

**ENVIRONMENTAL ACOUSTIC
IMPACT ASSESSMENT**

**Royal Berkshire Archives,
9 Coley Avenue,
Reading
RG1 6AF**

**Reference : CS8831
Revision : Revision A
Status : Planning
Issue Date: 24th January 2025**

Prepared By:

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Stuart Metcalfe MIOA

CLIENT:

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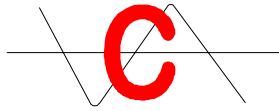
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Revision & Changes Log

Revision	Date	Comments/Summary of changes	Amended By:
A	18-09-2026	Plant Details Added	SJM

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1 Introduction

Conabeare Acoustics Limited have been commissioned by Proair Consultants Limited, to undertake an Environmental Acoustic Survey and BS4142:2014 assessment in relation to noise emissions of proposed plant to Royal Berkshire Archives, 9 Coley Avenue, Reading RG1 6AF.

The Survey was undertaken by Stuart Metcalfe MIOA who has been practicing in Building Services Acoustics and Noise Control Engineering for in excess of 30 years, is a Member of the Institute of Acoustics (MIOA) and is a Director at Conabeare Acoustics Ltd.

2 Acoustic Criteria

BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.

BS4142:2014+A1:2019 gives a method for rating sound from industrial and commercial sources affecting people inside or outside dwellings or premises used for residential purposes.

An initial estimate of the significance of the sound from the industrial/commercial nature can be assessed by subtracting the measured background noise level from the rating level (this is the specific sound level of the source with any corrections or penalties for distinctive acoustic characteristics).

The site is located within the Reading Borough Council demise which has adopted the National Planning Policy Guidelines and as such References and evaluations are to be made to the National Planning Policy Framework 2019 (NPPF) and the Noise Policy Statement for England 2010 (NPSE).

Furthermore Reading Borough Council Local Plan adopted November 2019 section 4. GENERAL POLICIES—BUILT AND NATURAL ENVIRONMENT states the following.

EN17: NOISE GENERATING EQUIPMENT

Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.

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There are several key phrases within the NPSE aims and these are discussed below.
“Significant adverse” and “adverse”

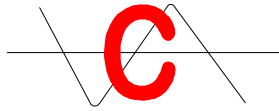
NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected. Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

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3 Plant Location and Measurement Position

The area consists of a mixture of residential and commercial premises with the closest sound sensitive façades being adjudged to be as below.

- Rear of Coley Hill at a distance of approximately 33 metres.
- Rear of Castle Crescent at a distance of approximately 30 metres.

View A – Looking North



Measuring Location **Proposed Plant Location** **Sound Sensitive Façades**



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Measurement Location



4 Existing Noise Climate

The area is a mixture of residential and commercial premises with transportation noise from the area being adjudged to be the dominant source during the survey period.

5 Noise Survey

5.1 Measurements

The Survey commenced at approximately 11:35 hours on Tuesday 7th January 2025 until approximately 11:40 hours on Wednesday 8th January 2025.

The Analyser was programmed to record 15 minute sampling periods over the survey duration.

The microphone was located on a tripod at approximately 1.5 metres above, and at a minimum of 1m from, a reflecting plane.

The measurements and their interpretation are in accordance with BS 7445: Parts 1 and 2. All readings are Sound Pressure Levels (Lp) in dB (re 20µPa).

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5.2 Weather during Survey Period

The weather was cold and dry throughout the measuring period. The weather did not, in our opinion, adversely influence the readings obtained.

5.3 Instrumentation

The instrumentation used was a Type 1 Larson Davis SoundExpert 821 Sound Level Analyser confirming to IEC 651-1979 Type 1, EN60651 Type 1 and IEC 804-1985 Type 1, EN60804 Type 1.

- **Larson Davis 821 Sound Level Analyser, Serial Number 40317, calibrated on 20th June 2024, Certificate Number 2024009064.**
- **Larson Davis PRM821 Preamplifier, Serial Number 001704, calibrated on 20th May 2024, Certificate Number 2024007510.**

The additional following equipment was also used

- **Larson Davis type CAL200 Calibrator, Serial Number 17720 calibrated on 8th November 2023, Certificate Number 16246.**
- **Extension Cable**

Field calibration checks were made using the Calibrator and no significant drift was noted against the Calibration level of $114.0\text{dB} \pm 0.2\text{dB}$ at $1000\text{Hz} \pm 0.2\%$.

