

**Report No:**

13 Daleham Gardens – Noise Impact Assessment 04122024

**Date:**

04/12/2024

**For:**

Marek Wojciechowski Architects

# **13 DALEHAM GARDENS**

## **PLANT NOISE IMPACT ASSESSMENT**

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## REVISION SCHEDULE

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## Introduction

No.13 Daleham Gardens, London NW3 5BY, is a residential property in the London Borough of Camden. It is proposed that 2x air source heat pump units (ASHPs) are to be installed in the rear garden. It is understood that the plant will have the facility to operate 24hrs, Monday to Sunday.

Gillieron Scott Acoustic Design (GSAD) have been commissioned to undertake a background noise survey at the site and a plant noise impact assessment in accordance with Camden Council's noise policy, in order to ensure the necessary requirements are met for this installation.

GSAD have carried out a long-term environmental noise survey from the 3<sup>rd</sup> to the 5<sup>th</sup> of September 2024 to measure the background noise level on site. The microphone location was chosen to be representative of the closest noise sensitive receptor (NSR). The site location, plant area and nearest residential receptor are indicated in Appendix A.

The results, findings and supporting evidence for this assessment are presented within this report.

### 1.0 Brief

- Undertake noise measurements at a fixed monitoring location equivalent to the nearest noise sensitive building over an extended period.
- Identify noise sensitive dwellings located close to the site and assess the topography of the intervening ground.
- Analyse the site-acquired data and determine the appropriate criteria to adopt from Camden Council's noise policy.
- Using measured data from the survey and manufacturer's data for the proposed items of plant where possible, verify the impact of the development to satisfy the Local Authority's noise policy.
- Provide a technical report detailing findings of the noise survey.

### 2.0 Context

The site is a single-family house on a residential road. The client is proposing to install 2x ASHP units in the rear garden, along the southern fence.

The nearest noise sensitive residential receptor has been identified as the property at No.11 Daleham Gardens, approximately 21m south-east at its shortest distance, from the proposed plant location.

The dominant noise sources noted whilst on site included noise from cars, infrequent planes, construction work, and plant noise from a nearby unspecified location.

### 3.0 Summary

A background noise survey was undertaken from the 3<sup>rd</sup> to the 5<sup>th</sup> of August 2024 at a single fixed monitoring location representative of the nearest noise-sensitive receptor, as shown in Appendix B.

It is understood that the plant will have facility to operate 24hrs, Monday-Sunday. Therefore, the periods for this assessment will be based on the representative background noise levels for daytime and night-time. Manufacturer's noise data is provided in Appendix I.

The Local Authority (Camden Council), requires any installation of new plant machinery to be in accordance with BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'. Appendix 3 of the Camden Local Plan 2017 specifies noise thresholds for fixed plant installations. The 'rating level' must not exceed 10 dB below the background sound level (15 dB if tonal components are present).

Results from the survey show representative background sound levels of 39 dB  $L_{A90,15min}$  during the daytime, and 30 dB  $L_{A90,15min}$  at night.

The site location, measurement position and measured results are presented in the following Sections and Appendices.

### 4.0 Plant Noise Assessment Criteria

#### 4.1 British Standard 4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound"

Camden Council's noise policy requires new plant machinery installations to be in accordance with BS 4142:2014 + A1:2019. BS 4142 provides methods for rating and assessing industrial and commercial sound. The standard is used to rate sound from fixed installations and sound from the loading and unloading of goods and materials at commercial premises. The standard requires a "Specific Sound Level", in terms of  $L_{Aeq}$ , is determined either by measurement or calculation at a receptor location. This Specific Sound Level may then be corrected for the character of sound and is then termed the "Rating Level".

Once the Rating Level has been determined, the background sound level is subtracted from it and the greater the difference, the greater the likelihood of an '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. The standard advocates that each site and situation should take the context of the scenario into consideration and that "not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact".

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 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.

The standard provides reference periods over which the assessment should take place which have been reproduced in the table below.

**Table 1: Reference Periods**

Period	Hours
Typical Daytime	07:00 – 23:00
Typical Night-time	23:00 – 07:00

## 4.2 Local Authority Noise Policy

The London Borough of Camden’s noise policy provides limits for noise from industrial and commercial sources. These are stated in Appendix 3 of the Camden Local Plan 2017 and are reproduced below.

**Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)**

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	‘Rating level’ 10dB* below background	‘Rating level’ between 9dB below and 5dB above background	‘Rating level’ greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	‘Rating level’ 10dB* below background and no events exceeding 57dBL <sub>Amax</sub>	‘Rating level’ between 9dB below and 5dB above background or noise events between 57dB and 88dB L <sub>Amax</sub>	‘Rating level’ greater than 5dB above background and/or events exceeding 88dBL <sub>Amax</sub>

**Figure 1: Camden Local Plan noise limits for industrial & commercial sources**

In addition to the standard criteria of BS 4142, the London Borough of Camden’s policy requires that the rating level of the plant noise is at least 10 dB below the background sound level. The guidance goes on to state that, “10 dB should be increased to 15 dB if the noise contains audible tonal elements.”

## 5.0 Survey Details and Results

A long-term background noise survey was undertaken between 12:00hrs on Tuesday 3<sup>rd</sup> to 15:15hrs on Friday 5<sup>th</sup> of September 2024. The measurement location was chosen to be representative of the immediate acoustic environment of the nearest noise sensitive receptor. The microphone position is shown in Appendix B.

The levels were recorded in octave bands as  $L_{eq}$ ,  $L_{max}$  and  $L_{90}$  with Fast time-weighting along with their respective A-weighted single-figure values. The clocks on the sound level meters were synchronised to the correct time before deployment. The meters were then set to integrate sound levels over 15-minute periods in synchronisation mode. A list of the measurement equipment is reported in Appendix G.

The equipment was calibrated at the beginning and a reading taken at the end of the survey period and no calibration drift was noted.

A weather station was also deployed alongside the sound level meter during the long-term measurement. Conditions were considered conducive to acoustic measurement. The wind speed did not exceed 0.4 m/s for the duration of the survey; the temperature varied between 13 and 24°C; short periods of light drizzle and rainfall were recorded on Friday 5<sup>th</sup> of September. Noise data from periods with rainfall have been excluded from the results.

Full survey results to one decimal place are presented in Appendix E. Graphical representations of the results are presented in Appendices C and D.

**Table 2 – Summary of survey results**

	Daytime	Night-time
<b>Average Measured Noise Level <math>L_{Aeq,T}</math></b>	46 dB(A)	44 dB(A)
<b>Lowest Background Noise Level <math>L_{A90,15min}</math></b>	33 dB(A)	28 dB(A)
<b>Representative Background Noise Level <math>L_{A90,15min}</math></b>	39 dB(A)	30 dB(A)

The plant unit will have the facility to operate 24hrs Monday-Sunday. This assessment of the newly proposed plant items in the following section will be based on the representative background noise levels of 39 dB  $L_{A90,15min}$  during daytime and 30 dB  $L_{A90,15min}$  during night-time.

