



Azymuth Acoustics UK

Professional Acoustic Services

Noise Impact Assessment

Ref: AA0521.1

5no. ASHPs to Plots 24-28

Queens Drive

Rochdale,

OL11 2NP

On behalf of

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1.0 Introduction

Azymuth Acoustics UK (henceforth Azymuth) has been contracted by MSV Housing to perform a Noise Impact Assessment (NIA) in relation to 5no. Air Source Heat Pumps (ASHPs) to be installed on the houses plots 24-28 at a proposed housing development located on Queens Drive, Rochdale.

Azymuth understand the units will be operational 24hrs per day, with individual ASHP to service each of the plots 24-28 (5no). All units are to be located on the 2nd floor balcony level. Figure 1 below shows the proposed development layout.



Figure 1 – Property locations and addresses

This noise impact assessment is intended to provide information relating to the potential noise impact of the 5no. ASHPs on the surrounding environment in order to support the detailed planning application for the installation. The noise impact assessment will evaluate the following information:

- Assess cumulative noise from all 5no. ASHP units on plots 24-28.
- Include a background noise survey (refer to separate NIA AA0521).
- Consider tonal and intermittent characteristics.
- Demonstrate compliance with MCS-020 guidance (target ≤ 37 dB LAeq, 5 mins at the nearest noise-sensitive receptor).

In particular, the report sets out the following details:

- The results of a baseline noise survey undertaken in the vicinity of existing and proposed receptor locations. (For further details refer to NIA AA0521)
- The appropriate assessment criteria and guidance relating to noise in the environment as associated with this kind of development.
- An assessment of the proposed plant items with calculated noise impact.

It is understood that the plant items will operate during both daytime and night-time periods. As such night-time periods are assessed to produce a worst-case scenario where background noise levels in the area would be at their lowest.

2.0 Baseline Noise Survey

2.1 Measurement Procedures

The instrumentation used for the NIA consisted of a SvanTek 971 type 1 precision sound level meter. The equipment was calibrated before and after measurements. The sound level meter measured A-weighted (fast response) noise levels as well as octave bands noise levels for all measurement record.

Daytime noise level measurements were undertaken between 12:52hrs and 16:09hrs on Tuesday 26th November 2024. The night-time measurements were undertaken between 23:00hrs on Monday 2nd December and 00:19hrs on Tuesday 3rd December 2024.

The noise measurements were undertaken using the sound level meter at the positions shown in Figure 2 below:

- Position 1: Existing carpark entrance, northeast of site boundary (~1m from roadside)
- Position 2: Site footpath entrance, central of site boundary (~1m from roadside)
- Position 3: Q-Gardens, northwest of site boundary (~1m from roadside)



Figure 2 – Noise measurement positions



2.2 Summary of Measurements

2.2.1 Noise Survey

The following table summarises the results of the noise measurements undertaken at the proposed site in terms of the average daytime and night-time noise levels.

Location	Period	L _{AFmax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
1) Existing carpark	Day	79.1	65.0	68.5	60.2	56.8
1) Existing carpark	Night	74.4	57.7	57.5	53.1	49.4
2) Site footpath	Day	80.7	66.2	68.9	62.5	60.0
2) Site footpath	Night	71.4	56.1	57.3	50.8	44.2
3) Q-Gardens	Day	80.3	68.2	71.3	66.0	61.3
3) Q-Gardens	Night	76.5	58.1	60.1	50.2	43.6

Table 1 – Summary of noise measurements

Azymuth assumes that all noise levels measured on-site during the baseline noise survey are typical of the site.

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

2.2.2 Assessment of Night-time L_{Amax} Data

Azymuth has carried out an assessment of the available night-time L_{Amax} noise level data for measurement position 3 (referenced to ~1m from the roadside). The highest measured L_{Amax} value was 79.2dB and the duration of the night-time survey at this position was exactly 25 minutes, hence it is estimated that the 10th highest L_{Amax} value over the entire 8hr night-time period is likely to be around 79-82dB.

2.3 Description of Noise Climate

The main sources of noise affecting the site are road traffic from Queens Drive, running along the northern boundary of the site, as well as the A664 main road, which runs parallel to Queens Drive set back 3m to 8m.