5.4 Survey Results

The following is a summary of the Background (L_{A90}) levels recorded in Daytime, Evening and Night-time Periods

- $L_{A90,15\text{min}}$ 42.6dB(A) between 07:00 hours to 19:00 hours.
- $L_{A90,15\text{min}}$ 39.1dB(A) between 19:00 hours to 23:00 hours.
- $L_{A90,15\text{min}}$ 30.5dB(A) between 23:00 hours to 07:00 hours.

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6 Assessment Methodology: BS4142:2014+A1:2019

BS 4142:2014+A1:2019 “Methods for Rating and Assessing Industrial and Commercial Sound” addresses the likelihood of adverse impact from noise generated by plant equipment. In the standard, a noise rating is determined and compared with the existing local background sound level, and several cumulative acoustic feature corrections to the noise rating are available to apply where appropriate.

For example if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional cumulative penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.

BS 4142:2014 seeks to determine a “representative” background sound level, stating that “...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.

The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level but also promotes a consideration of the context in which the sound occurs when making an assessment.

BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) 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.

It is also considered appropriate to consider other pertinent sources of guidance. The following sections consider absolute criteria advocated by both the World Health Organisation: 1999: “Guidelines for Community Noise” and BS 8233:1999: “Sound insulation and noise reduction for buildings – Code of practice”.

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World Health Organisation: 1999: “Guidelines for Community Noise”

This document provides a review of the effects of noise and a description of the principles of the WHO health criteria and guidelines for Community Noise.

The effects of noise in dwellings are identified as sleep disturbance, annoyance and speech interference. For bedrooms, the critical effect is sleep disturbance. The indoor guideline value for continuous noise in bedrooms is 30 dB LAeq. To enable casual conversation indoors during the daytime, the sound level of the interfering noise should not exceed 35 dB LAeq.

Table 1 of the document summarises the guideline values for community noise in specific environments and includes the noise indices to be adopted. Significantly, the corresponding time base to be used for the assessment is also included.

The relevant extracts of Table 1 are reproduced thus:

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmaz fast [dB]
Dwelling, indoors	Speech intelligibility & moderate annoyance daytime & evening	35	16	45
	Sleep disturbance, night-time	30	8	

This level should be a cumulative level from all plant running normally and makes allowance for any tonal or intermittent noise from the plant.

BS8233:2014

BS 8233: 2014 – “Guidance on sound insulation and noise reduction for buildings” provides information on achieving internal acoustic environments appropriate to their functions.

As part of this document, recommendations are given to the internal noise levels which are commensurate with achieving acceptable resting, dining and sleeping conditions within residential properties. The values given are generally in terms of an LAeq level although reference is also made with regards to maximum noise levels, although no criterion is specified in this recently revised version of the standard.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35dB LAeq 16 hours	-
Dining	Dining Room	40dB LAeq 16 hours	-
Sleeping	Bedroom	35dB LAeq 16 hours	30dB LAeq 8 hours

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It is generally accepted that a partially open window will provide a level difference of 15dB and therefore the guideline levels to achieve 30dBA within a bedroom would indicate a level of 45dBA directly outside a bedroom window would be acceptable.

Noise Change (dBA)	Category
0	No Impact
0.1 to 2.9	Slight Impact
3.0 to 4.9	Moderate Impact
5.0 to 9.9	Substantial Impact
10.0 and above	Severe Impact

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7 Noise Assessment

The objective of any specification limiting new noises should therefore be to ensure that sound emission from the new building services plant and any other new sources, in particular, should not materially add to the existing sound climate.

We understand that the plant will operate during the hours of 07:00 to 19:00 and would recommend setting a target level at the sound sensitive façades as below;

7.1 Plant Noise Emissions Criteria

- $L_{Aeq,15min}$ 33.0dB – 07:00 to 19:00 hours.

This level is 10dB(A) below the minimum measured background noise level.

7.2 Proposed Plant

The proposed plant being assessed is as detailed below;

- Air Handling Unit AHU01 1 number AirCraft Air Handling
- Air Handling Unit AHU02 1 number AirCraft Air Handling
- Condensing Units 4 number Mitsubishi PUZ-ZM250YKA

7.3 Plant Locations

The plant will be located on the roof of the building.

7.4 Plant Noise Levels

The manufacturers sound spectrums will be reproduced below when available.

Item	Model	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)								
			63	125	250	500	1k	2k	4k	8k	dBA
AHU01	AirCraft	Intake Lw	75	70	83	77	72	69	66	64	79
AHU01	AirCraft	Exhaust Lw	71	75	75	74	74	70	66	65	78
AHU01	AirCraft	Casing Lw	61	52	61	52	54	46	39	37	57
AHU02	AirCraft	Intake Lw	75	70	83	77	72	69	66	64	79
AHU02	AirCraft	Exhaust Lw	71	75	75	74	74	70	66	65	78
AHU02	AirCraft	Casing Lw	61	52	61	52	54	46	39	37	57
CU01-04	PUZ-ZM250	Lp @ 1m	71	61	61	61	56	53	49	42	62

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Acoustic Feature Correction

A 3dB allowance has been made for the sound sensitive façade.

