Acoustic Assessment

Proposed 72-bed care home, Coventry Road, Hinckley, Leicestershire, LE10 0JR

28th March 2025

ENVIRONMENTAL AND SUSTAINABILITY CONSULTANTS

encon associates

Report Reference Number: A7099

Document Control

Date of first Issue	Revision	Date of Revision	Authored By	Reviewed by
28th March 2025	-	-	Ben Phipps BSc, AMIOA	MB
-	A	31st March 2025	Ben Phipps BSc, AMIOA	MB

Contents

Executive Summary

An environmental noise survey has been carried out to determine the suitability of the proposed 72-bed care home at the land off Coventry Road, Hinckley, Leicestershire, LE10 0JR. External sound levels measured at the site have enabled a HTM-08-01 assessment to be undertaken.

An external noise break-in assessment has been undertaken, and a subsequent sound insulation scheme has been provided in section 5.0, including glazing and alternative ventilation. These measures are designed to manage noise levels and support compliance with the internal acoustic standards set out in HTM 08-01 and BS 8233:2014. These recommendations **will be sufficient to achieve** the levels specified in HTM-08-01 and BS 8233:2014. A brief summary of the recommendations is shown below:

Summary of Recommendations and Mitigation

- The most noise-exposed windows at Tanglewood Care Home have been identified, and a sound insulation performance of 29 dB Rw Ctr has been specified to help achieve the internal noise level criteria outlined in HTM 08-01.
- The assessment indicates that the internal noise level criteria can be achieved with a partially open window in all spaces apart from the bedrooms, the tea room and the office.
- All bedrooms within the development require alternative ventilation. It is recommended that the alternative ventilation system should provide the same sound reduction performance as the glazed components.

1 Introduction

1.1 Overview

Encon Associates Ltd have been commissioned to assess the acoustic conditions for the proposed construction of a three-storey, 72-bed care home ('the Proposed Development') at the land off Coventry Road, Hinckley, Leicestershire, LE10 0JR ('the Site'). The report assesses the current design proposals and determines the level of compliance with the identified criteria.

Due to the necessary technical nature of the report, a glossary of terms can be found in Appendix A to assist the reader.

2 Legislation, Policy and Guidance

This report is to be based primarily on the following legislation, policy and guidance.

- Health Technical Memorandum 08-01: Acoustics
- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: Planning & Noise
- ISO 9613-2 Attenuation of sound during propagation outdoors

2.1 Health Technical Memorandum 08-01: Acoustics

The Health Technical Memorandum (HTM) 08-01 is a guidance document that was written for healthcare professionals to understand acoustic requirements and to help those involved in the development of healthcare facilities.

The Health Technical Memorandum covers the acoustic design criteria that are important for healthcare premises, and addresses issues such as the provision of temporary healthcare facilities, refurbishments and the control of noise and vibration during construction.

The document recommends acoustic criteria for:

- Noise levels in rooms – both from mechanical services within the building and from noise coming from outside. It is important to create an acoustic environment that allows rooms to be used for resting, sleeping, treatment, consultation and concentration. There are also statutory limits for noise levels that individuals can be exposed to whilst working.

- External noise levels – noise created by the healthcare building and operation should not unduly affect those that live and work around it;

- Sound insulation between rooms – allows rooms to exist side by side. Noisy activities should not interfere with the requirements of adjacent rooms, and private conversations should not be overheard outside the room. The guidance given no allows for raised voices being commonly expected for hearing-impaired patients and staff;

- Impact sound insulation – prevents footfall noise of people walking over rooms interfering with the use of rooms below;

- Room acoustics – guidance is given on quantities of acoustically-absorbent material to provide a comfortable environment;

- Audio systems – announcements to patients, visitors and staff should be intelligible;

- Audiology facilities – without proper acoustic conditions the hearing-test facilities cannot function (see Health Building Note 12-01 Supplement C – 'ENT and audiology clinics');

- Vibration caused by plant, medical equipment and activities should not affect the use of the building. Some medical equipment is sensitive to vibration, and so are people.

The following table shows the internal ambient noise level criteria for different spaces within a healthcare building for noise intrusion from external sources.

Room Type	**Example**	**Criteria for noise intrusion to be met inside the spaces from external sources**
Ward – single person	Single-bed ward, single-bed recovery areas and on-call room, relatives' overnight stay	40 dB $L_{Aeq,1hour}$ daytime 35 dB $L_{Aeq,1hour}$ night 45 dB L_{AFMax} night
Ward – multi-bed	Multi-bed wards, recovery areas	45 dB $L_{Aeq,1hour}$ daytime 35 dB $L_{Aeq,1hour}$ night 45 dB L_{AFMax} night
Small office-type spaces	Private offices, small treatment rooms, interview rooms, consulting rooms	40 dB $L_{Aeq,1hour}$
Open clinical areas	A&E	45 dB $L_{Aeq,1hour}$
Circulation spaces	Corridors, hospital street, atria	55 dB $L_{Aeq,1hour}$
Public areas	Dining areas, waiting areas, playrooms	50 dB $L_{Aeq,1hour}$
Personal hygiene (en-suite)	Toilets, showers	45 dB $L_{Aeq,1hour}$
Personal hygiene (public and staff)	Toilets, showers	55 dB $L_{Aeq,1hour}$
Small food-preparation areas	Ward kitchens	50 dB $L_{Aeq,1hour}$
Large food-preparation areas	Main kitchens	55 dB $L_{Aeq,1hour}$
Large meeting rooms (>35 m^2 floor area)	Lecture theatres, meeting rooms, board rooms, seminar rooms, classrooms	35 dB $L_{Aeq,1hour}$
Small meeting rooms (>35 m^2 floor area)	Meeting rooms, seminar rooms, classrooms, board rooms	40 dB $L_{Aeq,1hour}$
Operating theatres	Operating theatres	40 dB $L_{Aeq,1hour}$ 50 dB L_{AFMax}
Laboratories	Laboratories	45 dB $L_{Aeq,1hour}$

Table 1.0 – HTM 08-01 – Criteria for noise intrusion from external sources

2.2 British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings

British Standard 8233:2014 'Sound Insulation and Noise Reduction for Buildings' provides design criteria for internal ambient noise levels for dwellings providing a reasonable or good level of protection from external noise. The desired criteria for internal ambient noise levels are shown in the following table.

Activity	**Location**	**Daytime 07:00 - 23:00**	**Night-time 23:00 - 07:00**
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/ Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 2.0 – BS8233:2014 Internal Noise Levels Criteria

It should be noted that the target levels shown above may be relaxed by 5dB where development is considered necessary or desirable.

It is recommended in the standard that the external noise levels should not exceed 50 $dBL_{Aeq,\ T}$ or 55 $dBL_{Aeq,\ T}$ in noisier environments for traditional outdoor amenity areas such as gardens. However, it is understood that these guideline values are not achievable in all circumstances where development might be desirable. In areas where noise levels are higher, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors such as convenience of living in these areas or making efficient use of land resources to ensure development needs can be met, may be justified. In this situation, the development should be designed to achieve the possible levels practicable.

2 Site Description & Background Information

2.1 Site & Surrounding Area

The proposed site is located just off Coventry Road, Hinkley, Leicestershire, LE10 0JR. The immediate surrounding consists of a mixture of the road networks, residential dwellings, and commerical units. Immediately to the north of the site is currently barren land where it is proposed that a new apartment block and 7 houses be erected. Also situated to the north of the site is Trinity Hall, which an entertainment venue available for hire. It is assumed that events (such as exercise classes) do not run later thean 23:00 at night. Further north, adjacent to Trinity Vicarage Road is Holy Trinity Church, which operates between the hours of 09:15 and 14:30 Monday, Wednesday and Friday. Immediately to the east of the site is an apartment building. Immediately to the south of the site is Coventry Road and Trinity Lane, which facilitates regular traffic flow. On the opposite side of Coventry road is The White Bear public house, which operates between the hours of 12:00 and 23:00, Monday to Sunday. Approximately 70m to the south of the site is Petku Hand Car Wash, which operates between 08:30 and 17:30, Monday to Sunday. On the the other side of Petku Hand Car Wash is Marchant Road, which runs adjacent to the top of the site. On the west side of Marchant Road is the Lidl supermarket and its associated carpark. Also on Marchant Road is East Green Garage. To the north-west of the site is The Meeting Centre entertainment venue. The venue holds a music license that allows them to host events until 02:00 in the morning.The site location is shown in the figure below. A site plan can be found in Appendix E.

Figure 1.0 – Site and Surrounding Area

2.2 Background

It is proposed that a 72-bed care home along with a 21-space carpark be built on the land off Coventry Road. Consequently, a noise assessment was required to provide acceptable acoustic conditions for future residents.

The existing acoustic environment is dominated by road traffic along Coventry Road and Trinity Lane. Road traffic movements on Marchant Road, particularly coming to and from the Lidl supermarket also contribute to the acoustic environment. Petku Hand Car Wash was not audible at any area of the site during site visits and has therefore not been included in the assessment. Additionally, East Green Garage was not open during any of the site visits and had a 'To Let' outside, suggesting that the premises is no longer operational. Therefore, East Green Garage was not included in the assessment either. The White Bear Public House was not audible at any area of the site during site visits. However, if at any point during the unattended survey activity from The White Bear was contributing to the acoustic environment, it would have been captured by the sound level meter opposite.

3 Environmental Noise Survey

To characterise the acoustic environment of the area, a noise survey was carried out from the 21st until the 25th of March 2025.