## 6.0 Plant Noise Assessment

It is proposed 2x Samsung AE160CXYDGK ASHPs are installed at ground level in the south side of the rear garden, within an acoustic enclosure, as indicated in Appendices A and B. The proposed plant location and the manufacturer noise data are shown in Appendices H and I. The nearest noise sensitive building has been identified as being 11 Daleham Gardens. The nearest rear facing windows of the NSR are approximately 21m from the proposed enclosure positions.

The plant noise impact assessment for the most affected noise sensitive building has been carried out in the following tables. The noise impact assessment is shown for the new proposed plant units during daytime and night-time periods, with the required mitigation measures to comply with the Local Authority's noise criteria.

**Table 3 – Mitigation Measures – Daytime**

Element	Level dB(A)	Comments
Sound Power Level (SWL)	65	SWL from manufacturer's datasheet
Sound Pressure Level (SPL)	54	-11dB from sound power to sound pressure level
Cumulative SPL	+3	Cumulative level for 2 units
Reflections	+6	2 additional acoustically hard reflective surface (floor + fence)
Specific Sound Level, $L_s$	63	Specific sound level before acoustic feature corrections
Distance losses	-26	Point source distance attenuation over 20m (1m from nearest identified noise sensitive receptor)
Mitigation Measures	-8	Noise reduction required during daytime hours
Acoustic Feature Correction	0	Where the specific sound level is reduced to 10dB below the background noise, no distinguishing features are likely to be perceptible at the nearest NSR
<b>Rating Level, <math>L_{Ar,Tr}</math></b>	<b>29</b>	<b>At 1m from the nearest noise-sensitive receptor</b>
Representative background noise level, $L_{A90,15min}$	39	Representative background noise level, daytime
Difference (Rating Level – Background)	-10	The rating level is calculated at 10 dB below representative background noise level, which demonstrates compliance with the Local Authority.

**Table 4 – Mitigation Measures - Night-time**

Element	Level dB(A)	Comments
Sound Power Level (SWL)	65	SWL from manufacturer's datasheet
Sound Pressure Level (SPL)	54	-11dB from sound power to sound pressure level
Cumulative SPL	+3	Cumulative level for 2 units
Reflections	+6	2 additional acoustically hard reflective surface (floor + fence)
Specific Sound Level, $L_s$	63	Specific sound level before acoustic feature corrections
Distance losses	-26	Point source distance attenuation over 20m (1m from nearest identified noise sensitive receptor)
Mitigation Measures	-17	Noise reduction required during night-time hours
Acoustic Feature Correction	0	Where the specific sound level is reduced to 10dB below the background noise, no distinguishing features are likely to be perceptible at the nearest NSR
<b>Rating Level, <math>L_{Ar,Tr}</math></b>	<b>20</b>	<b>At 1m from the nearest noise-sensitive receptor</b>
Representative background noise level, $L_{A90,15min}$	30	Representative background noise level, night-time
Difference (Rating Level – Background)	-10	The rating level is calculated at 10 dB below representative background noise level, which demonstrates compliance with the Local Authority.

The assessment shows that the currently proposed units would require an acoustic enclosure offering a minimum of 17 dB(A) of attenuation (e.g. by ENVIRON, NOICO or CAICE) in order to comply with the Local Authority's noise requirements.



## 7.0 Uncertainty

The sound level meter was checked at the beginning and end of the survey and the field calibration showed no drift.

Weather conditions during the survey were recorded and were considered conducive to acoustic measurement. The wind speed did not exceed 0.4 m/s throughout (a maximum of up to 5 m/s is permissible). Noise data from periods with rainfall have been excluded from the results.

Overall, the uncertainty within the survey procedure is deemed not to have significant influence on the outcome of the assessment.

## 8.0 Conclusion

GSAD have been commissioned to undertake a noise impact assessment in accordance with Camden Council's noise policy.

GSAD has undertaken a background noise survey at the site and the survey results are presented within this report, together with BS4142:2014+A1:2019 and the Council's policy on plant noise assessment for the proposed unit.

Representative background sound levels of 39 dB  $L_{A90,15min}$  during daytime and 30 dB  $L_{A90,15min}$  during night-time, between 12:00hrs on Tuesday 3<sup>rd</sup> to 15:15hrs on Friday 5<sup>th</sup> of September 2024, have been determined.

Results from the assessment for the proposed units and enclosure demonstrate a rating level of 20 dB(A) at the closest noise sensitive receptor during the night-time period and demonstrates compliance with the Local Authority's noise policy. It has been calculated that the acoustic enclosure should provide a minimum 17 dB(A) reduction to achieve the required rating levels.

## 9.0 Statement of Competence

The assessment has been undertaken by the author of this report: Matias Duarte, BSc (Music Technology) MSc (Environmental and Architectural Acoustics) AMIOA. The author is an Acoustic Consultant at Gillieron Scott Acoustic Design. Matias has undertaken several noise surveys according to the BS 4142:2014 standard.

The assessment has been checked by: Lucie Zalberg, BSc (Physics) MSc (Architectural Acoustics) MIOA. The author is a Director of Gillieron Scott Acoustic Design with 15+ years' experience since completing a degree at Pierre et Marie University in Paris and Bath University. Lucie has undertaken numerous noise assessments according to the 1997 revision of the British Standard and the most recent 2014 revision of the standard.