No allowance has been made for tonal noise as no items of plant are considered to be tonal in nature.

No allowance has been made for intermittency as it is likely that one or more units will be running at any time.

Distance Attenuation

The distance loss figures are shown on our calculation sheet below.

Barrier Attenuation

We have allowed for a 5dB reduction for partial screening due to the building edge for the AHU's and an allowance for the proposed hit and miss fencing to screen the AHU casing.

As the condensing units are closer to the edge of the building they will have no screening.

Un-mitigated Noise Levels – Residential Facade.

The combined noise level for all items of plant with no mitigating measures, and with all suitable allowances made, will be 50dBA at 1 metre from the nearest residential sound sensitive façade at the Old Registry Office.

The assessment would indicate that the plant will therefore have a rating of *SOAEL – Significant Observed Adverse Effect Level* as it is more than 10dBA above the lowest measured background level.

It will therefore be necessary to reduce the Air Handling Unit noise levels by 16dBA to meet the proposed target level.

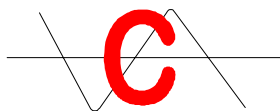
It will therefore be necessary to reduce the Condensing Unit noise levels by 9dBA to meet the proposed target level.

The combined noise levels should also ensure the target noise level is met.

Proposed mitigating measures are detailed below.

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8 Recommendations

To enable the target noise levels at the adjacent Residential façades to be met it will be necessary to install the following mitigating measures.

AHU01 and AHU02

Fresh Air Intake

We would recommend that a fresh air attenuator is fitted which will have the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
7	14	21	26	30	19	15	14

The attenuator is envisaged to be 1500mm long with 50% free area. The pressure loss over the attenuator would need to be less than 50Pa based upon plenum to duct conditions.

Exhaust Air

We would recommend that a fresh air attenuator is fitted which will have the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
7	14	21	26	30	19	15	14

The attenuator is envisaged to be 1500mm long with 50% free area. The pressure loss over the attenuator would need to be less than 50Pa based upon duct to plenum conditions.

Condensing Units

The condensing units should have an acoustic louvred screen fitted around the plant area to allow air to and from the plant whilst screening from the sound sensitive facades and which will require the following minimum acoustic performance.

Sound Reduction Index (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
5	5	7	12	16	19	15	15

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The acoustic louvre will be 300mm thick and would need to be 500mm taller than the condensing units at approximately 1800mm high .

Our calculations as below indicate that if the proposed mitigating measures are introduced then the resulting noise level at the nearest sound sensitive façades will meet the required target levels.

We have detailed below the attenuators required for the AHU's.

Attenuator Schedule

Ref.	Model	Type	Length	Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
				63	125	250	500	1k	2k	4k	8k
ATT.01	KSD6060	AHU Fresh Air	1500	7	14	21	26	30	19	15	14
ATT.02	KSD6060	AHU Exhaust	1500	7	14	21	26	30	19	15	14

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9 Conclusion

A background Noise Survey was carried during a typical day and night time period at a location representative of the nearest sound sensitive receivers.

A target noise level has been proposed which complies with the requirements of Reading Borough Council policy.

An assessment in line with BS4142:2014+A1:2019 has been carried out and mitigating measures proposed.

In our opinion, the scheme should be acceptable to the Local Authority subject to the proposed mitigating measures being introduced.

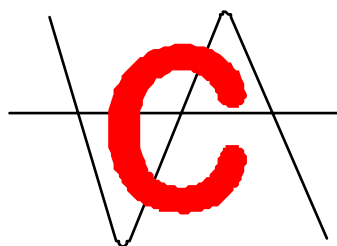
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- Period result profile -