The weather throughout the assessment was mild, mostly dry with occasional drizzle and maximum wind speeds of 10mph.

3.0 Assessment Criteria

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

- British Standard 8233: 2014
- World Health Organisation Environmental Noise Guidelines 2018
- British Standard 4142:2014+A1: 2019
- Microgeneration Certification Scheme 020a 2025
- IOA/CIEH Heat Pumps Professional Advice Note 2022

3.1 British Standard 8233: 2014

“Guidance on sound insulation and noise reduction for buildings” (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

3.2 World Health Organisation Environmental Noise Guidelines 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 Environmental Noise Guidelines (ENG) guidelines supersede the Community Noise Guidelines (CNG) 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.

3.3 British Standard 4142:2014+A1: 2019

"Methods for assessing and rating industrial sound" (BS 4142) describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

- Typically, the greater the difference between background sound and industrial/commercial noise, the greater the magnitude of the impact.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

BS 4142 notes that: "Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

3.3 Microgeneration Certification Scheme 020a 2025

The Microgeneration Certification Scheme (MCS 020a) allows for ASHPs to be installed on residential properties under permitted development.

Permission is granted if noise from the ASHP is equal to or lower than the noise limit of 37.0dB $L_{Aeq,5min}$ at 1 metre from a window or door opening to a habitable room ("a room other than a bathroom, shower room, water closet or kitchen") on the façade of a neighbouring residential property (including flats within the same block of flats). Compliance is determined via a series of steps set out in MCS 020a. The 37.0dBA noise limit approximately equates to an internal noise level ≤ 25 dBA in rooms with half-opened windows. This is in line with target night-time limits for bedrooms described in BS 8233 and ENG.

3.4 IOA/CIEH Heat Pumps Professional Advice Note 2022

This document provides advice for the installation of ground / air source heat pumps (GSHPs/ASHPs) with reference to both MCS assessment for permitted development schemes and BS 4142 assessment where planning consent is required. Insight is provided into disturbance factors not fully covered in MCS, such as noise characteristics (tonality, intermittency), structure borne sound and vibration transmission. NB these factors are addressed in alternative assessment guidance e.g. BS 4142, BS 6472 (Guide to evaluation of human exposure to vibration in buildings). The document states:

"The assessment should be proportionate and take into account the local circumstances and the nature of the installation."

3.5 Recommended Noise Assessment Criteria

Azymuth recommend the following noise limits for the on-site receptors and those located off-site at 17-27 Queens Drive.

- On-site: Noise contribution from individual ASHP units shall not exceed 37dBA at 1m from the nearest neighbouring window of habitable rooms, including flats within the same block of flats, for both day and night periods.
- A habitable room as defined by MCS 020a is *“any room used or intended to be used for sleeping or living which are not solely used for cooking purposes, but does not include bath or toilet facilities, service rooms, corridors, laundry rooms, hallways or utility rooms.”*
- No noise sensitive on-site receptor locations have been identified to the proposed ASHPs external locations (i.e., no bedroom or living room windows located on the same façade). This obviously doesn't include stairwells or landings. Therefore, a 45dBA internal limit has been adopted for the assessment for on-site receptors and is deemed appropriate given the context of the proposal.
- Off-site: Cumulative noise from all ASHPs operating simultaneously shall not exceed the background sound level at 1m from the nearest (structurally separate) noise sensitive receptors.

4.0 Noise and Vibration Assessment

4.1 Air Source Heat Pumps (ASHP)

Azymuth understand the ASHP will be operational 24hrs per day, with a single ASHP to serve each of the plots 24-28 (5no.). All units are to be located on the top floor balcony at 2nd floor level at the rear of the property. The heat pump layout is detailed in Figure 3 below. It should be noted that:

- 1) There are no habitable floors above this and the heat pump is shielded from the floor below by the balcony structure.
- 2) The only habitable areas that could be impacted by the heat pumps are the bedrooms at 2nd floor level.
- 3) As detailed in floor plan layout below there is a small window to a stairwell and corridor before the nearest habitable bedroom which are located at the front of the property.
- 4) Each ASHP is screened from each other between balconies.