# APPENDICES

## APPENDIX A: Site Overview



Figure 1: Aerial view of site

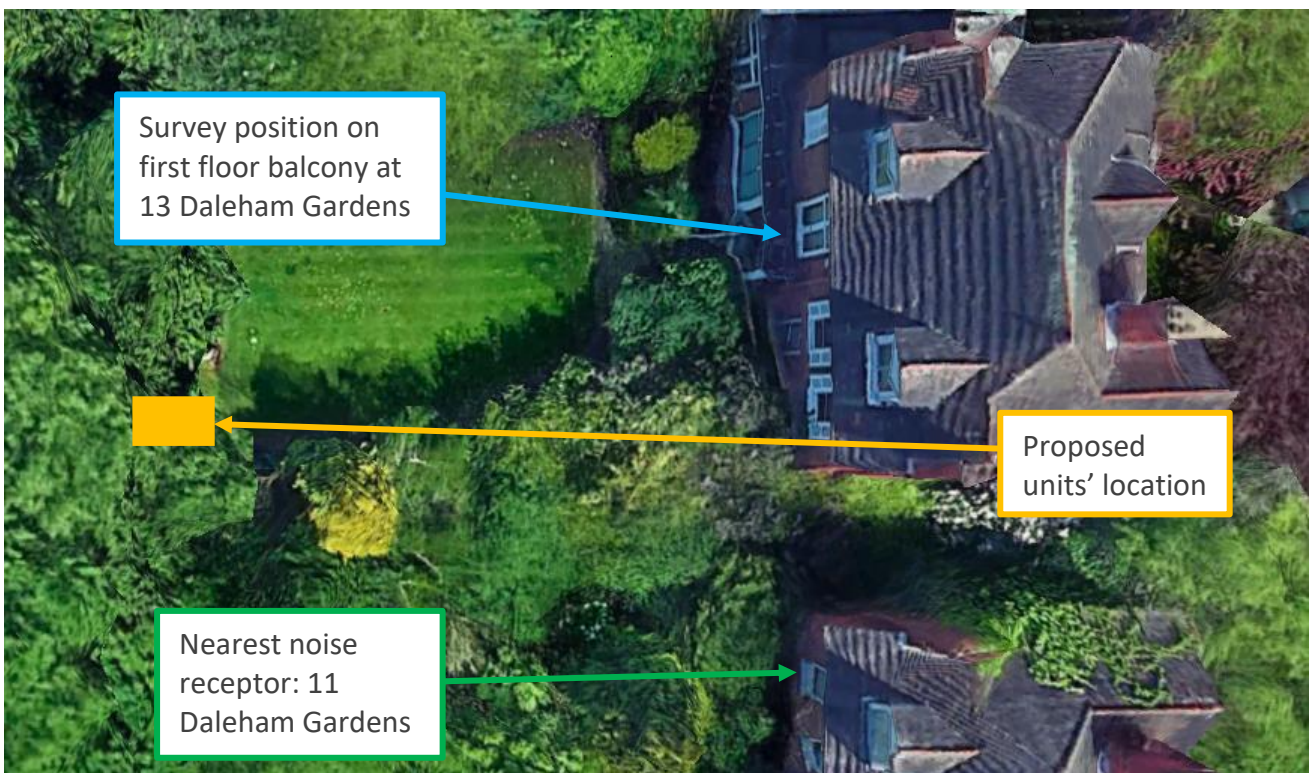


Figure 2: Aerial view of site with equipment location

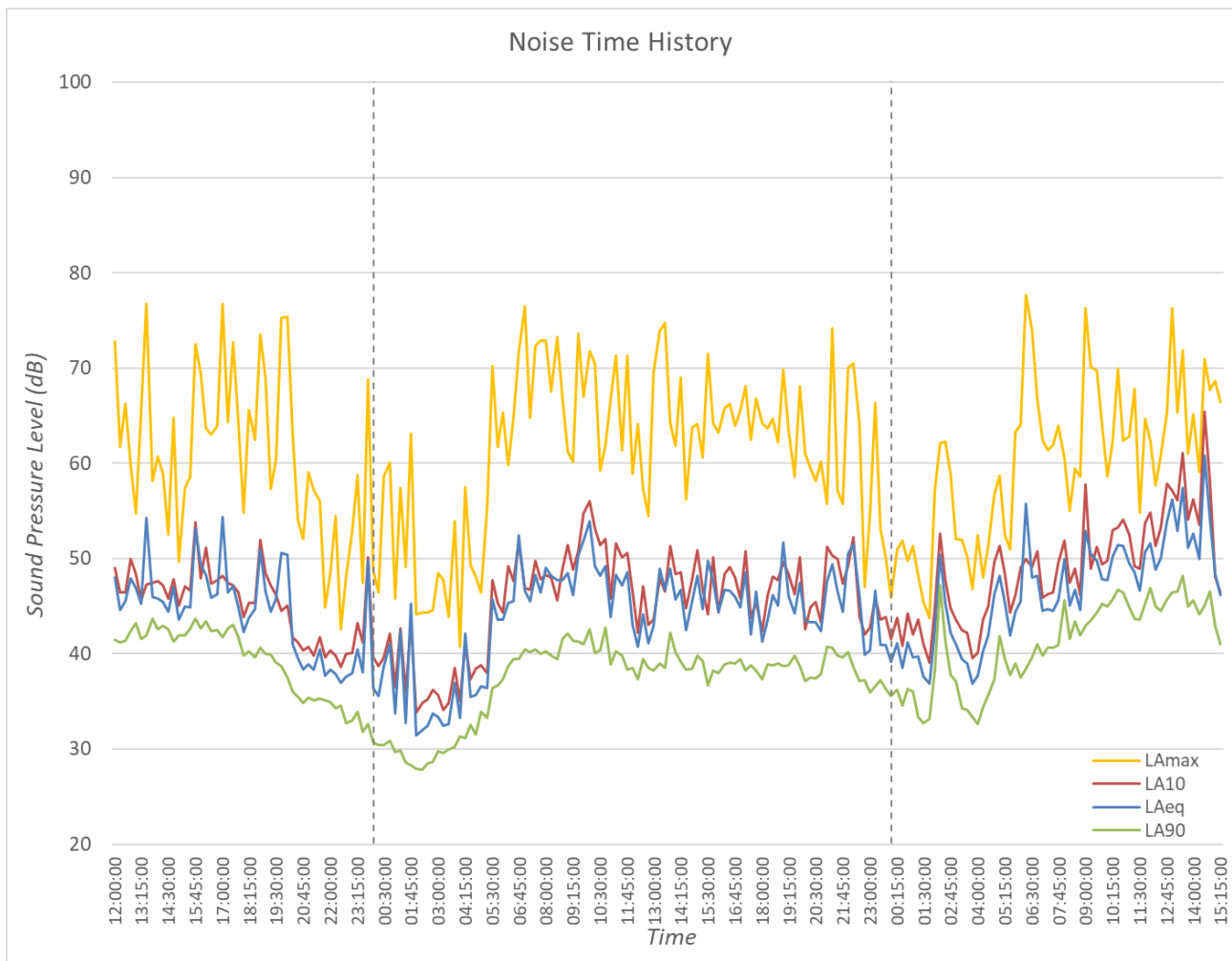


## APPENDIX B: Survey Arrangement



Figure 3: Sound level meter and weather station in situ in relation to nearest noise-sensitive receptor

