46.7	32.8	35.7	31.2	29
02:00:00	109 LR	00:30:00	46.6	32.6	35.6	30.8	28.8
02:30:00	109 LR	00:30:00	56.3	32.7	35.5	30.9	28.9
03:00:00	109 LR	00:30:00	46.5	32	34.8	30.3	28.7
03:30:00	109 LR	00:30:00	50.1	31.7	34.2	29.9	28.5
04:00:00	109 LR	00:30:00	46.6	31.4	33.9	29.7	28.4
04:30:00	109 LR	00:30:00	54	31.5	33.9	29.8	28.4
05:00:00	109 LR	00:30:00	46.9	31	33.2	29.7	28.4
05:30:00	109 LR	00:30:00	46.7	31	33.2	29.7	28.4
06:00:00	109 LR	00:30:00	46.6	31.5	34	29.8	28.4
06:30:00	109 LR	00:30:00	47	31.6	34.2	29.8	28.5
07:00:00	109 LR	00:30:00	46.8	31.5	34	29.8	28.5
07:30:00	109 LR	00:30:00	46.7	31.6	34.3	29.9	28.5
08:00:00	109 LR	00:30:00	46.6	32.4	35.5	30.6	28.7
08:30:00	109 LR	00:30:00	46.9	32.5	35.3	30.9	29
09:00:00	109 LR	00:30:00	53.9	33.2	36.1	31.6	29.2
09:30:00	109 LR	00:30:00	48.9	33.5	36.2	32.3	29.4
10:00:00	109 LR	00:30:00	55.9	33.7	36.5	32.3	29.4
10:30:00	109 LR	00:30:00	47.4	33.7	36.4	32.7	29.6
11:00:00	109 LR	00:30:00	51.9	34	36.5	32.9	29.6
11:30:00	109 LR	00:30:00	48.9	34.2	36.7	33.3	30
12:00:00	109 LR	00:30:00	47.4	33.6	35.9	32.7	29.9
12:30:00	109 LR	00:30:00	47.1	33.9	36.5	33	30
13:00:00	109 LR	00:30:00	59.1	34.3	36.7	32.9	29.5
13:30:00	109 LR	00:30:00	47.1	33.7	36.3	32.9	29.7
14:00:00	109 LR	00:30:00	54.6	33.8	36.2	32.7	29.5
14:30:00	109 LR	00:30:00	47.2	33.8	36.5	32.7	29.4
15:00:00	109 LR	00:30:00	47	33.8	36.3	33	29.6