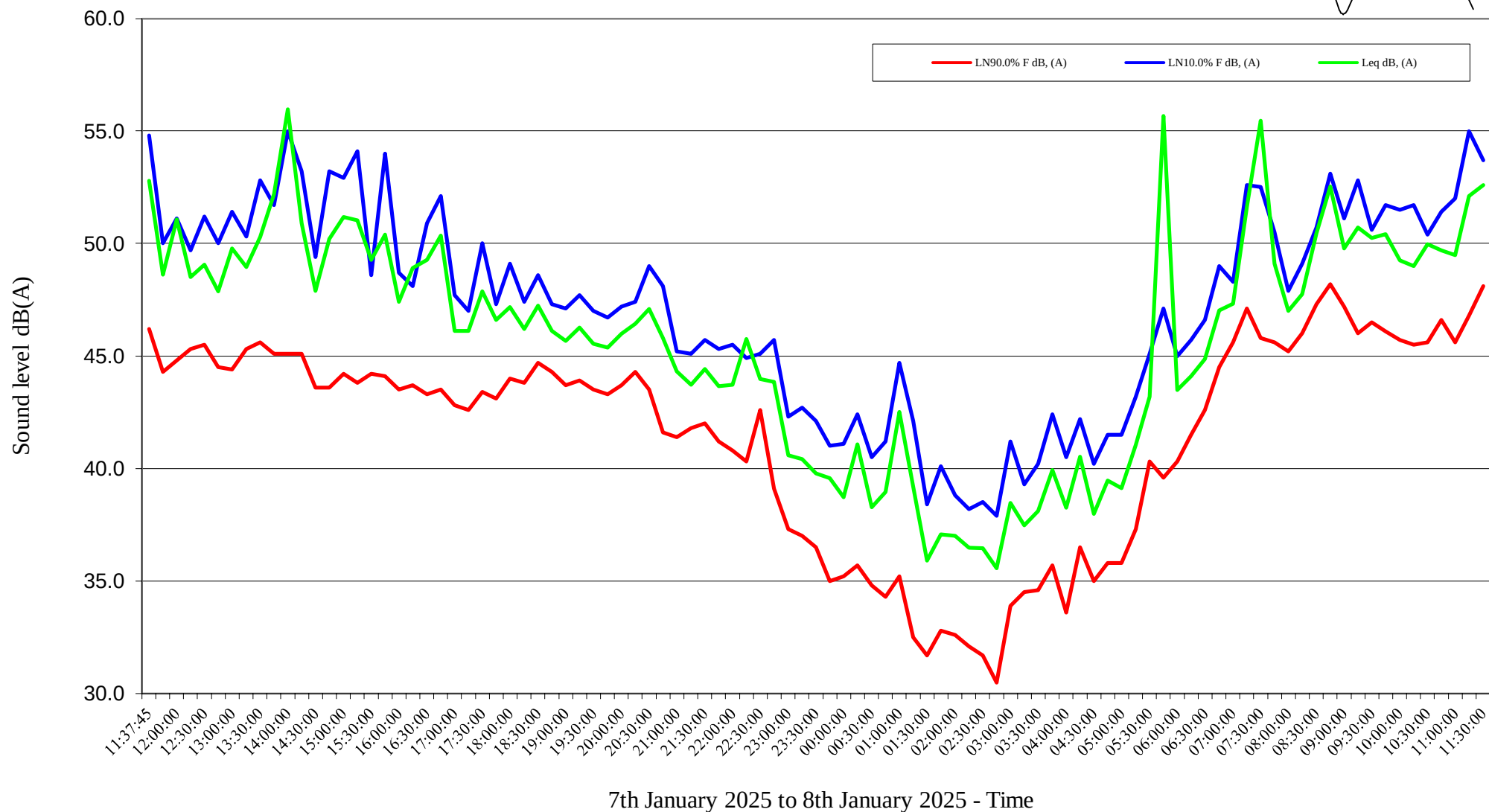
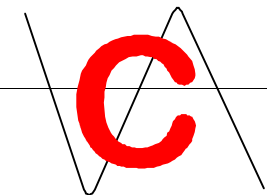
Overload occurred	No
Low battery occurred	No
Pause was used	No
Frequency weighting	A
Band	Broadband
Period time	15 min
Periods too short for LNs	No
First period listed	1 : 97
Measurement Description	
Start	07/01/2025 11:37
Stop	08/01/2025 11:41
Run Time	24:03:38
Pre Calibration	07/01/2025 11:35