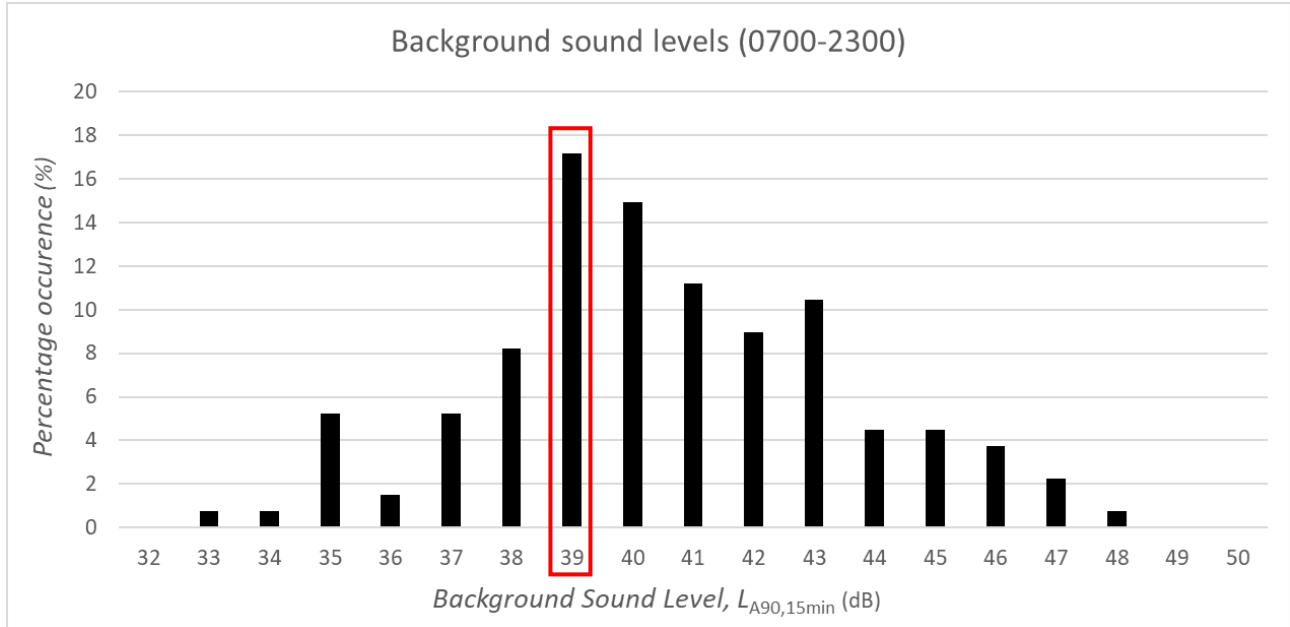
## APPENDIX C: Time Series Graph



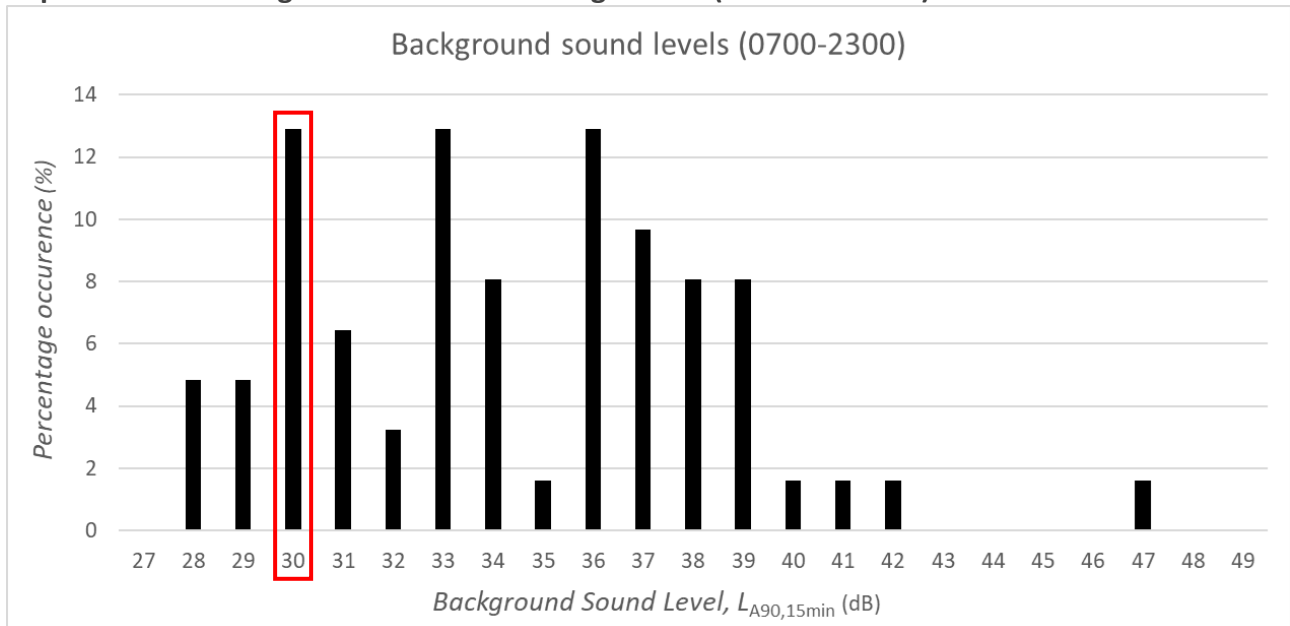
## APPENDIX D: Histogram Plots

The following histograms shows the distribution of background sound levels during daytime (07.00-23.00) and night-time (23.00-07.00) periods over the survey duration.

### Representative Background Noise Level – Daytime (07:00-23:00hrs)



### Representative Background Noise Level – Night-time (23:00-07:00hrs)



## APPENDIX E: Full Survey Results

### Long-term Measurement Data (03/09/2024-05/09/2024)

Date	Time	L <sub>Aeq,T</sub> [dB]	L <sub>Amax</sub> [dB]	L <sub>A10</sub> [dB]	L <sub>A90</sub> [dB]
03/09/2024	12:00	48	72.8	49	41.5
03/09/2024	12:15	44.6	61.7	46.4	41.2
03/09/2024	12:30	45.5	66.2	46.4	41.4
03/09/2024	12:45	47.9	59.8	49.9	42.4
03/09/2024	13:00	46.9	54.7	48.4	43.2
03/09/2024	13:15	45.2	65.4	45.6	41.6
03/09/2024	13:30	54.3	76.7	47.3	41.9
03/09/2024	13:45	46	58.1	47.5	43.7
03/09/2024	14:00	45.8	60.7	47.6	42.6
03/09/2024	14:15	45.4	58.9	47.2	42.9
03/09/2024	14:30	44.4	52.5	45.8	42.6
03/09/2024	14:45	47	64.8	47.8	41.3
03/09/2024	15:00	43.6	49.7	45.1	41.9
03/09/2024	15:15	45	57.4	47.1	41.9
03/09/2024	15:30	44.9	58.6	46.6	42.7
03/09/2024	15:45	53.2	72.5	53.8	43.7
03/09/2024	16:00	49.4	69.5	47.9	42.7
03/09/2024	16:15	48.3	63.7	51.1	43.4
03/09/2024	16:30	45.9	63	47.4	42.4
03/09/2024	16:45	46.3	63.9	47.7	42.5
03/09/2024	17:00	54.4	76.7	48.2	41.7
03/09/2024	17:15	46.4	64.3	47.5	42.7
03/09/2024	17:30	47.1	72.7	47.2	43
03/09/2024	17:45	44.9	64.2	46.4	41.7
03/09/2024	18:00	42.3	54.8	43.9	39.8
03/09/2024	18:15	43.8	65.6	45.3	40.3
03/09/2024	18:30	44.7	62.5	45.3	39.6
03/09/2024	18:45	51	73.5	52	40.6
03/09/2024	19:00	46.5	68.9	48.5	40
03/09/2024	19:15	44.4	57.3	47.2	39.9
03/09/2024	19:30	45.8	60.4	46.2	39.1
03/09/2024	19:45	50.6	75.3	44.5	38.7
03/09/2024	20:00	50.4	75.4	45.1	37.5
03/09/2024	20:15	41	63.1	41.7	36
03/09/2024	20:30	39.5	54	41.2	35.5
03/09/2024	20:45	38.3	52.1	40.4	34.8
03/09/2024	21:00	38.9	59.1	40.7	35.4
03/09/2024	21:15	38.3	57.2	39.8	35.1
03/09/2024	21:30	40.5	56	41.7	35.3