3.1 Measurement Methodology

Long-term and short-term noise monitoring was conducted at multiple measurement positions. The following figure shows the different noise monitoring locations.

Figure 2.0 – Measurement Positions

- Measurement Position 1 (MP1): A sound level meter was installed on the southern side of the site 3.5m from the edge of Coventry Road from the 21st until the 25th of January 2025. The sound level meter was installed inside a secure box attached to a lamppost with the microphone protruding at a height of 3.5m from the ground. The microphone was in free-field conditions (more than 3.5m from any reflective surfaces apart from the ground). This measurement position was chosen to the obtain sound levels that are representative of the most exposed part of the building and to inform the noise break-in assessment.

- Attended Measurement Position 1 (AMP1): The sound level meter was positioned approximately 1m from the edge of Marchant Road. The sound level meter was mounted onto a tripod 1.5m above the ground. This measurement position was chosen to obtain sound measurements of Marchant Road, which are to be used in the noise model.

- Attended Measurement Position 2 (AMP2): The sound level meter was positioned approximately 1m from the edge of Trinity Vicarage Lane. The sound level meter was mounted onto a tripod 1.5m above the ground. This measurement position was chosen to obtain sound measurements of Trinity Vicarage Lane, which would be used in the noise model.

- Attended Measurement Position 2 (AMP2): The sound level meter was positioned approximately 1m from the edge of Trinity Vicarage Lane. The sound level meter was mounted onto a tripod 1.5m above the ground. This measurement position was chosen to obtain sound measurements of Trinity Vicarage Lane, which would be used in the noise model.

- Attended Measurement Position 3 (AMP3): The sound level meter was positioned approximately 10m from the edge of Coventry Road. The sound level meter was mounted onto a tripod 1.5m above the ground. This measurement position was chosen to obtain comparative sound measurements with MP1.

3.2 Instrumentation

Equipment	Serial No.	Laboratory Calibration
Cirrus Optimus Green+ Class 1 Sound Level Meter	G303153	18/06/2025
Cirrus Optimus Green+ Class 1 Sound Level Meter	G303154	18/06/2025
Cirrus CR:515 Class 1 Acoustic Calibrator	96656	18/06/2025

Table 3.0 – Instrumentation

All sound level meters were field calibrated immediately before and after the measurement period, and no significant drift (≤0.5 dB) occurred. Laboratory calibration by a third party is carried out on all sound level meters every twenty-four months, with all calibrators being calibrated every twelve months. All microphones were fitted with a protective windshield. Calibration certificates can be seen in Appendix B.

3.3 Weather Conditions

The weather conditions throughout the survey period were considered suitable, i.e., in accordance with those laid out in BS 7445-2:1991 and provided no significant uncertainty to the measured data.

3.4 Survey Results

A time history graph showing the results of the automated survey at Measurement Position 1 can be found in Appendix C. This graph displays the 1-hour L_{Aeq}, L_{AFmax}, L_{A10} and L_{A90} sound levels at the MP1 throughout the survey period.

A summary of the automated survey results for the daytime and night-time periods at MP1 are shown in the following tables.

Measurement Position 1				
Daytime	**$L_{Aeq,t}$**	**$L_{AFmax,t}$**	**$L_{A10,t}$**	**$L_{A90,t}$**
Friday 21/03/2025 (18:00 – 23:00)	67.8	98.8	69.8	57.2
Saturday 22/03/2025 (07:00 – 23:00)	67.6	98.6	70.2	57.9
Sunday 23/03/2025 (07:00) – 23:00)	67.4	98.8	69.5	54.7
Monday 24/03/2025 (07:00 – 23:00)	68.2	97.0	70.5	57.6
Tuesday 25/03/2025 (07:00 – 11:00)	69.8	96.9	60.9	60.9

Table 4.0 – Daytime Environmental Noise Survey Results – MP1

Measurement Position 1				
Night-time (23:00 - 07:00)	**$L_{Aeq,8hour}$**	**$L_{AFmax,8hour}$**	**$L_{A10,8hour}$**	**$L_{A90,8hour}$**
Friday - Saturday 21-22/03/2025	59.5	85.8	62.2	45.2
Saturday - Sunday 22-23/03/2025	59.6	89.7	62.1	41.5
Sunday - Monday 23-24/03/2025	59.7	88.6	59.4	36.3
Monday - Tuesday 24-25/03/2025	60.7	92.1	60.8	41.2

Table 5.0 – Night-time Environmental Noise Survey Results – MP1

Tables 6.0, 7.0 and 8.0 outline a summary of the attended measurements taken at AMP1, AMP2 and AMP3.

Attended Measurement Position 1				
Daytime	**$L_{Aeq,15min}$**	**$L_{AFmax,15min}$**	**$L_{A10,15min}$**	**$L_{A90,15min}$**
Monday 24/03/2025 (12:37 – 12:52)	57.5	78.6	60.0	51.9
Monday 24/03/2025 (13:30 – 13:45)	57.2	76.8	60.0	49.0
Monday 24/03/2025 (14:25 – 14:40)	59.0	81.8	60.9	51.3

Table 6.0 – Attended Measurement Results – AMP1

Attended Measurement Position 2				
Daytime	**$L_{Aeq,15min}$**	**$L_{AFmax,15min}$**	**$L_{A10,15min}$**	**$L_{A90,15min}$**
Monday 24/03/2025 (12:00 – 12:15)	54.0	71.0	56.9	44.5
Monday 24/03/2025 (13:00 – 13:15)	53.4	72.3	55.2	43.1
Monday 24/03/2025 (14:44 – 14:59)	56.0	74.4	56.0	44.9

Table 7.0 – Attended Measurement Results – AMP2

Attended Measurement Position 3				
Daytime	**$L_{Aeq,15min}$**	**$L_{AFmax,15min}$**	**$L_{A10,15min}$**	**$L_{A90,15min}$**
Monday 24/03/2025 (12:18 – 12:15)	64.1	73.1	67.8	55.6
Monday 24/03/2025 (13:50 – 14:05)	64.4	78.7	67.6	56.9
Monday 24/03/2025 (14:05 – 14:20)	63.6	77.8	66.5	56.1

Table 8.0 – Attended Measurement Results – AMP3

The following tables present the highest measured 1-hour daytime and night-time sound levels at MP1 during the survey. The L_{Aeq} values will be used to inform the noise break-in assessments for the worst-case 1-hour daytime and night-time assessments.

Measurement Position 1				
Daytime	**$L_{Aeq,1hour}$**	**$L_{AFmax,1hour}$**	**$L_{A10,1hour}$**	**$L_{A90,1hour}$**
Monday 24/03/2025 (08:00 – 09:00)	70.2	96.0	72.2	60.5

Table 9.0 - Highest Measured 1-hour Daytime Sound Levels – MP1

Measurement Position 1				
Night-time	**$L_{Aeq,1hour}$**	**$L_{AFmax,1hour}$**	**$L_{A10,1hour}$**	**$L_{A90,1hour}$**
Tuesday 25/03/2025 (06:00 – 07:00)	65.6	89.3	68.9	54.8

Table 10.0 - Highest Measured 1-hour Night-time Sound Levels – MP1

The following table shows the maximum sound level results at MP1. HTM-08-01 demands that the value of 45 dB L_{AFMax} should not be exceeded several times during the night-time period but doesn't specify a specific number of occurrences. ProPG states: "…in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can e used do that individual noise events do not normally exceed 45dB L_{AFmax} more than 10 times a night". Therefore, it has been determined that the assessment will be carried out according to the tenth highest value.

Measurement Position 1		
Night-time (23:00 - 07:00)	**Highest $L_{AFMax,5min}$**	**10th Highest $L_{AFMax,5min}$**
Friday - Saturday 21-22/03/2025	83.4	76.6
Saturday - Sunday 22-23/03/2025	88.0	76.7
Sunday - Monday 23-24/03/2025	85.5	77.5
Monday - Tuesday 24-25/03/2025	91.1	78.6

Table 11.0 – Maximum Sound Levels – MP1

4 Noise Sources

4.1 Road traffic noise

Sound Measurements taken at MP1, AMP1 and AMP2 have been entered into the noise model for the daytime and night-time period. The highest 1-hour measurement value at MP1 for the daytime and night-time period have been used to characterise Coventry Road/Trinity Road. The highest measurement of Marchant Road and Trinity Vicarage Road have been used for both the 1-hour daytime period. Night-time measurements of Marchant Road and Trinity Vicarage Road have not been obtained, therefore, the highest daytime measurements have been used for the night-time assessment, thus ensuring a robust assessment.

4.2 Other Sound Sources

4.2.1 Tanglewood Carehome Carpark Noise

The worst-case 1-hour daytime period considers a scenario of a full carpark with half the cars leaving in the same hour. Measurements of vehicle movements were taken from an existing carpark. The total sound level can then be determined by the predicted number of vehicle movements within the carpark over an hour. It is understood that the night shift will start at 20:00 and finish after 07:00 the next morning and it is unlikely that there will be visitors during the night-time, it is assumed that there will typically be no vehicle movements in the carpark between the hours of 23:00 and 07:00. The table below presents the sound levels from carpark vehicle movements for the 1-hour daytime period.

Source	L_{AE}	Measurement Distance (m)	Number of Events	dB $L_{Aeq,\ 1hour}$	A weighted Sound Power Level
Car Pulling into Car Park	75	5	21	53	77.6
Car Passage	73	3	32	52	73.0
Car Reversing	66	7	21	44	71.6
Car Door Slam	90	1	64	72	83.5
Car Engine Starting	68	5	11	43	67.8
Car Pulling off Parking Space	70	4	11	45	67.9
Car Pulling Onto Street	72	8	11	47	75.9
Total A-weighted Sound Power Level					**85.7**

Table 12.0 – Car Park Vehicle Movements Noise Levels

The 21-space carpark has been modelled as an area source with the total sound power level or vehicle movements entered into the model for the area.