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
15:30:00	109 LR	00:30:00	46.8	33.7	36.4	32.7	29.4
16:00:00	109 LR	00:30:00	47	34.2	36.8	33.2	29.8
16:30:00	109 LR	00:30:00	47.5	33.9	36.6	32.9	29.5
17:00:00	109 LR	00:30:00	47.4	33.6	36	32.6	29.4
17:30:00	109 LR	00:30:00	47.4	33.8	36.2	32.9	29.8
18:00:00	109 LR	00:30:00	52.8	33.7	36.2	32.6	29.5
18:30:00	109 LR	00:30:00	50.5	33.7	36.1	32.6	29.6
19:00:00	109 LR	00:30:00	47.2	33.7	36.2	32.8	29.7
19:30:00	109 LR	00:30:00	47.3	33.5	36	32.6	29.4
20:00:00	109 LR	00:30:00	47.3	33.7	36.4	32.7	29.5
20:30:00	109 LR	00:30:00	47.3	33.6	36.1	32.5	29.3
21:00:00	109 LR	00:30:00	47	33.4	35.8	32.5	29.4
21:30:00	109 LR	00:30:00	47.7	33.1	35.8	32	29.2
22:00:00	109 LR	00:30:00	48.4	33.3	36	32	29.2
22:30:00	109 LR	00:30:00	47.1	33.3	35.8	32.2	29.3
23:00:00	109 LR	00:30:00	47.6	33.4	36	32.4	29.4
23:30:00	109 LR	00:30:00	47	33.5	36.2	32.3	29.2
Sunday 18 th December 2022							
00:00:00	109 LR	00:30:00	46.9	33.4	36.1	32.2	29.3
00:30:00	109 LR	00:30:00	47.3	33.4	36.3	32	29.3
01:00:00	109 LR	00:30:00	47	33.1	35.9	31.5	29.1
01:30:00	109 LR	00:30:00	47	32.7	35.7	30.8	29
02:00:00	109 LR	00:30:00	46.9	32.5	35.3	31	29
02:30:00	109 LR	00:30:00	47.1	32.3	35.2	30.5	28.8
03:00:00	109 LR	00:30:00	47.2	31.9	34.5	30.4	28.8
03:30:00	109 LR	00:30:00	47.5	31.7	34	30.2	28.7
04:00:00	109 LR	00:30:00	47.3	31.9	34.6	30.4	28.9
04:30:00	109 LR	00:30:00	47.3	31.5	33.8	29.9	28.6
05:00:00	109 LR	00:30:00	46.8	30.9	33.1	29.7	28.5
05:30:00	109 LR	00:30:00	46.8	31.1	33.3	29.7	28.5
06:00:00	109 LR	00:30:00	47.3	31.1	33.2	29.7	28.4
06:30:00	109 LR	00:30:00	46.9	30.9	32.7	29.6	28.4
07:00:00	109 LR	00:30:00	46.8	30.9	32.9	29.7	28.5
07:30:00	109 LR	00:30:00	47.1	31.2	33.6	29.8	28.5
08:00:00	109 LR	00:30:00	46.9	31.5	34.1	29.9	28.5
08:30:00	109 LR	00:30:00	46.6	31.7	34.5	30	28.6
09:00:00	109 LR	00:30:00	47	32	34.6	30.4	28.8
09:30:00	109 LR	00:30:00	47.1	32.6	35.7	30.8	29
10:00:00	109 LR	00:30:00	46.9	33	35.8	31.6	29.1
10:30:00	109 LR	00:30:00	48	33.2	35.8	31.9	29.4
11:00:00	109 LR	00:30:00	47	33.4	35.9	32.4	29.3
11:30:00	109 LR	00:30:00	46.9	33.1	35.7	32.1	29.4
12:00:00	109 LR	00:30:00	47.3	33.6	36.1	32.6	29.6
12:30:00	109 LR	00:30:00	51.7	33.4	35.9	32.4	29.8
13:00:00	109 LR	00:30:00	47	33.6	36.1	32.8	29.8
13:30:00	109 LR	00:30:00	54	34.3	36.6	33.2	29.8
14:00:00	109 LR	00:30:00	47	33.6	36.1	32.9	29.6
14:30:00	109 LR	00:30:00	46.9	34	36.6	33	29.7
15:00:00	109 LR	00:30:00	46.9	34	36.6	33.1	29.5



Start	Plot	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
15:30:00	109 LR	00:30:00	47.2	33.6	36.3	32.6	29.5
16:00:00	109 LR	00:30:00	47.3	33.1	35.8	31.9	29.3
16:30:00	109 LR	00:30:00	47.5	33.1	35.8	32	29.2
17:00:00	109 LR	00:30:00	47.1	33	35.9	31.8	29.1
17:30:00	109 LR	00:30:00	47.2	33.3	35.9	32.2	29.3
18:00:00	109 LR	00:30:00	47	33.1	35.7	32.1	29.3
18:30:00	109 LR	00:30:00	46.8	33.4	35.9	32.4	29.4
19:00:00	109 LR	00:30:00	47.3	33	35.7	32	29.2
19:30:00	109 LR	00:30:00	47.1	33.3	36	32.2	29.2
20:00:00	109 LR	00:30:00	47	33	35.8	31.8	29.1
20:30:00	109 LR	00:30:00	47.2	32.7	35.3	31.5	28.9
21:00:00	109 LR	00:30:00	47.1	32.2	34.8	30.9	28.6
21:30:00	109 LR	00:30:00	47	32.5	35	31.2	28.6
22:00:00	109 LR	00:30:00	47	32	34.6	30.7	28.6
22:30:00	109 LR	00:30:00	56.1	32.2	34.6	30.8	28.5
23:00:00	109 LR	00:30:00	47.2	32	34.5	30.9	28.6
23:30:00	109 LR	00:30:00	46.7	31.6	34	30.2	28.4
Monday 19 th December 2022							
00:00:00	109 LR	00:30:00	47	31	33.4	29.7	28.2
00:30:00	109 LR	00:30:00	47	31.3	33.9	29.8	28.2
01:00:00	109 LR	00:30:00	47.1	30.9	33.1	29.4	28.1
01:30:00	109 LR	00:30:00	46.8	30.6	32.8	29.4	28.1
02:00:00	109 LR	00:30:00	46.7	30.1	31.8	29.1	28
02:30:00	109 LR	00:30:00	46.8	29.8	31.4	28.9	28
03:00:00	109 LR	00:30:00	46.7	29.8	31.1	28.8	28
03:30:00	109 LR	00:30:00	46.7	29.7	31.1	28.9	28
04:00:00	109 LR	00:30:00	46.9	29.4	30.5	28.7	27.9
04:30:00	109 LR	00:30:00	46.7	29.5	30.5	28.7	27.8
05:00:00	109 LR	00:30:00	46.9	29.8	31.4	28.8	27.9
05:30:00	109 LR	00:30:00	46.7	30.2	32.1	28.9	28
06:00:00	109 LR	00:30:00	47	30.6	33.1	29.3	28
06:30:00	109 LR	00:30:00	46.9	31.2	33.9	29.6	28.1
07:00:00	109 LR	00:30:00	46.9	31.9	34.7	30.4	28.3
07:30:00	109 LR	00:30:00	59.8	32.9	35.5	31.1	28.5
08:00:00	109 LR	00:30:00	47	32.9	35.5	31.8	28.9