03/09/2024	21:45	37.7	44.9	39.6	35.1
03/09/2024	22:00	38.3	48.5	40.4	34.9
03/09/2024	22:15	37.9	54.5	39.8	34.3
03/09/2024	22:30	37	42.6	38.6	34.6
03/09/2024	22:45	37.6	48.2	40	32.7
03/09/2024	23:00	38	52.9	40.1	33
03/09/2024	23:15	40.5	58.8	43.2	33.9
03/09/2024	23:30	38.1	47.5	41.2	31.8
03/09/2024	23:45	49.8	68.8	50.1	32.6
04/09/2024	00:00	36.4	48.7	39.6	30.7
04/09/2024	00:15	35.6	46.4	38.7	30.4
04/09/2024	00:30	38.7	58.6	39.6	30.4
04/09/2024	00:45	41	60.1	42.1	30.9
04/09/2024	01:00	33.7	45.8	36.5	29.7
04/09/2024	01:15	42.4	57.4	42.7	29.9
04/09/2024	01:30	32.7	49.1	35.9	28.6
04/09/2024	01:45	45.2	63.1	43.3	28.3
04/09/2024	02:00	31.4	44.1	33.8	27.9
04/09/2024	02:15	32	44.3	34.8	27.8
04/09/2024	02:30	32.4	44.3	35.2	28.5
04/09/2024	02:45	33.7	44.6	36.2	28.7
04/09/2024	03:00	33.4	48.5	35.7	29.8
04/09/2024	03:15	32.4	47.7	34.1	29.6
04/09/2024	03:30	32.6	43.9	34.8	30
04/09/2024	03:45	37	53.9	38.5	30.2
04/09/2024	04:00	33.3	40.7	35	31.3
04/09/2024	04:15	42.1	57.5	41.1	31.2
04/09/2024	04:30	35.5	49.3	37.3	32.5
04/09/2024	04:45	35.7	48.1	38.4	31.5
04/09/2024	05:00	36.6	46.4	38.8	33.9
04/09/2024	05:15	36.4	55.4	38	33.3
04/09/2024	05:30	45.7	70.2	47.7	36.4
04/09/2024	05:45	43.6	61.7	45.3	36.7
04/09/2024	06:00	43.6	65.3	44.3	37.3
04/09/2024	06:15	45.3	59.8	49.2	38.7
04/09/2024	06:30	45.5	64.8	47.6	39.4
04/09/2024	06:45	52.4	71.6	51.7	39.4
04/09/2024	07:00	46.6	76.5	46.9	40.5
04/09/2024	07:15	45.5	64.8	46.7	40.2
04/09/2024	07:30	48.3	72.3	49.8	40.5
04/09/2024	07:45	46.4	72.9	47.8	40

04/09/2024	08:00	49	72.9	48.3	40.3
04/09/2024	08:15	48.2	67.5	48	39.8
04/09/2024	08:30	47.7	73.2	45.6	39.4
04/09/2024	08:45	47.7	66.8	48.9	41.6
04/09/2024	09:00	48.5	61.3	51.4	42.1
04/09/2024	09:15	46.2	60.2	48.8	41.4
04/09/2024	09:30	50.3	73.6	50.8	41.3
04/09/2024	09:45	51.9	67	54.7	41
04/09/2024	10:00	53.9	71.8	56	42.6
04/09/2024	10:15	49.2	70.5	53.2	40.1
04/09/2024	10:30	48.2	59.2	51.4	40.4
04/09/2024	10:45	49.2	61.9	52.1	42.8
04/09/2024	11:00	43.9	66.7	45.8	38.9
04/09/2024	11:15	48.3	71.3	51.6	40.3
04/09/2024	11:30	47.2	61.4	50.1	39.8
04/09/2024	11:45	48.6	71.3	50.6	38.3
04/09/2024	12:00	43	58.9	46.5	38.5
04/09/2024	12:15	40.7	64.1	42.2	37.3
04/09/2024	12:30	44.1	57.3	47.1	39.4
04/09/2024	12:45	41.1	54.5	43	38.5
04/09/2024	13:00	42.9	69.6	43.6	38.2
04/09/2024	13:15	48.9	73.9	47.9	39
04/09/2024	13:30	46.7	74.7	46.5	38.5
04/09/2024	13:45	48.9	64.2	51.3	42.2
04/09/2024	14:00	45.7	61.8	48.4	40.2
04/09/2024	14:15	46.7	69	48.6	39.2
04/09/2024	14:30	42.5	56.2	44.8	38.3
04/09/2024	14:45	45.5	63.8	47.8	38.4
04/09/2024	15:00	48.2	64.1	50.9	39.8
04/09/2024	15:15	44.7	60.6	46.8	39.3
04/09/2024	15:30	49.8	71.5	44.1	36.7
04/09/2024	15:45	47.6	64.2	50.1	38.2
04/09/2024	16:00	44.4	63.2	44.3	38
04/09/2024	16:15	46.7	65.8	48.4	38.9
04/09/2024	16:30	46.6	66.2	49.1	39.1
04/09/2024	16:45	46	63.9	48	39
04/09/2024	17:00	44.9	65.5	45.8	39.4
04/09/2024	17:15	48.6	68.1	50.8	38.2
04/09/2024	17:30	42	62.5	43.8	38.8
04/09/2024	17:45	46.5	66.8	45.4	38.2
04/09/2024	18:00	41.3	64.2	42.4	37.3
04/09/2024	18:15	43.5	63.7	46.1	38.9
04/09/2024	18:30	46.2	64.7	48.1	38.8
04/09/2024	18:45	45.1	62.2	47.7	39
04/09/2024	19:00	51.7	69.8	49.7	38.7

04/09/2024	19:15	46.1	63.5	48.4	38.8
04/09/2024	19:30	44.2	58.6	46.3	39.8
04/09/2024	19:45	47.5	68.1	50.1	38.7
04/09/2024	20:00	43.5	61	42.6	37.1
04/09/2024	20:15	43.3	59.5	44.9	37.5
04/09/2024	20:30	43.3	58.1	45.4	37.4
04/09/2024	20:45	42.4	60.2	43.3	37.9
04/09/2024	21:00	47.6	55.7	51.2	40.7
04/09/2024	21:15	49.4	74.2	50.3	40.6
04/09/2024	21:30	46.5	57.1	49.9	39.8
04/09/2024	21:45	44.4	55.7	47.4	39.6
04/09/2024	22:00	50.5	70	49.2	40.2
04/09/2024	22:15	51.5	70.5	52.2	38.6
04/09/2024	22:30	46.1	64.1	44	37.1
04/09/2024	22:45	39.9	47	42	37.2
04/09/2024	23:00	40.4	54.7	42.8	35.9
04/09/2024	23:15	46.6	66.3	45.9	36.6
04/09/2024	23:30	40.9	53.1	43.6	37.2
04/09/2024	23:45	40.9	50.1	43.9	36.3
05/09/2024	00:00	39.2	45.9	41.6	35.6
05/09/2024	00:15	41.1	51	43.8	36.2
05/09/2024	00:30	38.5	51.9	40.8	34.6
05/09/2024	00:45	41.2	49.8	44.2	36.3
05/09/2024	01:00	39.6	51.3	42	36
05/09/2024	01:15	39.7	48.2	43.6	33.4
05/09/2024	01:30	37.6	45.4	41	32.7
05/09/2024	01:45	36.9	43.8	39.1	33.2
05/09/2024	02:00	42.5	57.1	44.9	38.2
05/09/2024	02:15	50.4	62.1	52.6	47.2
05/09/2024	02:30	45.3	62.3	47.7	41.4
05/09/2024	02:45	42.2	58.9	44.8	37.8
05/09/2024	03:00	41	52.1	43.6	37.1
05/09/2024	03:15	39.4	52	42.5	34.3
05/09/2024	03:30	39	50.2	42.2	34.1
05/09/2024	03:45	36.9	46.8	39.5	33.4
05/09/2024	04:00	37.7	52.4	40.1	32.6
05/09/2024	04:15	40.3	48	43.6	34.4
05/09/2024	04:30	41.9	51.3	45	35.7
05/09/2024	04:45	46.3	56.8	49.7	37.3
05/09/2024	05:00	48.2	58.7	51.3	41.8
05/09/2024	05:15	45.3	52.4	48.4	39.4
05/09/2024	05:30	41.9	51	44.3	37.8
05/09/2024	05:45	44.4	63.3	46.2	39
05/09/2024	06:00	45.5	64	49	37.5
05/09/2024	06:15	55.7	77.7	49.9	38.4