4.2.2 The Meeting Centre Breakout Noise

The Meeting Centre holds a music license host amplified music events until 02:00. The internal noise level has been predicted based on a previous survey conducted by NOVA acoustics Ltd. The measurement was taken in the centre of a dance floor with 100 patrons dancing, and a band playing amplified music through a 4kW P.A. system. The predicted breakout noise level can be seen in the following table below assuming that the metal roller door is the weakest section of the façade in terms of sound reduction.

Description	Sound Pressure Level (dBA)
Predicted Internal Noise Level (L1)	95
Sound Reduction of Roller Shutter Door (R_w)	18
Predicted Façade Noise Level (L1-R_w- 6)	71

Table 13.0 – The Meeting Place Internal Breakout Sound Level

The Meeting Place has been modelled as a façade area noise source, which is calculated within the IMMI software using the formula Lw = Lp + 10log(s).

4.2.3 Trinity Hall Breakout Noise

Trinity Hall contains a large hall that can be hired for theatre shows and large exercise classes. To form a robust assessment, the expected internal noise level of the hall has been taken from a previous assessment of a PureGym facility undertaken by 'Red Acoustics'. The measured noise levels included peak time gym activity, music from a wall-mounted speaker system and an activity class. The predicted breakout noise level can be seen in the table below assuming again that the glazing (4mm glass/16mm glass/4mm glass) is the weakest part of the façade in terms of sound reduction.

Description	Sound Pressure Level (dBA)
Predicted Internal Noise Level (L1)	84
Sound Reduction of Standard Double Glazing (4mm/16mm/4mm) (R_w)	29
Predicted Façade Noise Level (L1-R_w- 6)	49

Table 14.0 – Trinity Hall Internal Breakout Sound Level

5 Noise Model

5.1 Noise Model Assumptions

The sound predictions in this assessment have been undertaken using a proprietary software-based noise model, IMMI, which implements a range of UK calculation methods. The algorithms set out in *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation* have been used, and the model assumes:

- Acoustically hard ground.
- The ground level of the building is 1.5m above Coventry Road.
- The ground level from Coventry Road slopes upwards to the top of Marchant Road by 5m.
- The ground level from slopes upwards from Coventry Road up to 3m.
- The ground level of Trinity Vicarage Road slopes up from Trinity Road (3m above the lowest point of Coventry Road) by 2m (5m above the lowest point of Coventry Road).
- Ground floor receptors set to a height of 1.5m above the ground level.
- First-floor receptors set to a height of 4.5m above the ground level.
- Second-floor receptors set to a height of 7.5m above the ground level.

The following figure shows the noise map for the daytime 1-hour period.

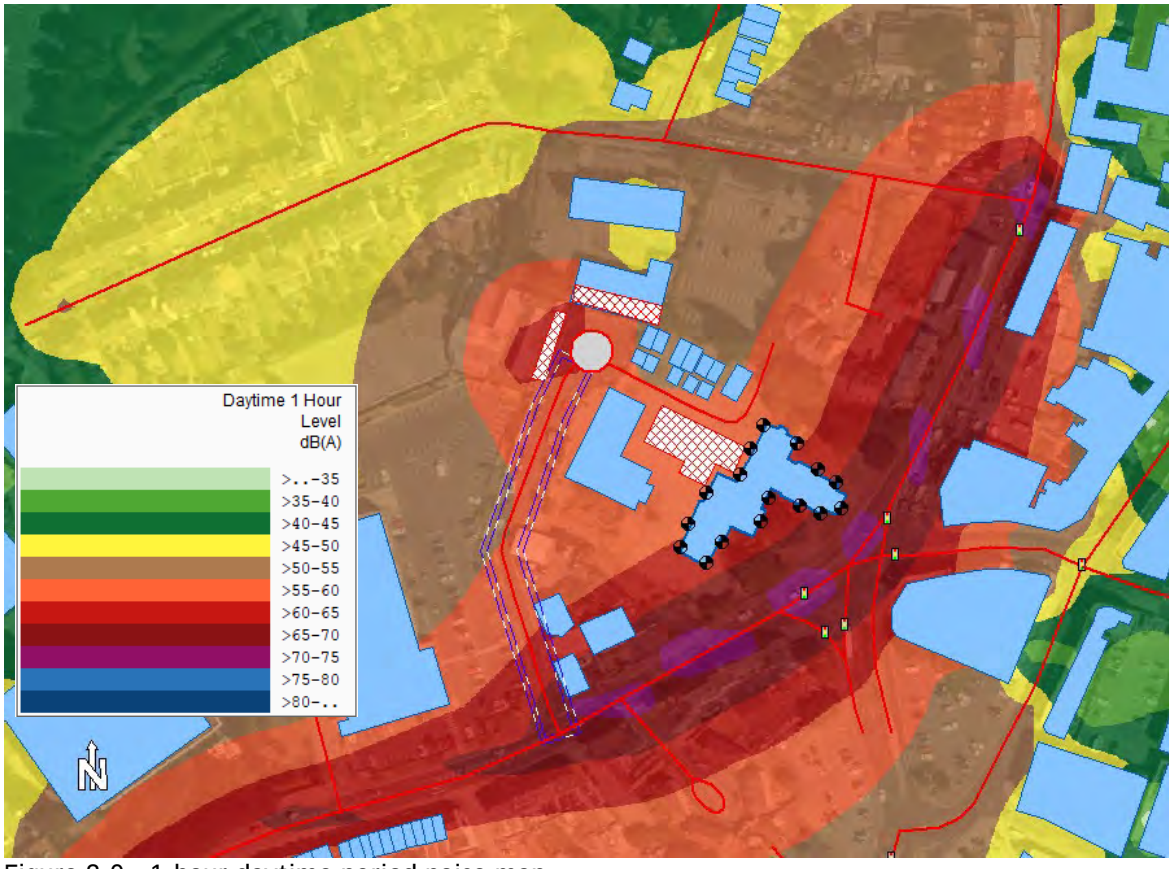


Figure 3.0 – 1-hour daytime period noise map

The following figure shows the noise map for the night-time 1-hour period.

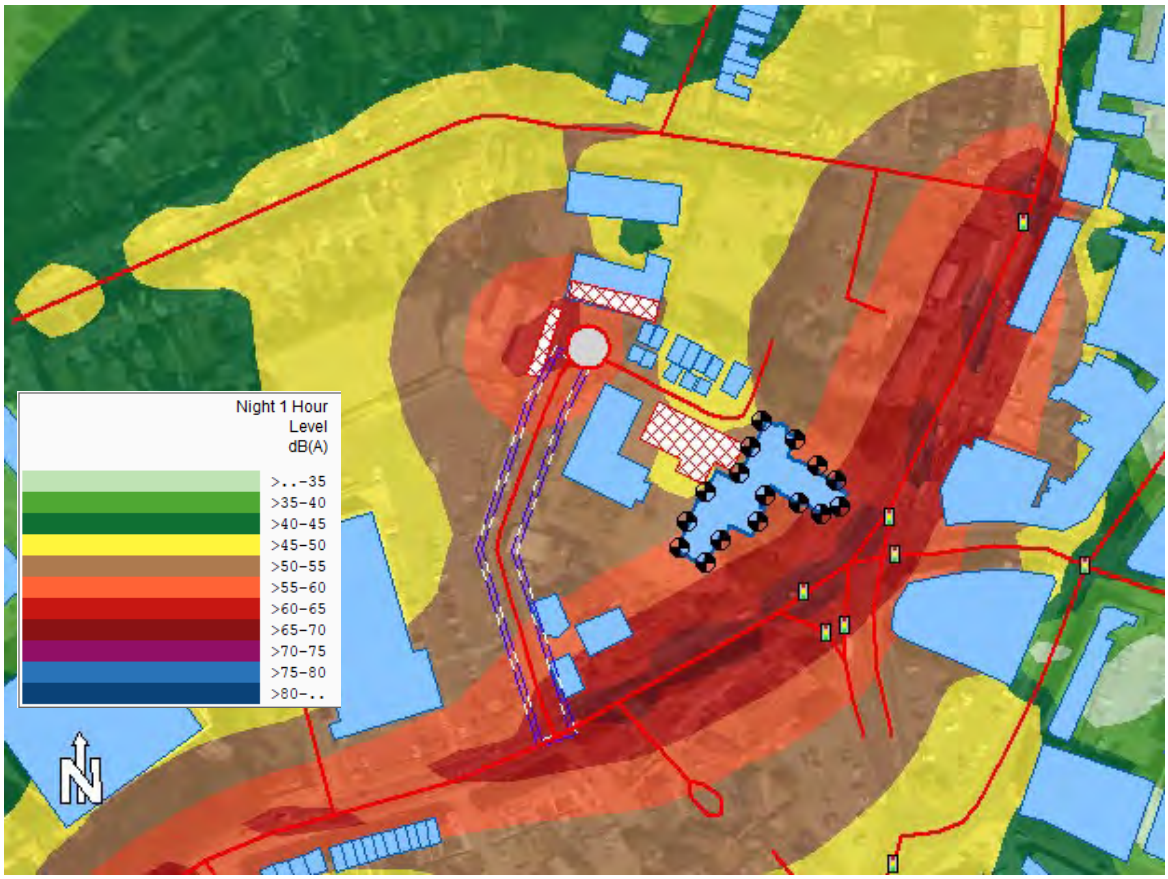


Figure 4.0 – 1-hour night-time period noise map

The following figure shows the noise map for the night-time LAFmax assessment.