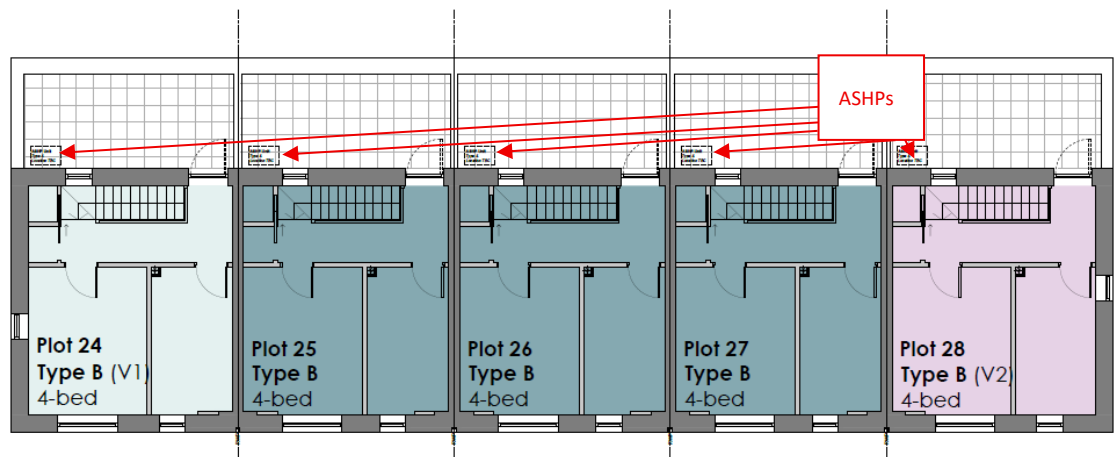


Figure 2 – Drawing of ASHP locations

The proposed units are understood to be the following:

- 5no. Arotherm-plus 7kw (based on Davis Partnership confirmation)

Noise emissions from the above heat pumps can be characterised as broadband air movement over fan blades with low level compressor noise, with no obvious narrow band tonality.

Azymuth have obtained the overall sound power level of the unit from the manufacturer's data sheet. The octave band spectrum has been derived from a similar unit and has been uniformly shifted to match the manufacturers sound power.

Unit	Centre Frequency (Hz) Octave Band Sound Power Level (dB)								Total ~L _{WA} (dB)
	63	125	250	500	1k	2k	4k	8k	
Arotherm-plus 7kw	47	55	56	50	45	45	43	41	53

Table 3 – Calculated sound power level for single ASHP unit – Arotherm-plus 7kw

4.2 Noise Impact

Azymuth have produced a 3D noise prediction model in SoundPLAN 9.1 to predict and visualise the impact of the proposed ASHPs on the surrounding environment, including the noise levels at the nearest worst-case residential receptors.

4.2.2 Grid Noise Map (GNM)

Azymuth have produced the following GNM (day and night) of the proposed installation with all ASHP units operating simultaneously.