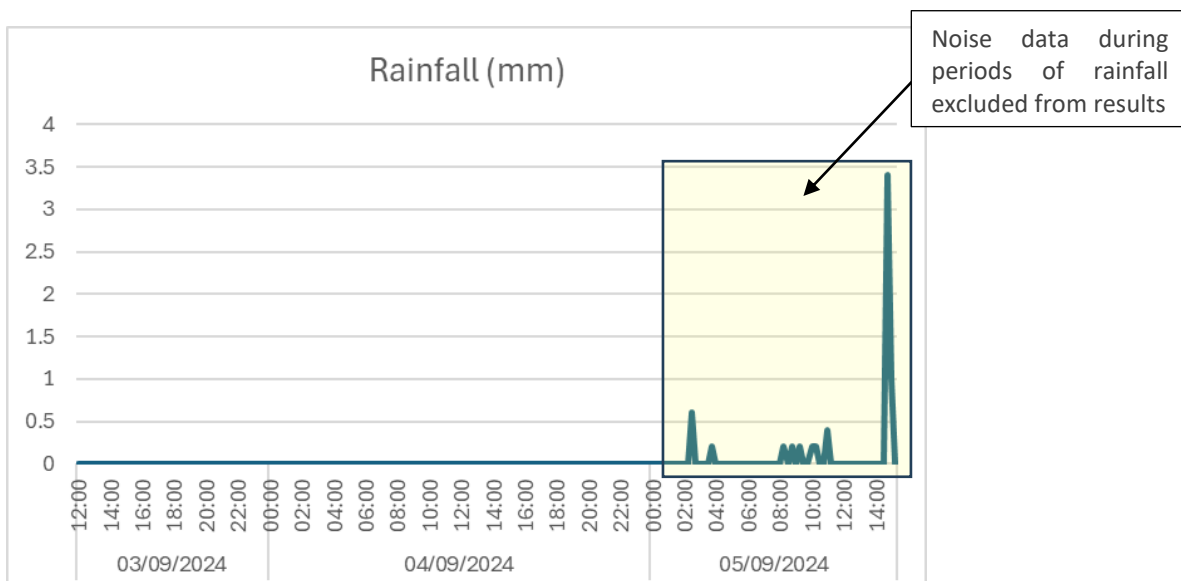
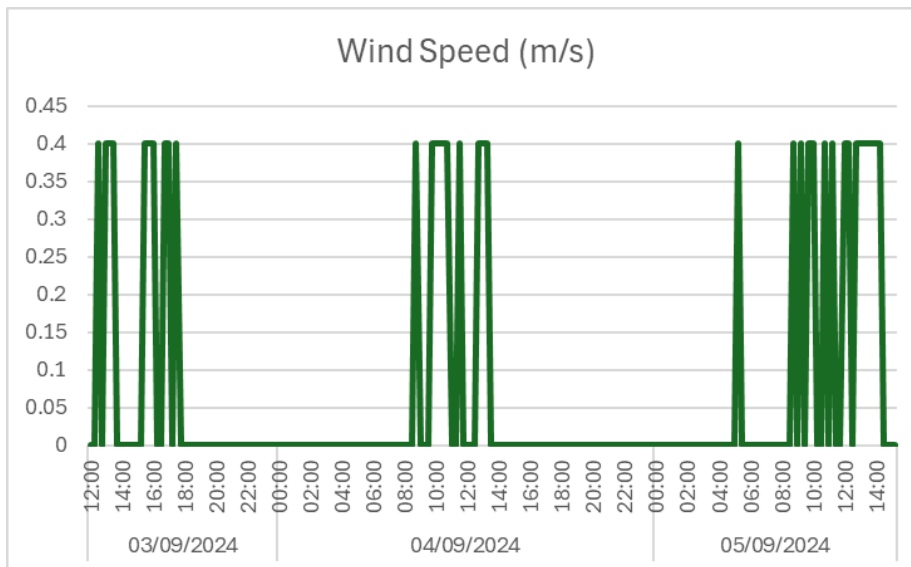
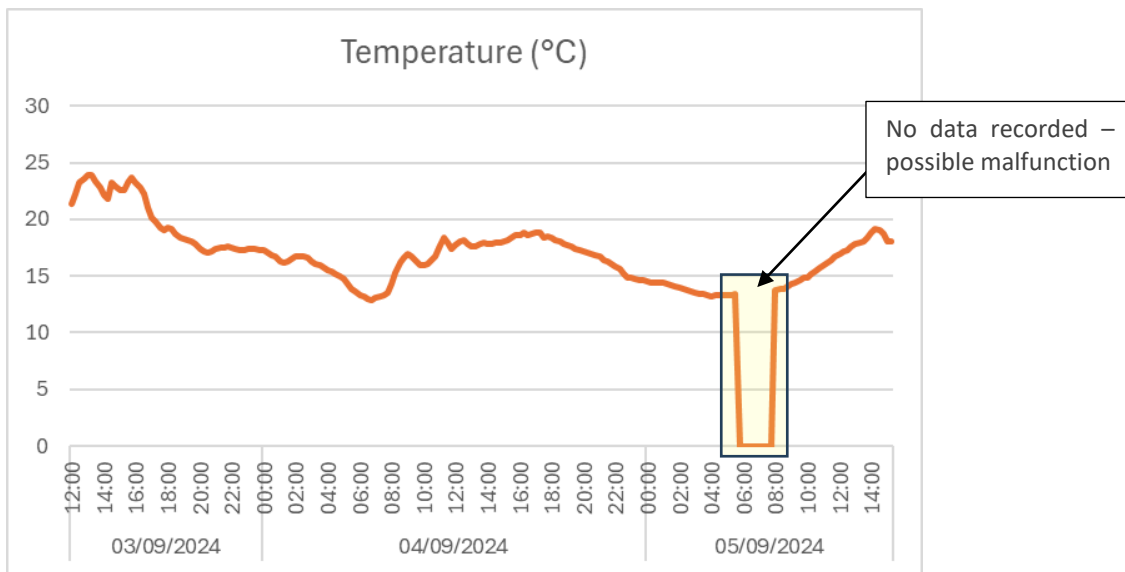
05/09/2024	06:30	48	74	49.1	39.6
05/09/2024	06:45	48.2	66.7	50.8	41
05/09/2024	07:00	44.5	62.5	45.9	39.8
05/09/2024	07:15	44.7	61.4	46.3	40.6
05/09/2024	07:30	44.5	61.9	46.4	40.6
05/09/2024	07:45	45.6	63.9	49.6	40.9
05/09/2024	08:00	49.9	60.5	51.9	45.6
05/09/2024	08:15	45.1	55	47.5	41.6
05/09/2024	08:30	46.7	59.4	48.9	43.4
05/09/2024	08:45	44.6	58.6	46.2	41.9
05/09/2024	09:00	52.9	76.3	57.8	42.9
05/09/2024	09:15	50.5	70.1	48.9	43.5
05/09/2024	09:30	49.8	69.7	51.2	44.3
05/09/2024	09:45	47.8	63.9	49.4	45.2
05/09/2024	10:00	47.7	58.6	49.8	45
05/09/2024	10:15	50.2	62.3	53	45.7
05/09/2024	10:30	51.4	69.9	53.3	46.7
05/09/2024	10:45	51.3	62.4	54.1	46.4
05/09/2024	11:00	49.5	62.8	52.5	44.9
05/09/2024	11:15	48.6	67.8	49.2	43.7
05/09/2024	11:30	46.6	54.8	48.9	43.6
05/09/2024	11:45	50.7	64.7	53.7	45.2
05/09/2024	12:00	51.6	62.4	54.8	46.9
05/09/2024	12:15	48.8	57.7	51.3	45
05/09/2024	12:30	50	60.8	53.3	44.5
05/09/2024	12:45	53.9	65.3	57.9	45.7
05/09/2024	13:00	56.2	76.3	57.1	46.4
05/09/2024	13:15	52.9	65.3	56.1	46.5
05/09/2024	13:30	57.4	71.9	61.1	48.2
05/09/2024	13:45	51.1	61	54.1	45
05/09/2024	14:00	52.6	65.1	56.2	45.6
05/09/2024	14:15	49.9	59.1	53.5	44.1
05/09/2024	14:30	60.8	70.9	65.4	45.1
05/09/2024	14:45	54.2	67.7	58.1	46.5
05/09/2024	15:00	48.4	68.6	48.1	42.9
05/09/2024	15:15	46.2	66.4	46.4	41