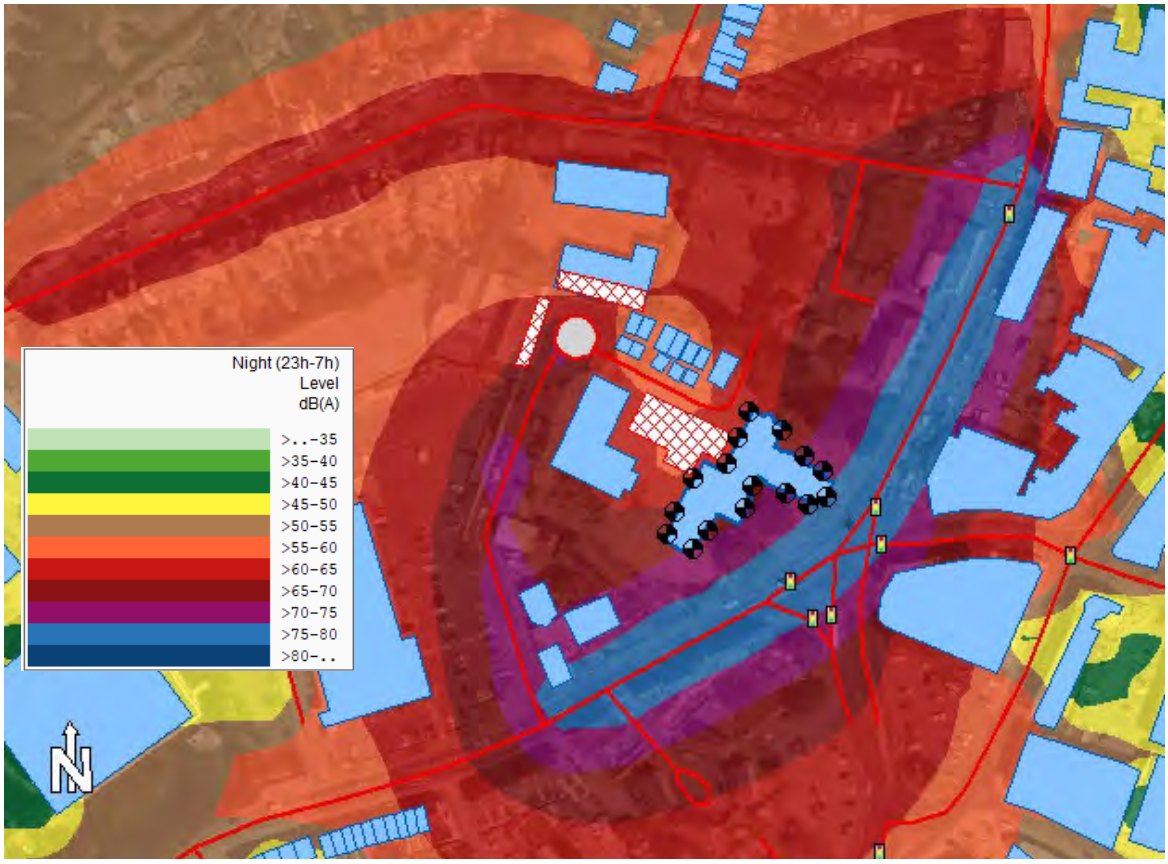
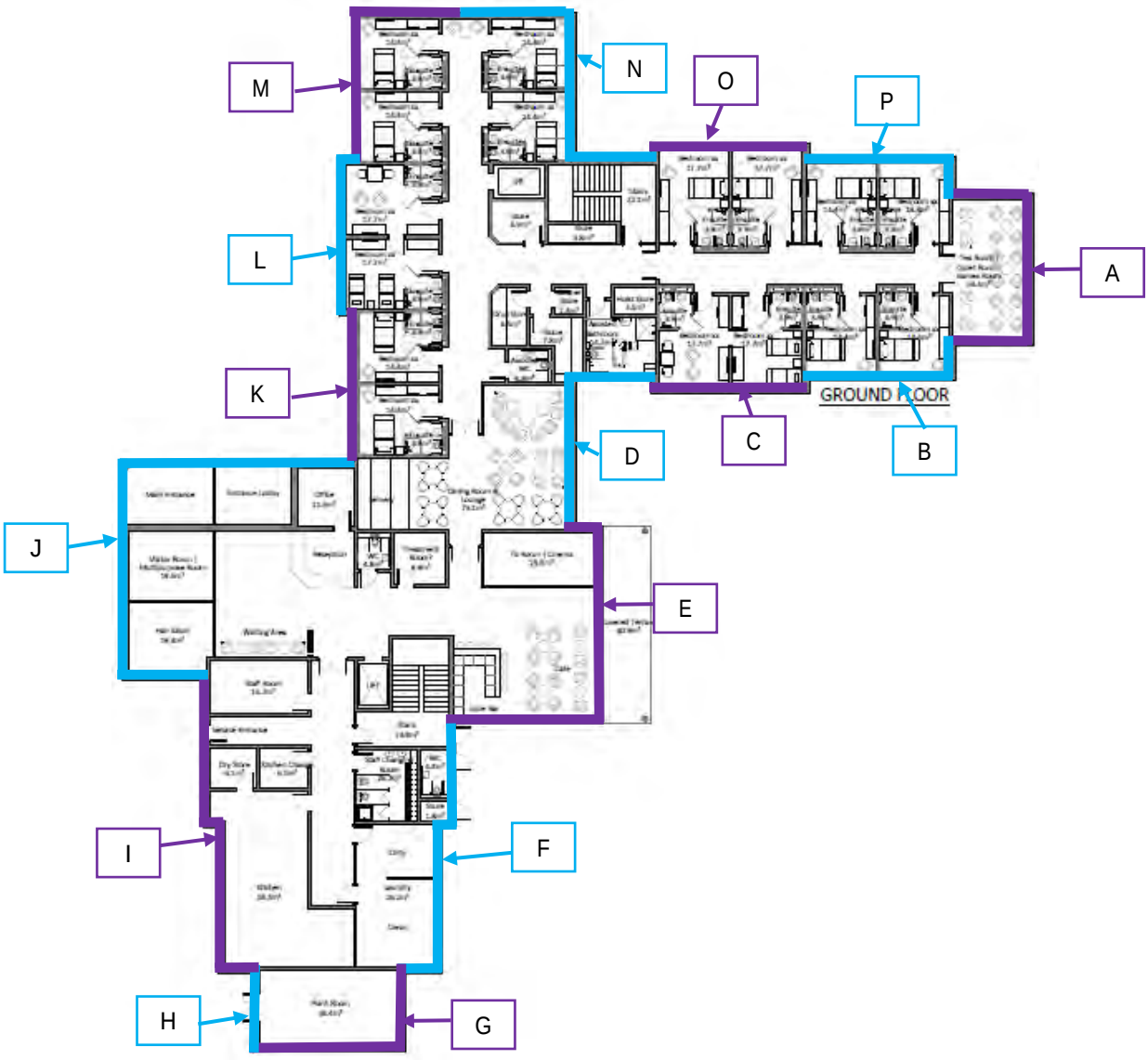


Figure 5.0 – Night-time LAFMax noise map

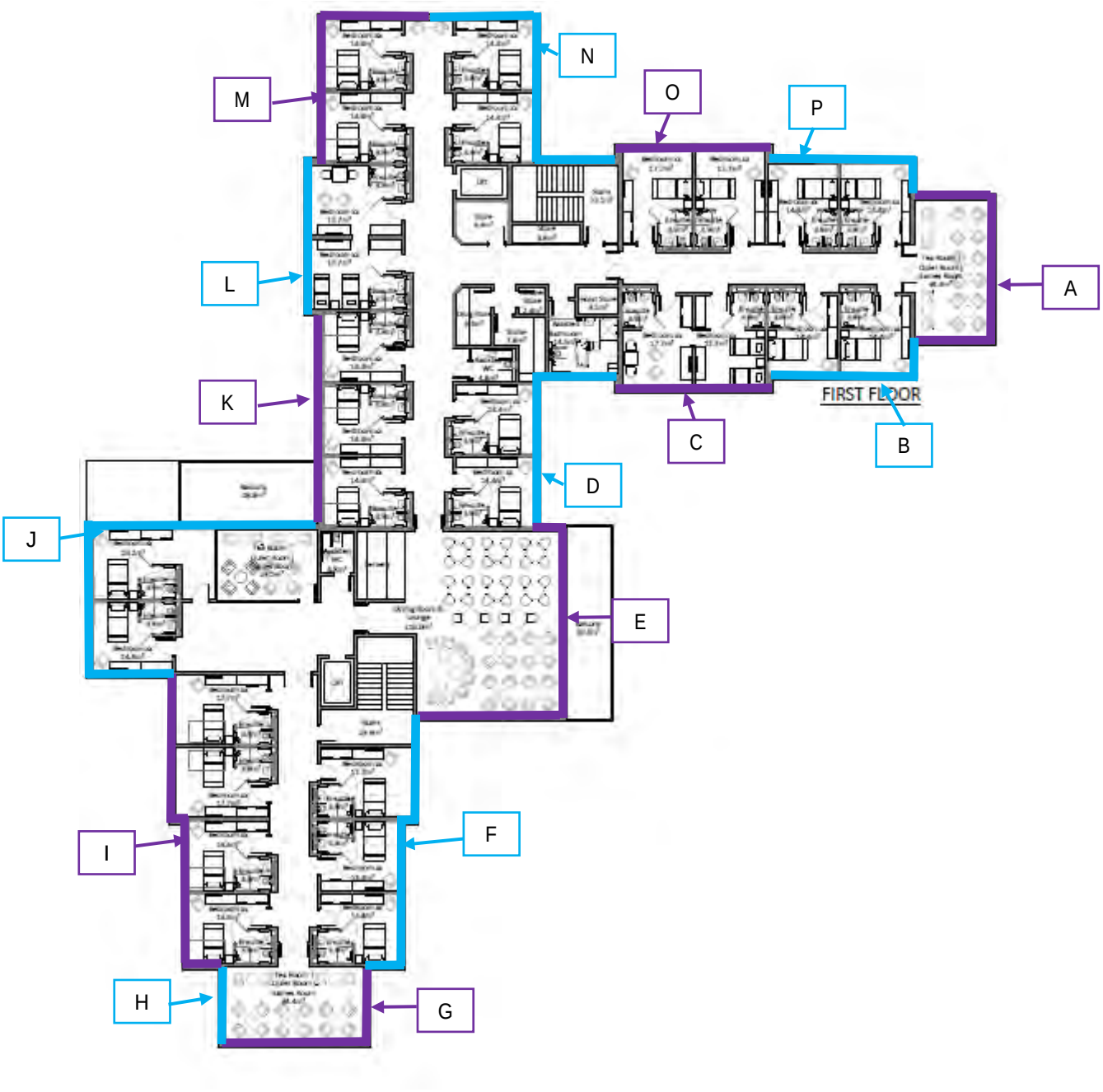
5 HTM 08-01 Internal Ambient Noise Level Assessment