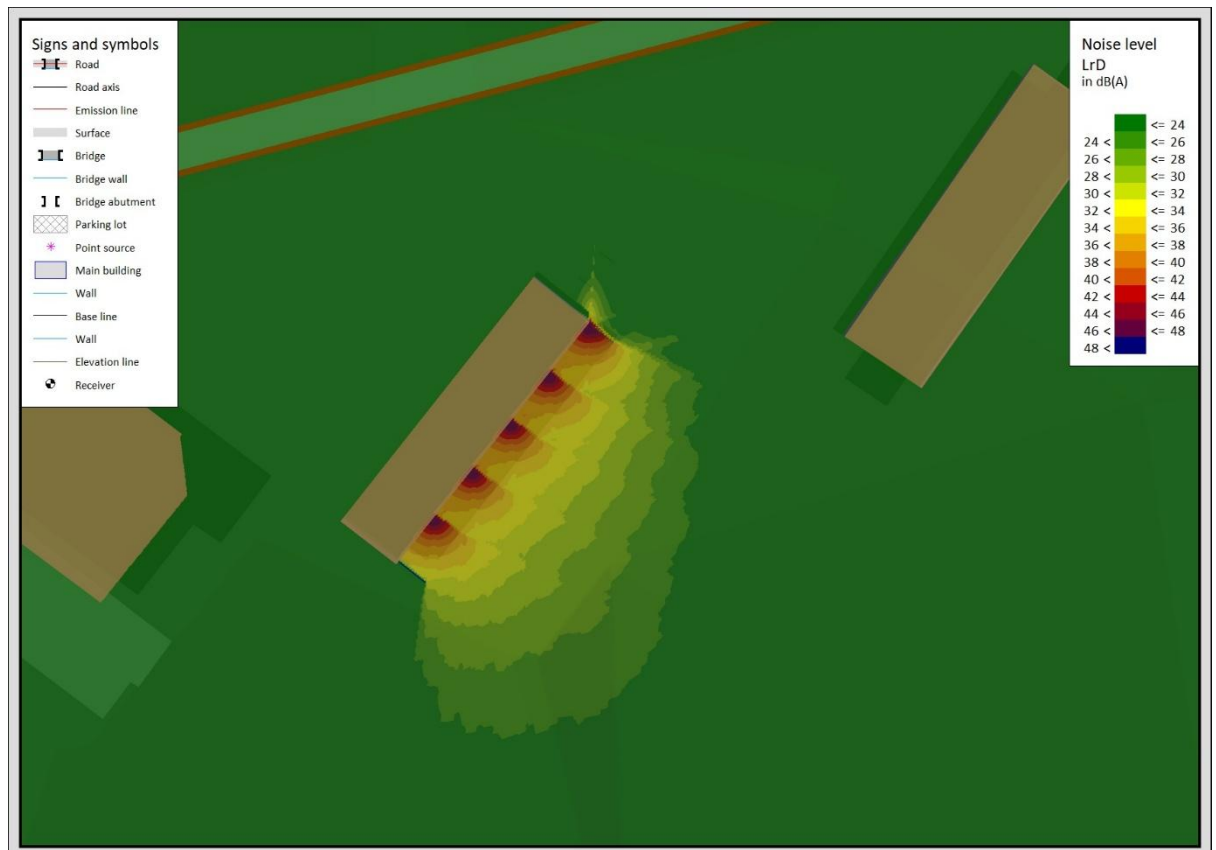


Figure 4 – ASHP Noise propagation

4.2.3 BS 4142 Style Assessment

Azymuth have undertaken a BS 4142 style assessment against the on-site 45dBA and off-site background sound level (57dBA day, 45dBA night).

The following predictions are based off a scenario in which all of the ASHPs are running at full capacity 24hrs per day. If the ASHPs are running for a lesser amount of time e.g. if restricted to predominantly the daytime hours only or less units simultaneously, then the overall impact shall be less.

Source-receiver distances have been measured as the distance between the closest ASHP unit to each respective receptor.

For on-site receptors individual ASHP noise levels from neighbouring units have been assessed (i.e. not the total cumulative noise level outside a receptor window). As such, for on-site receptors where neighbours are within the same plot the contribution from a residents own ASHP is not included in the assessment.

For off-site receptors the cumulative noise level from all ASHPs operating simultaneously have been assessed.

The worst-case noise levels calculated via SoundPLAN have been used in each case for assessment purposes.

No penalties have been applied for characteristic noise as per a BS 4142 style assessment. ASHP noise comprises broadband air movement over fan blades with low-level compressor noise so would not be considered tonal. Individual noise contributions lie below/close to the background sound level at all receptors thus intermittency of individual ASHPs would likely not be clearly perceptible, especially in the case of on-site receptors where the dominant noise contribution is likely the residents own ASHP (i.e. neighbouring ASHP intermittency will not be clearly perceptible over residents own ASHP). Impulsivity is not applicable to ASHPs.



Noise Source Location	Receptor Location	Period	Background Noise Level / Limit (dBA)	Predicted Noise Level (dBA)	Assessment Result (dBA)
Off-site Receptors (neighbouring buildings)					
All ASHP	Corner of 17-27 Queens Drive Rochdale	Day	57	16	-41
		Night	45	16	-29
All ASHP	Proposed flat block plots 1-23, Plot 19 worst case	Day	57	5	-52
		Night	45	5	-40
On-site Receptors (neighbours within the same flat block)					
Plot 28 ASHP	Plot 27 balcony	Day	45	23	-22
		Night			

Table 4 – Predicted noise levels at nearest noise sensitive receptors

As shown in the table above, the predicted noise levels are compliant with the noise limits at both on and off-site receptor locations. This indicates that there will be no noise impacts at the nearest receptors both on and off-site as per BS 4142.