Table B2 – Fully tabulated internal noise measurement results for Apartment 109 (living room)



Start	Plot	Time	L _{Aeq}
Friday 16 th December 2022			
15:05:32	401 BD	00:09:28	45.2
15:15:00	401 BD	00:15:00	37.4
15:30:00	401 BD	00:15:00	32.9
15:45:00	401 BD	00:15:00	33.1
16:00:00	401 BD	00:15:00	32.4
16:15:00	401 BD	00:15:00	32.1
16:30:00	401 BD	00:15:00	32.9
16:45:00	401 BD	00:15:00	32.6
17:00:00	401 BD	00:15:00	32.7
17:15:00	401 BD	00:15:00	33.2
17:30:00	401 BD	00:15:00	32.6
17:45:00	401 BD	00:15:00	33.1
18:00:00	401 BD	00:15:00	33.3
18:15:00	401 BD	00:15:00	33.5
18:30:00	401 BD	00:15:00	32.8
18:45:00	401 BD	00:15:00	32.9
19:00:00	401 BD	00:15:00	32.6
19:15:00	401 BD	00:15:00	32.5
19:30:00	401 BD	00:15:00	33.1
19:45:00	401 BD	00:15:00	32.8
20:00:00	401 BD	00:15:00	32.1
20:15:00	401 BD	00:15:00	32.8
20:30:00	401 BD	00:15:00	32.7
20:45:00	401 BD	00:15:00	32.6
21:00:00	401 BD	00:15:00	32.3
21:15:00	401 BD	00:15:00	32.9
21:30:00	401 BD	00:15:00	32.3
21:45:00	401 BD	00:15:00	32.2
22:00:00	401 BD	00:15:00	32.3
22:15:00	401 BD	00:15:00	32.8
22:30:00	401 BD	00:15:00	32.7
22:45:00	401 BD	00:15:00	32.3
23:00:00	401 BD	00:15:00	32.7
23:15:00	401 BD	00:15:00	31.9
23:30:00	401 BD	00:15:00	32.1
23:45:00	401 BD	00:15:00	32.0
Saturday 17 th December 2022			
00:00:00	401 BD	00:15:00	32.6
00:15:00	401 BD	00:15:00	31.9
00:30:00	401 BD	00:15:00	32.0
00:45:00	401 BD	00:15:00	31.8
01:00:00	401 BD	00:15:00	30.9
01:15:00	401 BD	00:15:00	31.5
01:30:00	401 BD	00:15:00	31.1
01:45:00	401 BD	00:15:00	31.5
02:00:00	401 BD	00:15:00	31.7
02:15:00	401 BD	00:15:00	30.5
02:30:00	401 BD	00:15:00	30.6