\*Data highlighted in yellow excluded from results due to rainfall.

## Calibration Data

	Date	Time	L <sub>eq,T</sub> @ 1kHz [dB]
Survey Start	03/09/2024	11:28	114.0
Survey End	05/09/2024	15:57	114.0

## APPENDIX F: Survey Weather Data

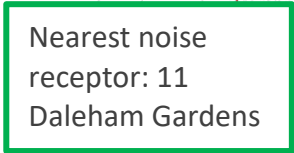


## **APPENDIX G: Equipment**

- NTi XL2 Real Time Analyser
- Norsonic 1251 Calibrator
- NTi outdoor kit
- Tripods
- Davis Vantage Weather Station

All sound level meters are Class 1 and within 2 years of their most recent laboratory calibration. Calibration certificates are available on request.

## APPENDIX H: Proposed Mechanical Layout



## APPENDIX I: Manufacturer's Data

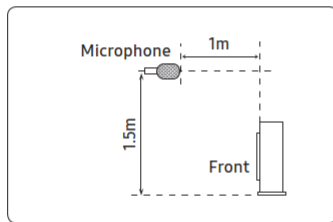
### 2x Samsung EHS Mono R290 AE160CXYDGK/EU

## 2. Outdoor Units

### 2-6. Sound data

#### Sound Pressure level

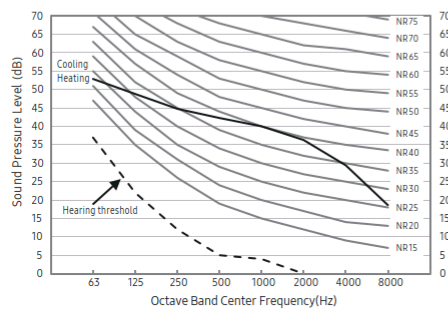
Unit: dB(A)



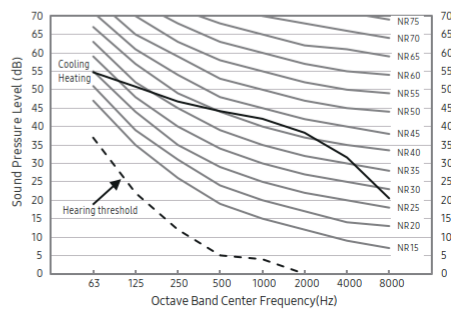
Model	Heating	Cooling
AE080CXYDGK/EU	45	45
AE120CXYDGK/EU	47	47
AE160CXYDGK/EU	51	51

- NR Curve

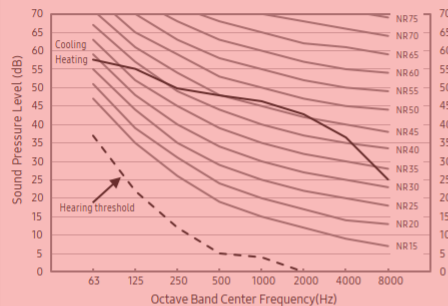
5) AE080CXYDGK/EU



6) AE120CXYDGK/EU



7) AE160CXYDGK/EU



2x Samsung EHS Mono R290 AE160CXYDKG/EU (continued)

## 2. Outdoor Units

### 2-6. Sound data

#### Sound Power level

Unit: dB(A)

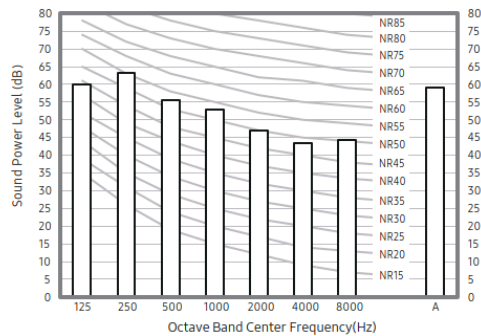
#### NOTE

- Specifications may be subject to change without prior notice
  - Sound power level is an absolute value that a sound source generates.
  - dBA = A-weighted sound power level.
  - Reference power : 1pW.
  - Measured according to ISO 3741.