The following mark-ups break the buildings down into different sections.

Ground Floor



First-Floor and Second-Floor



5.1 Noise Break-in Assessment

The following table shows the minimum required sound reduction performance to achieve the internal ambient noise level criteria specified in HTM-08-01 for each space. To ensure that that the assessment is robust the noise break-in assessment considers the highest 1-hour LAeq,1hour figures predicted in the IMMI noise model, as well as the 10th highest LAFMax, 5min value during the night-time used in the IMMI model.

Section	Location	Time Period	Façade Noise Level	HTM Criteria	Min. SRI Required (dB)
A	Tea Room	Daytime	66.8	50dB$_{LAeq, 1hour}$	17 R_w
B	Bedrooms	Daytime	64.7	40dB$_{LAeq, 1hour}$	25 R_w
		Night-time	60.1	35dB$_{LAeq, 1hour}$	26 R_w
		Night-time	72.9	45 dB L_{AFMax}	28 R_w
C	Bedrooms	Daytime	62.7	40dB$_{LAeq, 1hour}$	23 R_w
		Night-time	58.2	35dB$_{LAeq, 1hour}$	24 R_w
		Night-time	70.5	45 dB L_{AFMax}	26 R_w
D	Bedrooms	Daytime	61.2	40dB$_{LAeq, 1hour}$	22 R_w
		Night-time	61.2	35dB$_{LAeq, 1hour}$	27 R_w
		Night-time	68.7	45 dB L_{AFMax}	24 R_w
	Sluice	Daytime	61.2	55dB$_{LAeq, 1hour}$	7 R_w
	Dining Room	Daytime	61.2	50dB$_{LAeq, 1hour}$	12 R_w
E	Café and Dining Room	Daytime	63.0	50dB$_{LAeq, 1hour}$	13 R_w
F	Bedrooms	Daytime	63.0	40dB$_{LAeq, 1hour}$	24 R_w
		Night-time	58.7	35dB$_{LAeq, 1hour}$	24 R_w
		Night-time	70.6	45 dB L_{AFMax}	26 R_w
	Circulation	Daytime	63.0	55dB$_{LAeq, 1hour}$	9 R_w
	Utility	Daytime	63.0	55dB$_{LAeq, 1hour}$	9 R_w
	Toilets	Daytime	63.0	55dB$_{LAeq, 1hour}$	9 R_w
G	Plant Room	Daytime	63.9	55dB$_{LAeq, 1hour}$	9 R_w
	Tea Room	Daytime	63.9	55dB$_{LAeq, 1hour}$	9 R_w
H	Plant Room	Daytime	59.1	55dB$_{LAeq, 1hour}$	5 R_w
	Tea Room	Daytime	59.1	55dB$_{LAeq, 1hour}$	5 R_w
I	Bedrooms	Daytime	56.0	40dB$_{LAeq, 1hour}$	17 R_w
		Night-time	51.0	35dB$_{LAeq, 1hour}$	17 R_w
		Night-time	59.3	45 dB L_{AFMax}	15 R_w
	Kitchen	Daytime	56.0	50dB$_{LAeq, 1hour}$	7 R_w
	Circulation	Daytime	56.0	55dB$_{LAeq, 1hour}$	2 R_w

	Staff Room	Daytime	56.0	50dB$_{LAeq, 1hour}$	7 R_w
J	Bedrooms	Daytime	55.5	40dB$_{LAeq, 1hour}$	16 R_w
		Night-time	48.7	35dB$_{LAeq, 1hour}$	13 R_w
		Night-time	53.9	45 dB L_{AFMax}	9 R_w
	Hair Salon/Visitor Room	Daytime	55.5	50dB$_{LAeq, 1hour}$	6 R_w
	Entrance Lobby	Daytime	55.5	55dB$_{LAeq, 1hour}$	1 R_w
	Office	Daytime	55.5	40dB$_{LAeq, 1hour}$	16 R_w
K	Bedrooms	Daytime	55.5	40dB$_{LAeq, 1hour}$	16 R_w
		Night-time	49.2	35dB$_{LAeq, 1hour}$	15 R_w
		Night-time	49.2	45 dB L_{AFMax}	5 R_w
L	Bedrooms	Daytime	55.6	40dB$_{LAeq, 1hour}$	16 R_w
		Night-time	49.2	35dB$_{LAeq, 1hour}$	15 R_w
		Night-time	51.5	45 dB L_{AFMax}	7 R_w
M	Bedrooms	Daytime	56.3	40dB$_{LAeq, 1hour}$	17 R_w
		Night-time	51.4	35dB$_{LAeq, 1hour}$	17 R_w
		Night-time	58.3	45 dB L_{AFMax}	14 R_w
N	Bedrooms	Daytime	60.0	40dB$_{LAeq, 1hour}$	21 R_w
		Night-time	55.5	35dB$_{LAeq, 1hour}$	21 R_w
		Night-time	67.5	45 dB L_{AFMax}	23 R_w
	Circulation	Daytime	60.0	55dB$_{LAeq, 1hour}$	6 R_w
O	Bedrooms	Daytime	61.3	40dB$_{LAeq, 1hour}$	22 R_w
		Night-time	56.8	35dB$_{LAeq, 1hour}$	22 R_w
		Night-time	69.0	45 dB L_{AFMax}	25 R_w
P	Bedrooms	Daytime	63.5	40dB$_{LAeq, 1hour}$	24 R_w
		Night-time	58.7	35dB$_{LAeq, 1hour}$	24 R_w
		Night-time	71.7	45 dB L_{AFMax}	27 R_w

Table 15.0 – Composite SRI Requirements

5.1.1 Glazing

Considering that windows are often the weakest point of a façade in terms of sound reduction performance, the glazing configuration has been specified to achieve the required internal noise levels as though the entire façade were to consist of glazing. This ensures that the assessment is robust, as the composite sound reduction performance is likely to be significantly greater due to the presence of other building fabrics.

The following table provides glazing configurations that should achieve the sound reduction performance required to achieve the specified internal noise level criteria. The SRI value is for the whole window unit including the frame and other elements.

Section	Location	Glazing Configuration	Attenuation
A	Tea Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
B	Bedrooms	Double Glazing 8mm Glass – 16mm Air Cavity – 4mm Glass	29 dB $R_{w\ Ctr}$
C	Bedrooms	Double Glazing 6mm Glass – 16mm Air Cavity – 4mm Glass	28 dB $R_{w\ Ctr}$
D	Bedrooms	Double Glazing 6mm Glass – 16mm Air Cavity – 4mm Glass	28 dB $R_{w\ Ctr}$
	Sluice	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Dining Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
E	Café and Dining Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
F	Bedrooms	Double Glazing 6mm Glass – 16mm Air Cavity – 4mm Glass	28 dB $R_{w\ Ctr}$
	Circulation	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Utility	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Toilets	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
G	Plant Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Tea Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
H	Plant Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Tea Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$

I	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Kitchen	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Circulation	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Staff Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
J	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Hair Salon/Visitor Room	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Entrance Lobby	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Office	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
K	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
L	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
M	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
N	Bedrooms	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
	Circulation	Double Glazing 4mm Glass – 16mm Air Cavity – 4mm Glass	25 dB $R_{w\ Ctr}$
O	Bedrooms	Double Glazing 6mm Glass – 16mm Air Cavity – 4mm Glass	28 dB $R_{w\ Ctr}$
P	Bedrooms	Double Glazing 6mm Glass – 16mm Air Cavity – 4mm Glass	28 dB $R_{w\ Ctr}$

Table 16.0 – Glazing Specification

The values quoted in the above table are from British Standard 12758:2011 'Glass in building – Glazing and airborne sound insulation – Product descriptions and determination properties'

5.1.2 Open Window Assessment

BS8233:2014 stipulates that if partially open windows are to be relied upon for background ventilation, the sound insulation performance is likely to be reduced to approximately 15dB. This suggests that the internal ambient noise level criteria for the daytime or night-time will may not be achievable in any of the bedrooms. Additionally, the noise break-in assessment indicates that the internal ambient noise level criteria in the tea rooms and office will not be achieved. The internal ambient noise criteria should still be achievable in all other spaces with a partially open window.