Period number	Date	Time	LN90.0% F dB, (A)	LN10.0% F dB, (A)	Leq dB, (A)
1	07/01/2025	11:37:45	46.2	54.8	52.8
2	07/01/2025	11:45:00	44.3	50.0	48.6
3	07/01/2025	12:00:00	44.8	51.1	51.1
4	07/01/2025	12:15:00	45.3	49.7	48.5
5	07/01/2025	12:30:00	45.5	51.2	49.1
6	07/01/2025	12:45:00	44.5	50.0	47.9
7	07/01/2025	13:00:00	44.4	51.4	49.8
8	07/01/2025	13:15:00	45.3	50.3	48.9
9	07/01/2025	13:30:00	45.6	52.8	50.3
10	07/01/2025	13:45:00	45.1	51.7	52.2
11	07/01/2025	14:00:00	45.1	55.0	56.0
12	07/01/2025	14:15:00	45.1	53.2	50.9
13	07/01/2025	14:30:00	43.6	49.4	47.9
14	07/01/2025	14:45:00	43.6	53.2	50.2
15	07/01/2025	15:00:00	44.2	52.9	51.2
16	07/01/2025	15:15:00	43.8	54.1	51.0
17	07/01/2025	15:30:00	44.2	48.6	49.3
18	07/01/2025	15:45:00	44.1	54.0	50.4
19	07/01/2025	16:00:00	43.5	48.7	47.4
20	07/01/2025	16:15:00	43.7	48.1	48.9
21	07/01/2025	16:30:00	43.3	50.9	49.3
22	07/01/2025	16:45:00	43.5	52.1	50.4
23	07/01/2025	17:00:00	42.8	47.7	46.1
24	07/01/2025	17:15:00	42.6	47.0	46.1
25	07/01/2025	17:30:00	43.4	50.0	47.9
26	07/01/2025	17:45:00	43.1	47.3	46.6
27	07/01/2025	18:00:00	44.0	49.1	47.2
28	07/01/2025	18:15:00	43.8	47.4	46.2
29	07/01/2025	18:30:00	44.7	48.6	47.2
30	07/01/2025	18:45:00	44.3	47.3	46.1
31	07/01/2025	19:00:00	43.7	47.1	45.7
32	07/01/2025	19:15:00	43.9	47.7	46.3
33	07/01/2025	19:30:00	43.5	47.0	45.5
34	07/01/2025	19:45:00	43.3	46.7	45.4
35	07/01/2025	20:00:00	43.7	47.2	46.0
36	07/01/2025	20:15:00	44.3	47.4	46.4
37	07/01/2025	20:30:00	43.5	49.0	47.1
38	07/01/2025	20:45:00	41.6	48.1	45.8
39	07/01/2025	21:00:00	41.4	45.2	44.3

Period number	Date	Time	LN90.0% F	LN10.0% F	Leq
			dB, (A)	dB, (A)	dB, (A)
40	07/01/2025	21:15:00	41.8	45.1	43.7
41	07/01/2025	21:30:00	42.0	45.7	44.4
42	07/01/2025	21:45:00	41.2	45.3	43.7
43	07/01/2025	22:00:00	40.8	45.5	43.7
44	07/01/2025	22:15:00	40.3	44.9	45.8
45	07/01/2025	22:30:00	42.6	45.1	44.0
46	07/01/2025	22:45:00	39.1	45.7	43.8
47	07/01/2025	23:00:00	37.3	42.3	40.6
48	07/01/2025	23:15:00	37.0	42.7	40.4
49	07/01/2025	23:30:00	36.5	42.1	39.8
50	07/01/2025	23:45:00	35.0	41.0	39.6
51	08/01/2025	00:00:00	35.2	41.1	38.7
52	08/01/2025	00:15:00	35.7	42.4	41.1
53	08/01/2025	00:30:00	34.8	40.5	38.3
54	08/01/2025	00:45:00	34.3	41.2	38.9
55	08/01/2025	01:00:00	35.2	44.7	42.5
56	08/01/2025	01:15:00	32.5	42.1	39.2
57	08/01/2025	01:30:00	31.7	38.4	35.9
58	08/01/2025	01:45:00	32.8	40.1	37.1
59	08/01/2025	02:00:00	32.6	38.8	37.0
60	08/01/2025	02:15:00	32.1	38.2	36.5
61	08/01/2025	02:30:00	31.7	38.5	36.4
62	08/01/2025	02:45:00	30.5	37.9	35.6
63	08/01/2025	03:00:00	33.9	41.2	38.5
64	08/01/2025	03:15:00	34.5	39.3	37.5
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66	08/01/2025	03:45:00	35.7	42.4	39.9
67	08/01/2025	04:00:00	33.6	40.5	38.3
68	08/01/2025	04:15:00	36.5	42.2	40.5
69	08/01/2025	04:30:00	35.0	40.2	38.0
70	08/01/2025	04:45:00	35.8	41.5	39.5
71	08/01/2025	05:00:00	35.8	41.5	39.1
72	08/01/2025	05:15:00	37.3	43.2	41.1
73	08/01/2025	05:30:00	40.3	45.1	43.2
74	08/01/2025	05:45:00	39.6	47.1	55.7
75	08/01/2025	06:00:00	40.3	45.0	43.5
76	08/01/2025	06:15:00	41.5	45.7	44.1
77	08/01/2025	06:30:00	42.6	46.6	44.9
78	08/01/2025	06:45:00	44.5	49.0	47.0
79	08/01/2025	07:00:00	45.6	48.3	47.3
80	08/01/2025	07:15:00	47.1	52.6	51.6
81	08/01/2025	07:30:00	45.8	52.5	55.5
82	08/01/2025	07:45:00	45.6	50.5	49.1
83	08/01/2025	08:00:00	45.2	47.9	47.0
84	08/01/2025	08:15:00	46.0	49.1	47.7
85	08/01/2025	08:30:00	47.3	50.7	50.5
86	08/01/2025	08:45:00	48.2	53.1	52.5
87	08/01/2025	09:00:00	47.2	51.1	49.8
88	08/01/2025	09:15:00	46.0	52.8	50.7
89	08/01/2025	09:30:00	46.5	50.6	50.3
90	08/01/2025	09:45:00	46.1	51.7	50.4
91	08/01/2025	10:00:00	45.7	51.5	49.2
92	08/01/2025	10:15:00	45.5	51.7	49.0
93	08/01/2025	10:30:00	45.6	50.4	50.0
94	08/01/2025	10:45:00	46.6	51.4	49.7
95	08/01/2025	11:00:00	45.6	52.0	49.5
96	08/01/2025	11:15:00	46.8	55.0	52.1
97	08/01/2025	11:30:00	48.1	53.7	52.6