4.3 Vibration Control

Azymuth has assumed the build-up of the balcony as a lightweight timber deck structure (likely worst case). If the ASHP units are to be installed on this structure, then it is recommended that 50mm thick concrete paving slabs are used beneath the rubber isolation feet (rubber feet are standard practice). However, if no rubber feet are present on the units Azymuth recommends the inclusion of Deligo 400mm Rubber Mounting Feet.

The paving slabs would provide additional mass and localised stiffness directly beneath the ASHP units, thereby reducing vibration transmission and minimising structure-borne noise. This approach represents standard good practice for such installations, and we would expect a competent installers to typically adopt a similar solution as part of their normal installation methodology.

5.0 Summary

Azymuth Acoustics UK has been appointed by MSV Housing to undertake a Noise Impact Assessment (NIA) in relation to the proposed installation of five (5 no.) air source heat pumps (ASHPs) at a residential development located on Queens Drive, Rochdale. The purpose of this assessment is to consider the potential noise effects arising from the operation of the proposed ASHPs on the surrounding environment, in support of a detailed planning application.

The ASHPs are proposed to operate on a 24-hour basis, with one unit serving each individual dwelling. All units are proposed to be installed on the second-floor balconies of plots 24–28. Manufacturer's noise data for the ASHPs has been provided by the project MEP consultant, Davis Partnerships, and has been used as the basis for the assessment.

It is noted that there are no habitable rooms (within the flat block) located above the proposed ASHP positions, and the units are separated from the floor below by the balcony structure. The nearest potentially affected habitable rooms are second-floor bedrooms; however, these are located at the front of the dwellings and are separated from the proposed ASHP locations by a stairwell and corridor, with only a small non-habitable window positioned closest to the plant. Each ASHP is also separated from adjacent units by balcony screening.

A baseline noise survey was undertaken in the vicinity of the proposed development to establish representative background sound levels. Daytime background noise levels were measured in the range of approximately 56.8–61.3 dB L_{A90} , with night-time background noise levels measured between approximately 43.6–49.4 dB L_{A90} .

A noise prediction model was prepared using SoundPLAN version 9.1 to predict and assess the potential noise impact of the proposed ASHPs. The assessment has considered the worst-case off-site noise-sensitive receptors, identified as residential properties at 17–27 Queens Drive, as well as on-site receptors where neighbouring dwellings are located in close proximity. Reasonable assumptions regarding balcony construction have been applied within the model, and appropriate vibration isolation measures are recommended to reduce the risk of structure-borne noise.

The results of the assessment indicate that predicted operational noise levels from the proposed ASHPs are likely to be below the established background noise levels at all assessed on-site and off-site receptor locations. Predicted noise levels are between approximately 22 dB and 52 dB below the measured background noise levels, suggesting that the proposed development is unlikely to give rise to significant adverse noise effects when assessed in accordance with BS 4142.

Where the ASHPs operate for shorter periods or with fewer units running simultaneously, such as predominantly during daytime hours, the potential noise impact would be expected to reduce further.

Based on the assessment undertaken, the proposed ASHP installation is considered unlikely to result in unacceptable noise impacts at nearby noise-sensitive receptors. Subject to implementation of the recommended mitigation measures, the findings of this report are considered to support the proposed development from an acoustic perspective.