5.1.3 Ventilation

BS8233 states;

"If relying on closed windows to the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used, and sound attenuating types are available.
However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

It is recommended that the alternative ventilation system should provide the same sound reduction performance as the glazed components. Two alternative ventilation systems are displayed in the following table.

Model	Attenuation (dB)
Titon SF Xtra Sound Attenuator (Acoustic) Vent	44dB Open / 55dB Closed Dn,e,w
Greenwood EAR42W Acoustic Window Ventilator	42dB Open / 45dB Closed Dn,e,w

Table 17.0 – Ventilation Specification

The values quoted in the table above are from following sources:

Titon SF Xtra Sound Attenuator (Acoustic) Vent:

https://www.titon.com/uk/products/window-door-hardware/window-vents-window-door-hardware/sf-xtra-sound-attenuator-vent/

Greenwood EAR42W Acoustic Window Ventilator:

https://www.greenwood.co.uk/product/203/ear42w

It should be noted that it is beyond the scope/remit of this report to specify the ventilation performance of alternative ventilation systems. The models presented in table 13.0 have only been specified to achieve the required internal noise level criteria and a HVAC engineer should be consulted to confirm whether the systems provide sufficient air flow for the size and use of the room.

If a MHRV system is employed, the self-generating noise from the system will need to conform with the requirements of HTM-08-01.

5.1.4 Rain Noise

HTM-08-01 states:

"Rain noise should not result in undue disturbance in internal spaces. Some noise from rain is acceptable in most types of rooms, and indeed can be comforting to occupants. Indoor ambient noise levels during "heavy" rainfall should not exceed the intrusive noise criteria in Table 1 by more than 20 dB(A) or should not more than 65 dB(A), whichever is lower."

6 BS 8233 Internal Ambient Noise Level Assessment

The HTM-08-01 assessment considers sound levels for the worst-case 1-hour for daytime and night-time. Considering that the respective 16-hour daytime and 8-hour night-time figures are lower than the worst-case 1-hour sound levels, the internal noise level targets outlined in BS 8233:2014 should be achieved.

Encon Associates Limited

10 Chapel Lane

Arnold

Nottingham

NG5 7DR

Tel: 0115 987 55 99

Email: ben@enconassociates.com

Signed for and on behalf of Encon Associates Limited

Ben Phipps BSc (Hons), AMIOA

Acoustic Consultant

Date: 28th March 2025

Appendix A – Acoustic Terminology & Definitions

Sound Pressure	The fluctuations in air pressure, from the steady atmospheric pressure, created by sound, measured in pascals (Pa).
Sound Pressure Level (SPL)	The sound pressure measured on a decibel scale relative to a standard reference pressure of 20μPa (20x10-6 Pascals).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
Frequency (Hz)	The pitch of the sound, measured in Herts (Hz)
Integrating Sound Level Meter	An instrument used for measuring sound levels with the capacity to perform calculations to derive other parameters.
Calibration	A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level. This is performed in the field before and after measurement and by a laboratory every year calibrators and every two years for Sound Level Meters.
A-Weighting, dB(A)	A frequency waiting devised to attempt to take the fact that human response to sound is not equally sensitive at all frequencies into account.
Z-Weighting	A zero frequency weighting (often referred to as unweighted).
Attenuation	Noise reduction, measured in decibels.
Ambient Sound Level $L_{Aeq.T}$	The total encompassing sound in a given situation, at a given time. Usually composed of sounds from many sources, near and far.
Residual Sound Level $L_{Aeq.T}$	The ambient sound remaining when the specific sound source is suppressed to a degree it does not contribute to the ambient sound.
Specific Sound Level $L_{Aeq.T}$	The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
Rating Level $L_{Ar, tr}$	The specific sound level plus any adjustment for the characteristic features of the sound.
Background Sound Level $L_{A90.T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Sound Exposure Level , SEL (L_{AE})	A measure of A-weighted sound energy used to describe noise events such as the passing of trains; it is the A-weighted sound pressure level which, is occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event.
Frequency Analysis	Analysis of a sound into its frequency components. Commonly 1/1 or 1/3 octave bands
Frequency Spectrum	A graph resulting from frequency analysis and showing different levels of the signal in the various frequency bands.
Octave-bands	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
Noise Index	A method of evaluating or rating a noise, usually by assigning a single number to it, based on some combination of its physical parameters (sound pressure level, frequency, duration) and other factors such as time of day, tonal characteristics and impulsive characteristics.
Leq, T	Otherwise referred to as the 'continuous equivalent noise level' of a period of time (T). This is the steady noise level which contains the same amount of energy as the time varying sound level that was recorded.
Lmax,T	The maximum RMS sound pressure level that occurs within a specified time period. It is used often to describe occasional loud noise events that may have little influence on the Leq but will have an effect on the overall acoustic environment. The time weighting (Fast or Slow) is usually specified.

L90, T	The noise level exceeded for 90% of the specified time period (T). It is often used to characterise the background noise.
L10, T	The noise level exceeded for 10% of the specified time period (T). It is often used to characterise road traffic noise.
Free-Field	A situation where the radiation from a sound source is completely unaffected by the presence of reflective surfaces. In terms of environmental noise measurement, it is usually taken to mean at least 3.5m away from 3.5m away from reflective surfaces with the exception of the ground.
Façade Noise Level	A noise level measured within 3m of a building façade, which contains a contribution arising from reflection of sound at the façade. The difference between the façade level and free-field level is described as the façade correction factor.
Noise Sensitive Receptor	Premises that are used for purposes sensitive to noise and that require protection.
Line Source	A source of sound that as distance increases away from the source it still appears large in one dimension. Attenuation of this form of source occurs at a distance of (a/π) where a is the largest dimension of the source.
Point Source	A source of sound that as distance increases away from the source it appears as a point in space. Attenuation of this form of source occurs at a distance of (b/π) where b is the smallest dimension of the source.
Time Weighting	One of the standard averaging times (Fast, Slow or Impulsive) used for the measurement of RMS sound pressure level in sound level meters, specified in ISO 61671-1.
Rw	Single number quantity which characterises the airborne the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
DnT,w + Ctr	A single value that characterises the airborne sound insulation performance using the Ctr: spectrum adaption terms described in BS EN ISO 717-1. The value is based on field measurements and the value represents total sound transmission including flanking sound, not just the partition.

The table below presents an indication of sound levels associated with the environment starting from 0dB (the threshold of hearing) to 140dB (The threshold of pain).

Sound Level	Location/Activity
0 dB(A)	Threshold of Hearing
20 – 30 dB(A)	Inside Quiet Bedroom at Night
30 – 40 dB(A)	Inside a Living Room During the Day
40 – 50 dB(A)	Inside Typical Office
50 – 60 dB(A)	Inside a Car
60 – 70 dB(A)	Typical High Street
70 – 90 dB(A)	Inside Factory
100 – 110 dB(A)	Burglar Alarm at 1m
110 – 130 dB(A)	Jet Aircraft on Take Off
140 dB(A)	Threshold of Pain

The 'A' denotes the A-weighting scale used to replicate the frequency response of the human ear.

Appendix B – Instrument Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216431**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G303154	
Class:	1	
Firmware version:	5.8.3251	

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216431**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity: 50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.7 °C	Humidity: 50.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78135
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 11733F

Microphone

Model: MK:224

Serial number: 214535A

Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216430**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Octave-band filter : IEC 61260:1995

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G303154	
Class:	1	
Firmware version:	5.8.3251	

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61260:1995.

The filter submitted for testing successfully completed the Relative Attenuation test of IEC 61260 for the environmental conditions under which the test was performed.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216430**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity: 50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.7 °C	Humidity: 50.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78135
Environmental Monitor	Comet	T7510	16966334

Filters information

Filter class: 1
Filter base: 2
Reference attenuation: 0.0 dB

Additional instrument information

Instruction manual:
Pattern approval: No
Source of pattern approval: -
Reference level range: Single range

Laboratory uncertainties

Requirement	Value (dB)
Relative Attenuation High	0.41
Relative Attenuation Mid	0.18
Relative Attenuation Low	0.12

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216432**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Third-octave-band filter : IEC 61260:1995

Instrument information

Manufacturer:	Cirrus Research plc
Model:	CR:171B
Serial number:	G303154
Class:	1
Firmware version:	5.8.3251

Notes:

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61260:1995.

The filter submitted for testing successfully completed the Relative Attenuation test of IEC 61260 for the environmental conditions under which the test was performed.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216432**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity: 50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.7 °C	Humidity: 50.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78135
Environmental Monitor	Comet	T7510	16966334

Filters information

Filter class: 1
Filter base: 2
Reference attenuation: 0.0 dB

Additional instrument information

Instruction manual:
Pattern approval: No
Source of pattern approval: -
Reference level range: Single range

Laboratory uncertainties

Requirement	Value (dB)
Relative Attenuation High	0.41
Relative Attenuation Mid	0.18
Relative Attenuation Low	0.12

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **20 June 2024** CERTIFICATE NUMBER **216561**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Outdoor Kit Calibration Information

Instrument information

Manufacturer:	Cirrus Research plc
Model:	CK:685
Preamp Model	MK:172
Microphone Serial Number	2297
Primary Calibration Certificate Number	216431

Summary

Date of calibration: 20 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
This information is in addition to the primary calibration certificate for the sound level meter. The calibration certificate number is shown above and should be used in conjunction with this additional information.