Start	Plot	Time	L _{Aeq}
02:45:00	401 BD	00:15:00	29.8
03:00:00	401 BD	00:15:00	29.2
03:15:00	401 BD	00:15:00	28.7
03:30:00	401 BD	00:15:00	29.8
03:45:00	401 BD	00:15:00	29.0
04:00:00	401 BD	00:15:00	28.4
04:15:00	401 BD	00:15:00	28.6
04:30:00	401 BD	00:15:00	28.2
04:45:00	401 BD	00:15:00	27.8
05:00:00	401 BD	00:15:00	27.1
05:15:00	401 BD	00:15:00	27.4
05:30:00	401 BD	00:15:00	29.5
05:45:00	401 BD	00:15:00	28.6
06:00:00	401 BD	00:15:00	28.9
06:15:00	401 BD	00:15:00	28.4
06:30:00	401 BD	00:15:00	29.5
06:45:00	401 BD	00:15:00	29.1
07:00:00	401 BD	00:15:00	28.9
07:15:00	401 BD	00:15:00	29.2
07:30:00	401 BD	00:15:00	30.2
07:45:00	401 BD	00:15:00	30.8
08:00:00	401 BD	00:15:00	30.2
08:15:00	401 BD	00:15:00	30.8
08:30:00	401 BD	00:15:00	31.4
08:45:00	401 BD	00:15:00	31.5
09:00:00	401 BD	00:15:00	32.0
09:15:00	401 BD	00:15:00	32.6
09:30:00	401 BD	00:15:00	32.4
09:45:00	401 BD	00:15:00	33.1
10:00:00	401 BD	00:15:00	32.8
10:15:00	401 BD	00:15:00	33.0
10:30:00	401 BD	00:15:00	33.4
10:45:00	401 BD	00:15:00	32.9
11:00:00	401 BD	00:15:00	33.7
11:15:00	401 BD	00:15:00	33.4
11:30:00	401 BD	00:15:00	32.7
11:45:00	401 BD	00:15:00	32.9
12:00:00	401 BD	00:15:00	32.6
12:15:00	401 BD	00:15:00	33.3
12:30:00	401 BD	00:15:00	33.2
12:45:00	401 BD	00:15:00	34.4
13:00:00	401 BD	00:15:00	33.1
13:15:00	401 BD	00:15:00	33.2
13:30:00	401 BD	00:15:00	34.0
13:45:00	401 BD	00:15:00	32.7
14:00:00	401 BD	00:15:00	33.1
14:15:00	401 BD	00:15:00	33.1
14:30:00	401 BD	00:15:00	33.3
14:45:00	401 BD	00:15:00	33.5



Start	Plot	Time	L _{Aeq}
15:00:00	401 BD	00:15:00	33.6
15:15:00	401 BD	00:15:00	33.1
15:30:00	401 BD	00:15:00	34.1
15:45:00	401 BD	00:15:00	33.7
16:00:00	401 BD	00:15:00	33.5
16:15:00	401 BD	00:15:00	33.3
16:30:00	401 BD	00:15:00	32.9
16:45:00	401 BD	00:15:00	33.6
17:00:00	401 BD	00:15:00	33.3
17:15:00	401 BD	00:15:00	33.2
17:30:00	401 BD	00:15:00	33.1
17:45:00	401 BD	00:15:00	32.9
18:00:00	401 BD	00:15:00	32.7
18:15:00	401 BD	00:15:00	33.9
18:30:00	401 BD	00:15:00	32.6
18:45:00	401 BD	00:15:00	33.2
19:00:00	401 BD	00:15:00	32.8
19:15:00	401 BD	00:15:00	33.0
19:30:00	401 BD	00:15:00	33.1
19:45:00	401 BD	00:15:00	32.6
20:00:00	401 BD	00:15:00	32.5
20:15:00	401 BD	00:15:00	33.0
20:30:00	401 BD	00:15:00	33.1
20:45:00	401 BD	00:15:00	32.0
21:00:00	401 BD	00:15:00	32.3
21:15:00	401 BD	00:15:00	32.1
21:30:00	401 BD	00:15:00	32.0
21:45:00	401 BD	00:15:00	32.7
22:00:00	401 BD	00:15:00	31.9
22:15:00	401 BD	00:15:00	32.5
22:30:00	401 BD	00:15:00	32.6
22:45:00	401 BD	00:15:00	32.5
23:00:00	401 BD	00:15:00	32.3
23:15:00	401 BD	00:15:00	32.8
23:30:00	401 BD	00:15:00	32.8
23:45:00	401 BD	00:15:00	32.0
Sunday 18 th December 2022			
00:00:00	401 BD	00:15:00	32.5
00:15:00	401 BD	00:15:00	32.1
00:30:00	401 BD	00:15:00	32.0
00:45:00	401 BD	00:15:00	32.0
01:00:00	401 BD	00:15:00	32.0
01:15:00	401 BD	00:15:00	30.9
01:30:00	401 BD	00:15:00	30.6
01:45:00	401 BD	00:15:00	30.7
02:00:00	401 BD	00:15:00	30.8
02:15:00	401 BD	00:15:00	30.5
02:30:00	401 BD	00:15:00	30.1
02:45:00	401 BD	00:15:00	28.9