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Glossary of Terms

L_{A90}	The sound pressure level in dB(A) which is exceeded for 90% of the time and is taken to be the effective lowest background sound level for the period by such methods of sound rating as that recommended in BS4142:2014. It will also be used as a basis for selecting limiting sound levels from new plant by Local Planning Authorities when setting Planning Consent Conditions.
L_{Aeq}	The “equivalent continuous sound level” for the measuring period, defined as the level in dBA which, if held constant over the measuring period, would produce the same amount of sound energy as does the actual varying ambient sound level. It is a measure of the amount of sound energy affecting the site from sources other than new plant or operations.
L_{A10}	The sound level exceeded for 10% of the time over the sample period. Originally used as a measure of subjective reaction to traffic noise in particular, it can also be taken as an indication of the practical maximum sound level that the building envelope will have to protect against.
dBA	Describes measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dBA broadly agree with people’s assessment of loudness. A change of 3dBA is the minimum perceptible under normal conditions, and a change of 10dBA corresponds roughly to halving or doubling the loudness of a sound.

Conabeare Acoustics Limited

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Project: Q10522 - Royal Berkshire Archives, 9 Coley Avenue, Reading RG1 6AF

Client :

Revision: Revision A

Date : 5th December 2025

Item Calculation 01 - Noise to Old Registry Office - 07:00 to 19:00 - Proposed Plant - Target Level - 33dBA