The sound level meter detailed above has been calibrated to the published test and calibration data as detailed in the instrument handbook, using the techniques recommended in the standards to which the instrument has been designed.

All calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

The microphone capsule was calibrated using an electrostatic calibration system to produce the frequency response and a reference acoustic source for the final sensitivity testing.

In addition to the calibration of the complete sound level meter in its standard configuration, (instrument, MV:200 series preamplifier and microphone capsule), the sound level meter and microphone capsule were tested with the MK:172 preamplifier in place of the MV:200 series.

The sound level meter, G303154 , has been tested with Outdoor Microphone/Preamplifier Type MK:172 Serial Number 2297 and conforms to the requirements of the standards stated in the instrument user manual.

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216437**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 214535A

Calibration procedure

Date of calibration: 18 June 2024

Open circuit: 42.3 mV/Pa

Sensitivity at 1 kHz: -27.5 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.70 kPa

Temperature: 21.0 °C

Humidity: 55.0 %

CERTIFICATE OF CALIBRATION

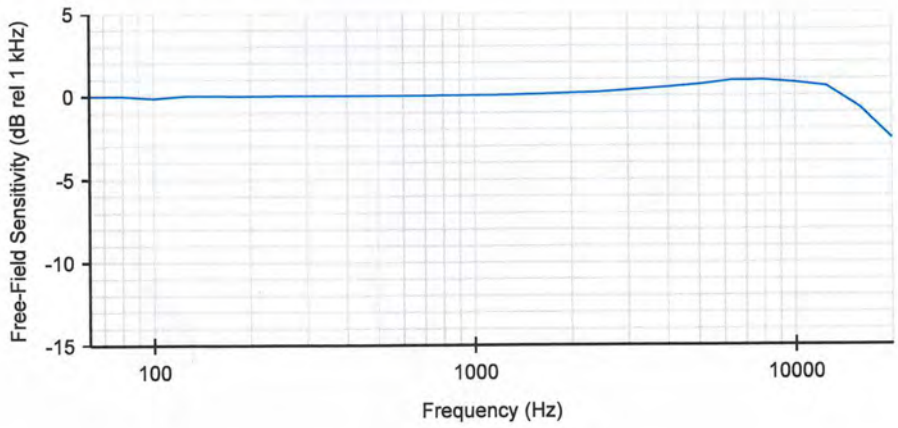
Certificate Number: **216437**

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	**-0.02**	**-0.18**
80	-0.02	-0.08
100	-0.15	-0.12
125	**-0.01**	**0.03**
160	-0.02	0.04
200	-0.02	0.05
250	**-0.01**	**0.08**
315	-0.01	0.05
400	-0.02	0.05
500	**-0.01**	**0.05**
630	-0.00	0.05
800	-0.00	0.04
1 000	**0.00**	**0.02**
1 250	0.02	0.01
1 600	0.06	-0.02
2 000	**0.12**	**-0.07**
2 500	0.18	-0.13
3 150	0.31	-0.22
4 000	**0.44**	**-0.45**
5 000	0.62	-0.74
6 300	0.85	-1.24
8 000	**0.86**	**-2.32**
10 000	0.72	-3.94
12 500	0.49	-5.93
16 000	**-0.82**	**-8.62**
20 000	-2.65	-11.66

Free-Field Frequency Response : Graphical



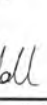
CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216433**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:



Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G303153	
Class:	1	
Firmware version:	5.8.3251	

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216433**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity:	50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.8 °C	Humidity:	50.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58000360
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 11542F

Microphone

Model: MK:224

Serial number: 218451F

Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216435**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R. Woodall

Octave-band filter : IEC 61260:1995

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G303153	
Class:	1	
Firmware version:	5.8.3251	

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61260:1995.

The filter submitted for testing successfully completed the Relative Attenuation test of IEC 61260 for the environmental conditions under which the test was performed.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216435**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity: 50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.8 °C	Humidity: 50.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58000360
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334

Filters information

Filter class: 1
Filter base: 2
Reference attenuation: 0.0 dB

Additional instrument information

Instruction manual:
Pattern approval: No
Source of pattern approval: -
Reference level range: Single range

Laboratory uncertainties

Requirement	Value (dB)
Relative Attenuation High	0.41
Relative Attenuation Mid	0.18
Relative Attenuation Low	0.12

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216434**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Third-octave-band filter : IEC 61260:1995

Instrument information

Manufacturer:	Cirrus Research plc
Model:	CR:171B
Serial number:	G303153
Class:	1
Firmware version:	5.8.3251

Notes:

Test summary

Date of calibration: 18 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61260:1995.

The filter submitted for testing successfully completed the Relative Attenuation test of IEC 61260 for the environmental conditions under which the test was performed.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **216434**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	101.00 kPa	Temperature:	21.8 °C	Humidity:	50.8 %
After	Pressure:	101.03 kPa	Temperature:	21.8 °C	Humidity:	50.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58000360
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334

Filters information

Filter class: 1
Filter base: 2
Reference attenuation: 0.0 dB

Additional instrument information

Instruction manual:
Pattern approval: No
Source of pattern approval: -
Reference level range: Single range

Laboratory uncertainties

Requirement	Value (dB)
Relative Attenuation High	0.41
Relative Attenuation Mid	0.18
Relative Attenuation Low	0.12

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **20 June 2024** CERTIFICATE NUMBER **216562**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Outdoor Kit Calibration Information

Instrument information

Manufacturer:	Cirrus Research plc
Model:	CK:685
Preamp Model	MK:172
Microphone Serial Number	2290
Primary Calibration Certificate Number	216433

Summary

Date of calibration: 20 June 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
This information is in addition to the primary calibration certificate for the sound level meter. The calibration certificate number is shown above and should be used in conjunction with this additional information.

The sound level meter detailed above has been calibrated to the published test and calibration data as detailed in the instrument handbook, using the techniques recommended in the standards to which the instrument has been designed.

All calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

The microphone capsule was calibrated using an electrostatic calibration system to produce the frequency response and a reference acoustic source for the final sensitivity testing.

In addition to the calibration of the complete sound level meter in its standard configuration, (instrument, MV:200 series preamplifier and microphone capsule), the sound level meter and microphone capsule were tested with the MK:172 preamplifier in place of the MV:200 series.

The sound level meter, G303153 , has been tested with Outdoor Microphone/Preamplifier Type MK:172 Serial Number 2290 and conforms to the requirements of the standards stated in the instrument user manual.

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216436**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 218451F

Calibration procedure

Date of calibration: 18 June 2024

Open circuit: 38.6 mV/Pa

Sensitivity at 1 kHz: -28.3 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.70 kPa

Temperature: 21.0 °C

Humidity: 55.0 %

CERTIFICATE OF CALIBRATION

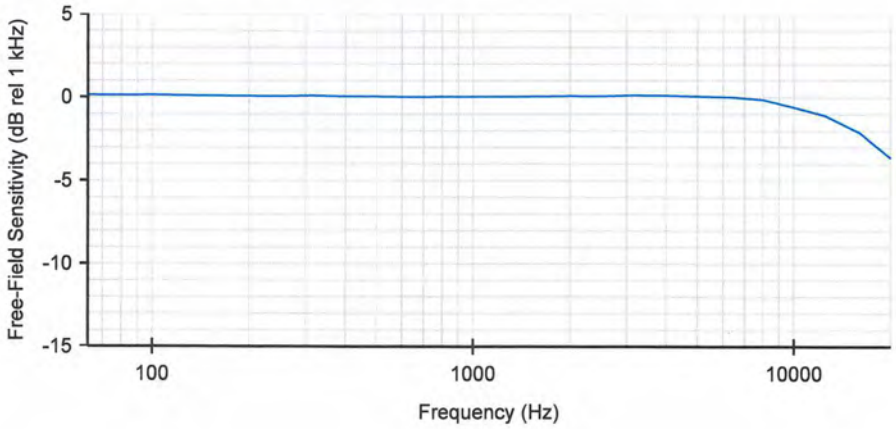
Certificate Number: **216436**

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	**0.09**	**-0.10**
80	0.07	-0.01
100	0.09	0.04
125	**0.07**	**0.06**
160	0.04	0.06
200	0.03	0.06
250	**0.02**	**0.06**
315	0.06	0.06
400	0.02	0.05
500	**0.02**	**0.04**
630	-0.01	0.00
800	0.01	0.01
1 000	**0.00**	**-0.01**
1 250	0.00	-0.04
1 600	0.01	-0.10
2 000	**0.05**	**-0.16**
2 500	0.04	-0.29
3 150	0.10	-0.46
4 000	**0.08**	**-0.80**
5 000	0.04	-1.31
6 300	-0.01	-2.07
8 000	**-0.18**	**-3.33**
10 000	-0.62	-5.24
12 500	-1.12	-7.63
16 000	**-2.15**	**-10.09**
20 000	-3.66	-12.77

Free-Field Frequency Response : Graphical



CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18 June 2024** CERTIFICATE NUMBER **216429**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Woodall
Electronically signed:

R.Woodall

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc **Notes:**

Model: CR:515

Serial number: 96656

Class: 1

Test summary

Date of calibration: 18 June 2024

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC60942_2003 Annex A to Class 1. This has been confirmed by Laboratoire National d'Essais (LNE), PhysikalischTechnische Bundesanstalt (PTB) and APPLUS (APPLUS).