Start	Plot	Time	L _{Aeq}
03:00:00	401 BD	00:15:00	29.2
03:15:00	401 BD	00:15:00	29.4
03:30:00	401 BD	00:15:00	29.5
03:45:00	401 BD	00:15:00	29.7
04:00:00	401 BD	00:15:00	28.9
04:15:00	401 BD	00:15:00	28.7
04:30:00	401 BD	00:15:00	27.8
04:45:00	401 BD	00:15:00	26.7
05:00:00	401 BD	00:15:00	27.9
05:15:00	401 BD	00:15:00	27.5
05:30:00	401 BD	00:15:00	27.7
05:45:00	401 BD	00:15:00	28.0
06:00:00	401 BD	00:15:00	26.9
06:15:00	401 BD	00:15:00	28.1
06:30:00	401 BD	00:15:00	27.9
06:45:00	401 BD	00:15:00	26.8
07:00:00	401 BD	00:15:00	28.0
07:15:00	401 BD	00:15:00	28.3
07:30:00	401 BD	00:15:00	28.9
07:45:00	401 BD	00:15:00	28.9
08:00:00	401 BD	00:15:00	29.4
08:15:00	401 BD	00:15:00	29.3
08:30:00	401 BD	00:15:00	30.0
08:45:00	401 BD	00:15:00	30.1
09:00:00	401 BD	00:15:00	30.3
09:15:00	401 BD	00:15:00	31.2
09:30:00	401 BD	00:15:00	31.5
09:45:00	401 BD	00:15:00	31.6
10:00:00	401 BD	00:15:00	31.3
10:15:00	401 BD	00:15:00	31.6
10:30:00	401 BD	00:15:00	32.3
10:45:00	401 BD	00:15:00	32.3
11:00:00	401 BD	00:15:00	31.9
11:15:00	401 BD	00:15:00	32.6
11:30:00	401 BD	00:15:00	32.4
11:45:00	401 BD	00:15:00	33.0
12:00:00	401 BD	00:15:00	32.3
12:15:00	401 BD	00:15:00	32.6
12:30:00	401 BD	00:15:00	32.6
12:45:00	401 BD	00:15:00	33.3
13:00:00	401 BD	00:15:00	33.7
13:15:00	401 BD	00:15:00	34.8
13:30:00	401 BD	00:15:00	33.0
13:45:00	401 BD	00:15:00	32.7
14:00:00	401 BD	00:15:00	33.4
14:15:00	401 BD	00:15:00	33.5
14:30:00	401 BD	00:15:00	33.6
14:45:00	401 BD	00:15:00	33.4
15:00:00	401 BD	00:15:00	33.5