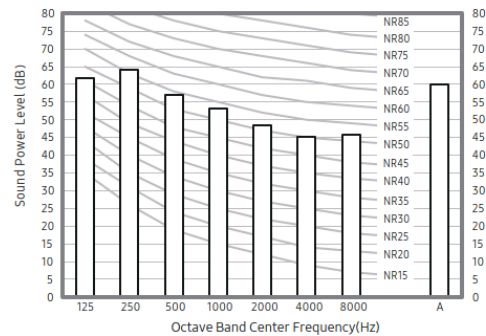
Model	Heating	Cooling
AE080CXYDGK/EU	59	59
AE120CXYDGK/EU	60	60
AE160CXYDGK/EU	65	65

- NR Curve

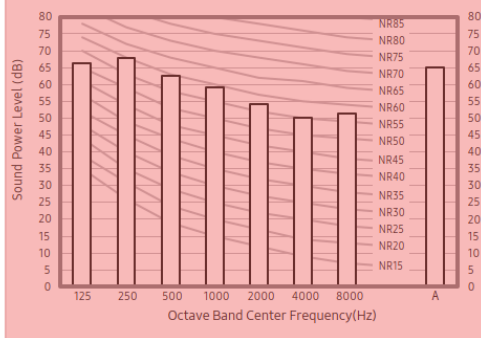
5) AE080CXYDGK/EU



6) AE120CXYDGK/EU











7) AE160CXYDGK/EU



2x Samsung EHS Mono R290 AE160CXYDKG/EU (continued)

# Specifications

Outdoor Unit			Indoor Unit		Control/Interface				
 			 		   				
			ClimateHub (200/260L)		Mono Control Kit	Wi-Fi Kit	Wired Remote Controller	Touch Controller	DMS2.5

			AE050CXYDEK	AE080CXYDEK	AE120CXYDEK	AE160CXYDEK	AE080CXYDGK	AE120CXYDGK	AE160CXYDGK
Capacity									
Capacity*	Heating (A7/W35)	kW	5.0	8.0	12.0	16.0	8.0	12.0	16.0
	Cooling (A35/W18)	kW	5.0	8.0	12.0	14.0	8.0	12.0	14.0
Performance									
Leaving Water Temperature	Heating	°C	15-75	15-75	15-75	15-75	15-75	15-75	15-75
	Cooling	°C	5-25	5-25	5-25	5-25	5-25	5-25	5-25
Efficiency	SCOP Class (35°C)		A+++	A+++	A+++	A+++	A+++	A+++	A+++
	SCOP Class (55°C)		A++	A++	A++	A++	A++	A++	A++
Sound Pressure**	Normal	dB(A)	41	45	47	51	45	47	51
	Quiet Mode	dB(A)	35	35	35	35	35	35	35
Operating Temperature Range	Heating	°C	-25~35	-25~35	-25~35	-25~35	-25~35	-25~35	-25~35
	Cooling	°C	10~46	10~46	10~46	10~46	10~46	10~46	10~46
Electrical Data									
Power Supply	Φ, V		1Φ, 2Line, 220~240V, 50Hz	1Φ, 2Line, 220~240V, 50Hz	1Φ, 2Line, 220~240V, 50Hz	1Φ, 2Line, 220~240V, 50Hz	3Φ, 4Line, 380~415V, 50Hz	3Φ, 4Line, 380~415V, 50Hz	3Φ, 4Line, 380~415V, 50Hz
Refrigerant									
Refrigerant Type			R290 (GWP=3)	R290 (GWP=3)	R290 (GWP=3)	R290 (GWP=3)	R290 (GWP=3)	R290 (GWP=3)	R290 (GWP=3)
Water Pipe	Inlet/Outlet	mm	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"	BSPP male 1"/BSPP male 1"
Dimensions									
Net Dimensions	W x H x D	mm	998 x 850 x 500	998 x 850 x 500	1270 x 1018 x 530	1270 x 1018 x 530	998 x 850 x 500	1270 x 1018 x 530	1270 x 1018 x 530

The available line-up, including capacities and models, may vary by region. Features and specifications are subject to change without notice.

\* A2W Condition: (Heating) Water In/Out 30°C/35°C, Outdoor Air 7°C [DB] /6°C [WB], (Cooling) Water In/Out 23°C/18°C, Outdoor Air 35°C [DB].

\*\* Sound pressure level is obtained in an anechoic room. Sound pressure level is a relative value, depending on the distance and acoustic environment.

Sound pressure level may differ depending on operation conditions.

## **APPENDIX J: Acoustic Feature Correction**

### **Tonality**

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

### **Impulsivity**

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

### **Intermittency**

When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

### **Other sound characteristics**

Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.



## APPENDIX K: Glossary of Acoustic Terms

**DECIBEL (dB)** - A unit of sound pressure measurement

Sound Pressure Level in dB ( $L_p$ ) =  $20 \log (\text{Measured sound pressure}/\text{Reference sound pressure} = 20 \mu\text{Pa})$

**dB(A)** - The A-weighted sound pressure level, the weighting network reduces low frequency sound in a similar way to the human ear.

**REVERBERATION TIME (RT or T)** – decay of sound in rooms

The time taken for a sound, once terminated, to fall through 60dB i.e. to one millionth of its original sound intensity.  $T_{30}$  – RT for first 30dB of decay.  $RT_{500}$  - Mid frequency RT.

**HERTZ (Hz)** - a unit of frequency measurement. The normal range of hearing is from 20Hz to about 15kHz.

**ABSORPTION COEFFICIENT** – degree to which a material absorbs sound.

The ratio of absorbed to incident sound energy (perfect absorber = 1)

**SOUND REDUCTION INDEX  $R$**  – quantity which describes a material's ability to reduce the sound pressure level across it (e.g. a wall or floor)

$$R = L_1 - L_2 + 10 \log (S/A)$$

$L_1$  - Average sound pressure level in source room (averaged from 100 Hz – 3150 Hz)

$L_2$  - Average sound pressure level in receiving room (averaged from 100 Hz – 3150 Hz)

$S$  – Wall Area ( $\text{m}^2$ )

$A$  – Total absorption in receiving room ( $\text{m}^2$  units)

**$R_w$**  – weighted sound reduction index

**AVERAGE ROOM TO ROOM LEVEL DIFFERENCE –  $D$** ,  $\text{dB} = L_1 - L_2$ , averaged 1/3 octave bands from 100Hz – 3150kHz.

**$D_w$**  – weighted value of  $D$  (usually 2 - 3dB higher)

**$D_{nT, w}$**  –  $D_w$  corrected for reverberation time of receiving room

**NOISE RATING CURVES (NR CURVES)** – set of curves used to describe optimum background noise levels for different tasks.

**$L_{10/90}$  LEVEL (dB)** - The level in dB of a time varying sound pressured level (e.g. traffic) exceeded for 10%/90% of the time of measurement.

$L_{90}$  is usually called the BACKGROUND NOISE LEVEL.

**$L_{eq}$  AVERAGE SOUND PRESSURE LEVEL** – level dB of a time varying sound pressure level with equal amounts of energy above and below it, for the time of measurement.

**TONAL NOISE** – noise of a single frequency (or a narrow band of frequencies that can be perceived as a tone), audible above the broad band noise background. Noise which is at least 5dB above the average of the 1/3 octave band sound pressure levels immediately on either side of it.