Notes:

CERTIFICATE OF CALIBRATION

Certificate Number: **216429**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 100.91 kPa
Temperature: 21.8 °C
Humidity: 48.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1053426
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Initial Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.17	94.17	94.16	**94.17**	0.17	±0.40	0.11 dB
Distortion (%)	< 3.00	0.58	0.56	0.52	**0.55**	0.55	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.4	1000.2	1000.4	**1000.3**	0.3	±100.0	0.1 Hz

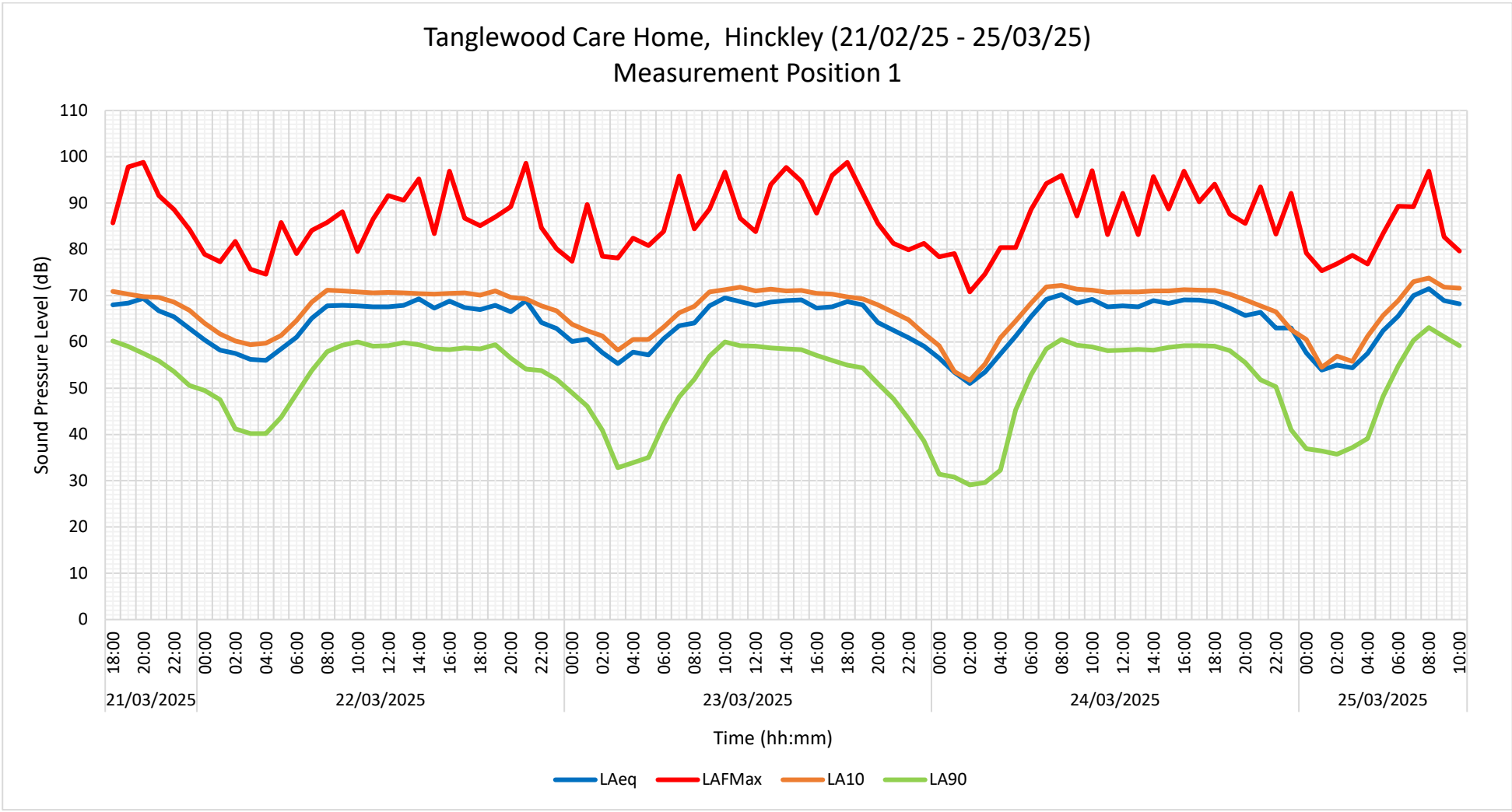
The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.00	93.97	93.98	**93.98**	-0.02	±0.40	0.11 dB
Distortion (%)	< 3.00	0.69	0.67	0.65	**0.67**	0.67	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.8	1000.7	**1000.6**	0.6	±100.0	0.1 Hz

End of results

Appendix C – Time History Graph



Appendix D – IMMI Noise Tables

Daytime and Night-time 1-hour

		Daytime 1 Hour		Night 1 Hour	
		LV	L r,A	LV	L r,A
		/dB	/dB	/dB	/dB
IPkt001	Section A GF		66.875		62.275
IPkt002	Section A UF1		66.673		62.073
IPkt003	Section A UF2		66.326		61.735
IPkt004	Section B GF		64.702		60.102
IPkt005	Section B UF1		64.629		60.030
IPkt006	Section B UF2		64.623		60.035
IPkt007	Section C GF		62.213		57.613
IPkt008	Section C UF1		62.472		57.873
IPkt009	Section C UF2		62.751		58.172
IPkt014	Section D GF		59.536		54.935
IPkt015	Section D UF1		60.584		55.984
IPkt016	Section D UF2		61.242		56.675
IPkt017	Section E GF		62.052		57.452
IPkt018	Section E UF1		62.658		58.058
IPkt019	Section E UF2		63.034		58.451
IPkt023	Section F GF		62.120		57.520
IPkt024	Section F UF1		62.984		58.384
IPkt025	Section F UF2		63.266		58.683
IPkt026	Section G GF		63.317		58.717
IPkt027	Section G UF1		63.879		59.280
IPkt028	Section G UF2		63.992		59.407
IPkt029	Section H GF		54.719		49.652
IPkt030	Section H UF1		55.813		50.847
IPkt031	Section H UF2		59.143		54.430
IPkt032	Section I GF		52.227		46.022
IPkt033	Section I UF1		52.820		46.973
IPkt034	Section I UF2		56.004		50.994
IPkt035	Section J GF		54.472		41.226
IPkt036	Section J UF1		53.767		42.361
IPkt037	Section J UF2		55.462		48.714
IPkt039	Section K GF		54.111		40.873
IPkt040	Section K UF1		53.218		41.873
IPkt041	Section K UF2		55.517		49.207
IPkt042	Section L GF		54.258		43.485
IPkt043	Section L UF1		53.507		44.459
IPkt044	Section L UF2		55.580		49.653
IPkt045	Section M GF		53.224		46.738
IPkt046	Section M UF1		53.578		47.769
IPkt047	Section M UF2		56.327		51.406
IPkt048	Section N GF		58.201		53.605
IPkt049	Section N UF1		59.422		54.827
IPkt050	Section N UF2		60.047		55.508
IPkt051	Section O GF		60.409		55.812
IPkt052	Section O UF1		60.773		56.180
IPkt053	Section O UF2		61.338		56.774
IPkt054	Section P GF		63.353		58.755
IPkt055	Section P UF1		63.335		58.738
IPkt056	Section P UF2		63.515		58.934

Night-time LAFmax

		Night (23h-7h)	
		LV	L r,A
		/dB	/dB
IPkt001	Section A GF		73.718
IPkt002	Section A UF1		75.110
IPkt003	Section A UF2		74.966
IPkt004	Section B GF		70.723
IPkt005	Section B UF1		72.879
IPkt006	Section B UF2		72.827
IPkt007	Section C GF		67.618
IPkt008	Section C UF1		70.005
IPkt009	Section C UF2		70.531
IPkt014	Section D GF		65.210
IPkt015	Section D UF1		67.084
IPkt016	Section D UF2		68.656
IPkt017	Section E GF		67.368
IPkt018	Section E UF1		69.454
IPkt019	Section E UF2		70.635
IPkt023	Section F GF		67.488
IPkt024	Section F UF1		69.386
IPkt025	Section F UF2		70.626
IPkt026	Section G GF		68.348
IPkt027	Section G UF1		70.484
IPkt028	Section G UF2		71.370
IPkt029	Section H GF		60.588
IPkt030	Section H UF1		61.807
IPkt031	Section H UF2		63.045
IPkt032	Section I GF		57.475
IPkt033	Section I UF1		58.357
IPkt034	Section I UF2		59.320
IPkt035	Section J GF		52.233
IPkt036	Section J UF1		52.891
IPkt037	Section J UF2		53.915
IPkt039	Section K GF		47.460
IPkt040	Section K UF1		47.757
IPkt041	Section K UF2		48.853
IPkt042	Section L GF		49.615
IPkt043	Section L UF1		50.197
IPkt044	Section L UF2		51.481
IPkt045	Section M GF		56.618
IPkt046	Section M UF1		57.351
IPkt047	Section M UF2		58.258
IPkt048	Section N GF		64.585
IPkt049	Section N UF1		66.036
IPkt050	Section N UF2		67.427
IPkt051	Section O GF		66.108
IPkt052	Section O UF1		68.156
IPkt053	Section O UF2		69.065
IPkt054	Section P GF		69.354
IPkt055	Section P UF1		71.605
IPkt056	Section P UF2		71.675

Appendix D – Site Plan