Start	Plot	Time	L _{Aeq}
15:15:00	401 BD	00:15:00	32.7
15:30:00	401 BD	00:15:00	32.7
15:45:00	401 BD	00:15:00	31.8
16:00:00	401 BD	00:15:00	31.8
16:15:00	401 BD	00:15:00	32.6
16:30:00	401 BD	00:15:00	32.4
16:45:00	401 BD	00:15:00	32.0
17:00:00	401 BD	00:15:00	32.3
17:15:00	401 BD	00:15:00	32.9
17:30:00	401 BD	00:15:00	32.1
17:45:00	401 BD	00:15:00	32.6
18:00:00	401 BD	00:15:00	32.3
18:15:00	401 BD	00:15:00	32.5
18:30:00	401 BD	00:15:00	32.1
18:45:00	401 BD	00:15:00	32.3
19:00:00	401 BD	00:15:00	32.6
19:15:00	401 BD	00:15:00	32.2
19:30:00	401 BD	00:15:00	31.7
19:45:00	401 BD	00:15:00	32.0
20:00:00	401 BD	00:15:00	32.0
20:15:00	401 BD	00:15:00	31.0
20:30:00	401 BD	00:15:00	30.6
20:45:00	401 BD	00:15:00	31.1
21:00:00	401 BD	00:15:00	31.1
21:15:00	401 BD	00:15:00	31.4
21:30:00	401 BD	00:15:00	31.4
21:45:00	401 BD	00:15:00	30.6
22:00:00	401 BD	00:15:00	30.6
22:15:00	401 BD	00:15:00	31.1
22:30:00	401 BD	00:15:00	30.4
22:45:00	401 BD	00:15:00	30.3
23:00:00	401 BD	00:15:00	30.1
23:15:00	401 BD	00:15:00	30.2
23:30:00	401 BD	00:15:00	29.2
23:45:00	401 BD	00:15:00	29.0
Monday 19 th December 2022			
00:00:00	401 BD	00:15:00	29.6
00:15:00	401 BD	00:15:00	29.0
00:30:00	401 BD	00:15:00	28.8
00:45:00	401 BD	00:15:00	28.2
01:00:00	401 BD	00:15:00	28.8
01:15:00	401 BD	00:15:00	27.6
01:30:00	401 BD	00:15:00	26.3
01:45:00	401 BD	00:15:00	26.2
02:00:00	401 BD	00:15:00	26.5
02:15:00	401 BD	00:15:00	24.5
02:30:00	401 BD	00:15:00	24.5
02:45:00	401 BD	00:15:00	25.9
03:00:00	401 BD	00:15:00	25.1



Start	Plot	Time	L _{Aeq}
03:15:00	401 BD	00:15:00	25.4
03:30:00	401 BD	00:15:00	24.4
03:45:00	401 BD	00:15:00	23.5
04:00:00	401 BD	00:15:00	23.7
04:15:00	401 BD	00:15:00	25.6
04:30:00	401 BD	00:15:00	24.9
04:45:00	401 BD	00:15:00	25.7
05:00:00	401 BD	00:15:00	25.5
05:15:00	401 BD	00:15:00	27.5
05:30:00	401 BD	00:15:00	27.2
05:45:00	401 BD	00:15:00	28.3
06:00:00	401 BD	00:15:00	28.4
06:15:00	401 BD	00:15:00	29.4
06:30:00	401 BD	00:15:00	29.7
06:45:00	401 BD	00:15:00	30.7
07:00:00	401 BD	00:15:00	30.5
07:15:00	401 BD	00:15:00	31.6
07:30:00	401 BD	00:15:00	31.8
07:45:00	401 BD	00:15:00	31.8
08:00:00	401 BD	00:15:00	33.6

Table B2 – Fully tabulated internal noise measurement results for Apartment 401 (bedroom)