AHU01	Air Handling Unit - AHU01 - Fresh Air Intake - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		75	70	83	77	72	69	66	64	79
		System Loss (Ducting and Bends)	0	0	0	0	0	0	0	0	
		End Reflection	-3	0	0	0	0	0	0	0	
	26	Distance to Listener	-40	-40	-40	-40	-40	-40	-40	-40	
		Directivity (90 Degrees)	2	2	1	0	-2	-5	-10	-15	
		Source Location (Junction)	6	6	6	6	6	6	6	6	
		Screening (Line of Sight)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Fresh Air Intake Only		38	36	48	41	34	28	20	13	43
	Proposed Attenuator - Insertion Loss - KSD6060 - 1500mm Long		-7	-14	-21	-26	-30	-19	-15	-14	
	Resultant Noise Level from AHU Fresh Air Intake with Mitigating Measures		31	22	27	15	4	9	5	-1	20
AHU01	Air Handling Unit - AHU01 - Exhaust - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		71	75	75	74	74	70	66	65	78
		System Loss (Ducting and Bends)	0	0	0	0	0	0	0	0	
		End Reflection	-3	0	0	0	0	0	0	0	
	26	Distance to Listener	-40	-40	-40	-40	-40	-40	-40	-40	
		Directivity (90 Degrees)	2	2	1	0	-2	-5	-10	-15	
		Source Location (Junction)	6	6	6	6	6	6	6	6	
		Screening (Line of Sight)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Exhaust Only		34	41	40	38	36	29	20	14	40
	Proposed Attenuator - Insertion Loss - KSD6060 - 1500mm Long		-7	-14	-21	-26	-30	-19	-15	-14	
	Resultant Noise Level from AHU Exhaust with Mitigating Measures		27	27	19	12	6	10	5	0	17
AHU01	Air Handling Unit - AHU01 - Casing Breakout - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		61	52	61	52	54	46	39	37	57
	26	Distance to Listener	-40	-40	-40	-40	-40	-40	-40	-40	
		Source Location (Plane)	3	3	3	3	3	3	3	3	
		Screening (Hit and Miss Fencing)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
		Estimated Lp at Listener Exhaust Only	22	13	22	13	15	7	0	-2	18
AHU02	Air Handling Unit - AHU02 - Fresh Air Intake - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		75	70	83	77	72	69	66	64	79
		System Loss (Ducting and Bends)	0	0	0	0	0	0	0	0	
		End Reflection	-3	0	0	0	0	0	0	0	
	22	Distance to Listener	-38	-38	-38	-38	-38	-38	-38	-38	
		Directivity (90 Degrees)	2	2	1	0	-2	-5	-10	-15	
		Source Location (Junction)	6	6	6	6	6	6	6	6	
		Screening (Line of Sight)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Fresh Air Intake Only		40	38	50	43	36	30	22	15	45
	Proposed Attenuator - Insertion Loss - KSD6060 - 1500mm Long		-7	-14	-21	-26	-30	-19	-15	-14	
	Resultant Noise Level from AHU Fresh Air Intake with Mitigating Measures		33	24	29	17	6	11	7	1	22
AHU02	Air Handling Unit - AHU02 - Exhaust - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		71	75	75	74	74	70	66	65	78
		System Loss (Ducting and Bends)	0	0	0	0	0	0	0	0	
		End Reflection	-3	0	0	0	0	0	0	0	
	22	Distance to Listener	-38	-38	-38	-38	-38	-38	-38	-38	
		Directivity (90 Degrees)	2	2	1	0	-2	-5	-10	-15	
		Source Location (Junction)	6	6	6	6	6	6	6	6	
		Screening (Line of Sight)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Exhaust Only		36	43	42	40	38	31	22	16	42
	Proposed Attenuator - Insertion Loss - KSD6060 - 1500mm Long		-7	-14	-21	-26	-30	-19	-15	-14	
	Resultant Noise Level from AHU Exhaust with Mitigating Measures		29	29	21	14	8	12	7	2	19
AHU02	Air Handling Unit - AHU02 - Casing Breakout - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Fan Lw - AirCRAFT Air Handling - Manufacturers Data		61	52	61	52	54	46	39	37	57
	26	Distance to Listener	-40	-40	-40	-40	-40	-40	-40	-40	
		Source Location (Plane)	3	3	3	3	3	3	3	3	
		Screening (Hit and Miss Fencing)	-5	-5	-5	-5	-5	-5	-5	-5	
		Façade Effect	3	3	3	3	3	3	3	3	
		Estimated Lp at Listener Exhaust Only	22	13	22	13	15	7	0	-2	18
	Cumulative Noise Level - with No Mitigating Measures - AHU's Only		44	46	53	47	42	36	27	21	49
	Cumulative Noise Level - with Mitigating Measures - AHU's Only		37	32	33	22	19	18	13	8	27

CU01	Condensing Unit - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Unit Lp at 1 metre - Mitsubishi PUZ-ZM250 - Manufacturers Data		71	61	61	61	56	53	49	42	62
	Additional Distance to Listener	23 m	-28	-28	-28	-28	-28	-28	-28	-28	
	Allowance for Intermittency		0	0	0	0	0	0	0	0	
	Additional Surfaces (0)		0	0	0	0	0	0	0	0	
	Screening		0	0	0	0	0	0	0	0	
	Façade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only		46	36	36	36	31	28	24	17	37
CU02	Condensing Unit - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Unit Lp at 1 metre - Mitsubishi PUZ-ZM250 - Manufacturers Data		71	61	61	61	56	53	49	42	62
	Additional Distance to Listener	25 m	-28	-28	-28	-28	-28	-28	-28	-28	
	Allowance for Intermittency		0	0	0	0	0	0	0	0	
	Additional Surfaces (0)		0	0	0	0	0	0	0	0	
	Screening		0	0	0	0	0	0	0	0	
	Façade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only		46	36	36	36	31	28	24	17	37
CU03	Condensing Unit - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Unit Lp at 1 metre - Mitsubishi PUZ-ZM250 - Manufacturers Data		71	61	61	61	56	53	49	42	62
	Additional Distance to Listener	27 m	-29	-29	-29	-29	-29	-29	-29	-29	
	Allowance for Intermittency		0	0	0	0	0	0	0	0	
	Additional Surfaces (0)		0	0	0	0	0	0	0	0	
	Screening		0	0	0	0	0	0	0	0	
	Façade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only		45	35	35	35	30	27	23	16	36
CU04	Condensing Unit - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	Unit Lp at 1 metre - Mitsubishi PUZ-ZM250 - Manufacturers Data		71	61	61	61	56	53	49	42	62
	Additional Distance to Listener	29 m	-30	-30	-30	-30	-30	-30	-30	-30	
	Allowance for Intermittency		0	0	0	0	0	0	0	0	
	Additional Surfaces (0)		0	0	0	0	0	0	0	0	
	Screening		0	0	0	0	0	0	0	0	
	Façade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only		44	34	34	34	29	26	22	15	35
	Cumulative Noise Level - with No Mitigating Measures - Condensing Units Only		51	41	41	41	36	33	29	22	42
	Proposed Attenuator - WSD300 Acoustic Louvres		-5	-5	-7	-12	-16	-19	-15	-15	
	Resultant Noise Level from AHU Exhaust with Mitigating Measures		46	36	34	29	20	14	14	7	31
	Cumulative Noise Level - with No Mitigating Measures - All Plant		52	48	53	48	43	38	31	25	50
	Cumulative Noise Level - with Mitigating Measures		47	38	37	30	23	19	17	11	32