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	Position	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
Tuesday 26th Novemeber 2024							
12:57:59	1	00:05:00	81.5	65.2	67.9	60.2	57.6
13:02:59	1	00:05:00	81.0	65.6	68.8	60.1	57.3
13:07:59	1	00:05:00	79.4	65.0	68.4	59.9	56.8
13:12:59	1	00:05:00	78.3	63.8	66.5	59.1	56.8
13:19:46	2	00:05:00	80.5	65.1	66.6	62.2	59.3
13:24:46	2	00:05:00	80.9	65.5	66.9	62.2	59.8
13:29:46	2	00:05:00	78.6	65.7	68.4	62.6	60.2
13:34:46	2	00:05:00	84.7	67.3	70.7	62.7	59.9
13:41:19	3	00:05:00	82.2	67.9	70.5	66.3	61.2
13:46:19	3	00:05:00	83.9	67.5	70.2	65.6	61.9
13:51:19	3	00:05:00	81.1	68.5	70.6	66.1	61.9
13:56:19	3	00:05:00	80.0	69.2	72.5	67.2	63.3
14:02:48	1	00:05:00	75.9	63.9	67.9	59.1	55.9
14:07:48	1	00:05:00	77.6	64.3	67.6	60.7	58.2
14:12:48	1	00:05:00	75.4	64.2	68.6	59.9	57.1
14:17:48	1	00:05:00	77.4	64.6	68.8	59.5	57.3
14:23:49	2	00:05:00	83.9	66.5	67.9	62.7	60.4
14:28:49	2	00:05:00	78.9	65.8	68.9	62.7	60.4
14:33:49	2	00:05:00	81.5	66.9	70.1	62.7	60.5
14:38:49	2	00:05:00	80.7	66.9	70.0	62.5	59.7
14:45:08	3	00:05:00	81.9	68.3	70.9	66.0	60.1
14:50:08	3	00:05:00	78.6	68.0	71.4	65.9	61.0
14:55:08	3	00:05:00	80.5	68.4	71.2	66.8	62.4
15:00:08	3	00:05:00	79.2	67.4	70.9	64.6	59.8
15:12:03	2	00:05:00	79.0	65.3	67.8	62.0	59.7
15:17:03	2	00:05:00	77.2	66.2	70.2	62.8	59.9
15:22:03	2	00:05:00	79.5	67.0	70.7	62.5	59.8
15:27:03	2	00:05:00	82.9	65.8	69.1	62.1	60.4
15:32:49	1	00:05:00	79.9	64.5	68.5	58.9	55.1
15:37:49	1	00:05:00	80.5	65.9	69.5	61.9	56.9
15:42:49	1	00:05:00	81.2	65.4	68.9	60.3	56.3
15:47:49	1	00:05:00	81.1	66.8	71.0	63.2	56.2
15:54:39	3	00:05:00	80.1	68.8	72.3	66.2	60.9
15:59:39	3	00:05:00	78.3	68.4	71.7	66.7	61.5
16:04:39	3	00:05:00	77.1	68.0	71.5	65.7	60.7
16:09:39	3	00:05:00	80.2	68.1	72.2	65.4	60.5
Monday 2nd Decemeber 2024							
23:05:00	1	00:05:00	73.6	54.9	55.2	51.7	48.3
23:10:00	1	00:05:00	73.7	57.8	57.8	53.1	50.0
23:15:00	1	00:05:00	78.0	60.9	61.3	54.3	49.8
23:20:00	1	00:05:00	75.1	57.0	57.3	53.3	49.9
23:25:00	1	00:05:00	71.7	55.0	56.0	53.0	48.9
23:32:00	2	00:05:00	62.1	54.9	58.7	53.3	46.8
23:37:00	2	00:05:00	63.0	53.6	57.4	50.8	44.2
23:42:00	2	00:05:00	72.8	54.4	56.9	50.8	45.3



Start	Position	Time	L _{Amax}	L _{Aeq}	L _{A10}	L _{A50}	L _{A90}
23:47:00	2	00:05:00	78.7	56.1	56.5	49.2	41.7
23:52:00	2	00:05:00	80.2	59.2	57.2	50.1	43.2
23:59:00	3	00:05:00	76.2	57.4	59.9	47.6	43.2
Tuesday 3rd Decemeber 2024							
00:04:00	3	00:05:00	75.8	57.9	61.1	51.6	43.4
00:09:00	3	00:05:00	79.2	58.1	57.7	49.8	44.4
00:14:00	3	00:05:00	75.2	56.3	59.8	50.1	43.0
00:19:00	3	00:05:00	76.1	59.8	61.9	52.0	43.9

Table B1 – Fully tabulated noise measurement results