Appendix C – Graphed Results

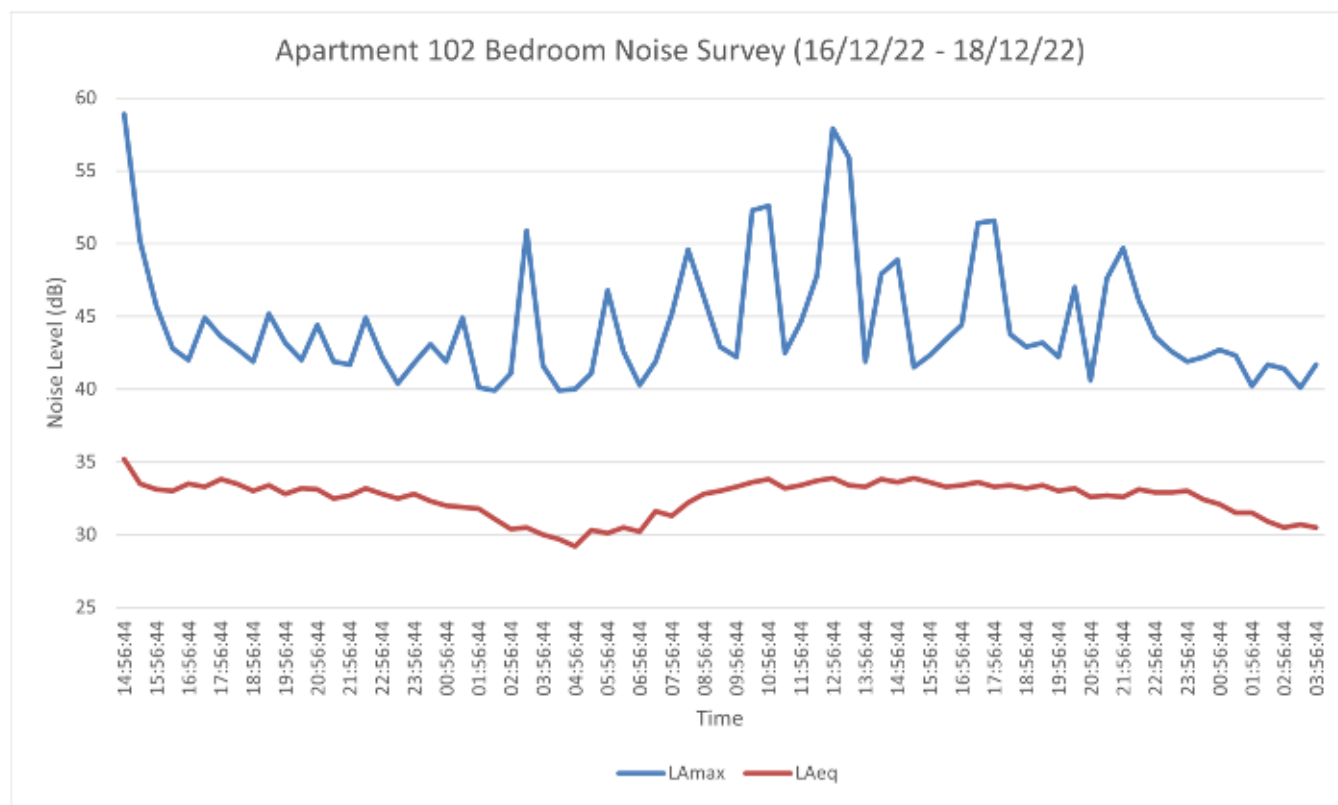


Figure C1 – Apartment 109 (bedroom) graphed measurement data

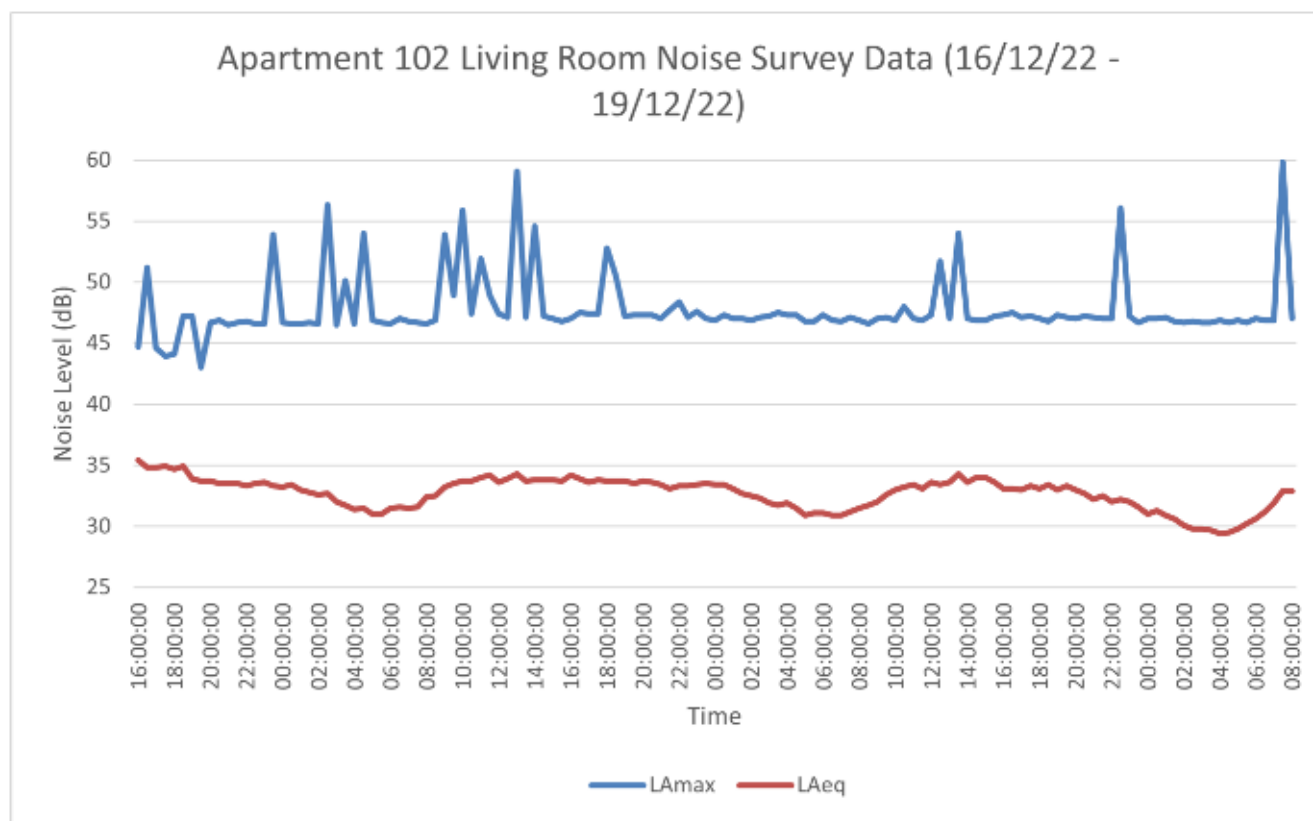