Calibration Certificate

Certificate Number 2024009064

Customer:

PC Environmental Ltd.
7 Winchester Street
The Old Stables Botley
Southampton, SO30 2EB United Kingdom

Model Number SoundExpert 821
Serial Number 40317
Test Results **Pass**
Initial Condition As Manufactured
Description SoundExpert 821
Class 1 Sound Level Meter
Firmware Revision: 1.201R11

Procedure Number D0001.8466
Technician Jacob Cannon
Calibration Date 20 Jun 2024
Calibration Due
Temperature 23.72 °C ± 0.25 °C
Humidity 51.3 %RH ± 2.0 %RH
Static Pressure 86.07 kPa ± 0.13 kPa

Evaluation Method **Tested with:** **Data reported in dB re 20 µPa.**

TMS 9917C. S/N 219
Larson Davis CAL200. S/N 9079
PCB 377B02. S/N 355935
Larson Davis PRM821. S/N 001704

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8467:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61260:2014 Class 1	ANSI S1.11-2014 Class 1
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis SoundExpert 721/821 Manual, I821.01 Rev B

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601 United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μ Pa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, 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 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 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 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2023-02-20	2024-08-20	006946
Larson Davis CAL200 Acoustic Calibrator	2023-07-17	2024-07-17	007027
1/2 inch Microphone - P - 0V	2024-02-12	2025-02-12	007080
Larson Davis Model 831	2024-02-15	2025-02-15	007182
SRS DS360 Ultra Low Distortion Generator	2024-03-26	2025-03-26	007635
TMS 9917C-LD Microphone Comparison Calibrator	2024-03-14	2025-03-14	007649
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2024-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-26.13	-27.50	-24.50	0.14	Pass

-- End of measurement results--

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.60	Pass
1000	0.26	0.00	-0.70	0.70	0.60	Pass
8000	-2.39	-3.00	-5.50	-1.50	0.81	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
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A-weighted	28.92
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-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601 United States
716-684-0001



Acoustic Calibration Services Limited
Unit 6H Diamond Industrial Centre
Works Road Letchworth Garden City
Hertfordshire SG6 1LW
Tel: 01462-677 197 Mobile: 0771 886 4944
Email: trevjohnlewis@aol.com



CERTIFICATE OF CALIBRATION

Model: LD CAL200

Serial Number: 17720

Organisation: Conabeare Acoustics Ltd, 11 Chilton Enterprise Centre
Station Road, Theale, Berkshire RG7 4AA

Job Number: 2964

Customer Order Reference: S Metcalfe

The acoustic calibrator was run for a period of time until a stable level was achieved. The output level was compared to the certified level of the laboratory measurement references. The calibrator was applied to the meter, removed, then reapplied to provide five separate readings, with the average value of these measurements recorded and certified.

The ambient temperature during calibration was **21.4 ± 1°C**.
The barometric pressure was **99.5 to 99.6 kPa**.
The relative humidity was **49 to 59 %**

The sound pressure level output from the Acoustic Calibrator was measured in its half inch configuration using a B&K 4134 microphone. The mean level output of the acoustic calibrator was 113.9 dB at the reference setting and 93.9 dB at the -20dB setting.

The output frequency signal of the acoustic calibrator is 1000Hz.

All ACSL's calibration instrumentation is fully traceable to National Standards. The acoustic references are calibrated by laboratories which are UKAS accredited for the purpose.

Certificate No: 16246

Date of Issue: 8th November 2023

Signature:

Print Name:

Trevor Lewis

A handwritten signature in black ink, appearing to read 'Trevor Lewis', is written over a white background.