Figure C2 – Apartment 109 (living room) graphed measurement data

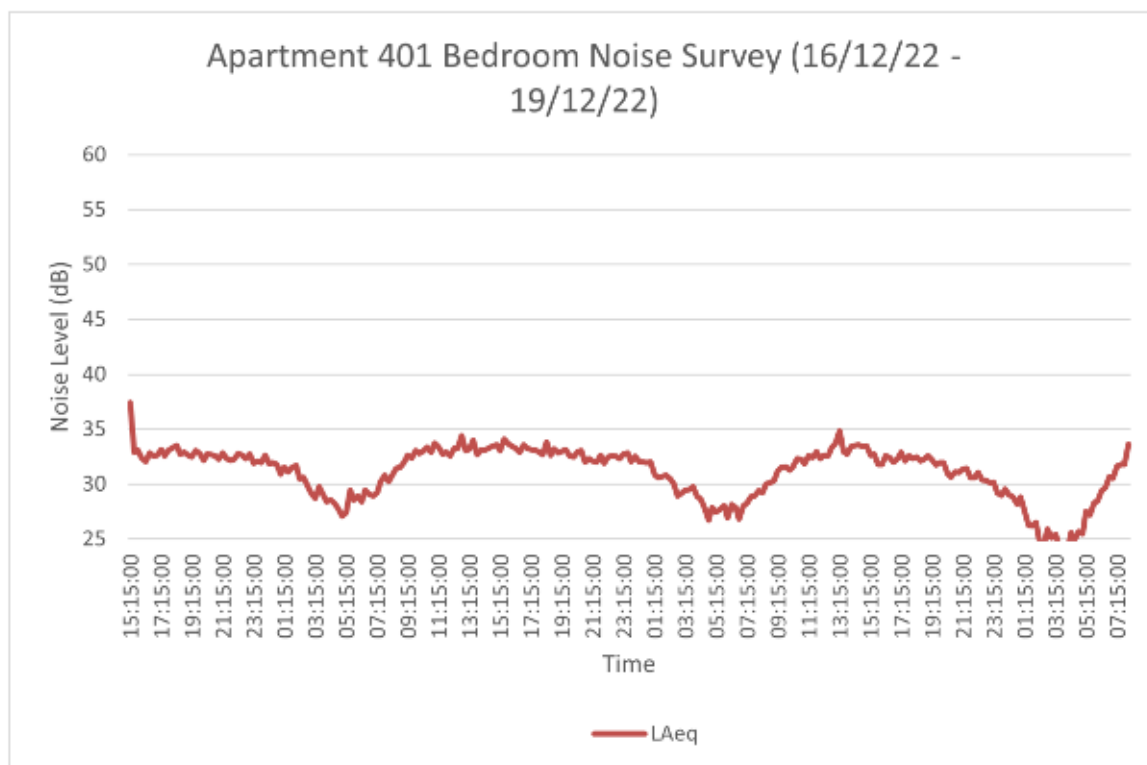


Figure C3 – Apartment 401 (bedroom) graphed measurement data