



Goodhand
Acoustics

HVAC Noise Report

Magnolia House Dental Practice

On Behalf of

AB and V Limited

March 2025

Document Control

Prepared by:	Daniel Goodhand MIOA
Date:	12 March 2025
Version:	3
Project Number:	3640
Document Reference:	3640_Magnolia House_250312_HVACNoiseReport_vS3.docx

The preparation of this report by Goodhand Acoustics has been undertaken within the terms of the Brief using all reasonable skill and care. Goodhand Acoustics accepts no responsibility for data provided by other bodies and no legal liability arising from the use by other persons of data or opinions contained in this report.

+44 (0) 1273 915 910

info@goodhandacoustics.co.uk

goodhandacoustics.co.uk

Goodhand Acoustics Ltd. Registered in England. Company No. 8269321.
Registered Office: The Offices, 57 Newton Road, Brighton, East Sussex, BN3 7BA

Contents

Document Control	i
Contents.....	ii
Tables and Figures	iv
1 Introduction	5
2 Planning Condition	6
2.1 Havant Borough Local Plan (Core Strategy) 2011	6
DM10 Pollution	6
2.2 National Planning Policy Framework	6
2.3 Environmental Health Advice	6
3 Sound Level Survey Details	8
3.1 Equipment and Location.....	8
3.2 Sound Level Results	11
4 Noise Calculation and Assessment	14
4.1 Proposed Development.....	14
4.2 Noise Predictions	14
4.3 BS 4142 Assessment.....	16
5 Uncertainty	18
5.1 Sources of Data.....	18
5.2 Prediction Methodology.....	18
ISO 9613 – Outdoor Propagation.....	18
5.3 Measurement Uncertainty	18
Barriers and Reflections	19
Sound Environment.....	19
Sound Level Meter.....	19

5.4	Mitigation of Uncertainty	19
6	Summary and Conclusion	20
	Appendix A – Email with Environmental Health Officer	21
	Appendix B – Calibration Certificates	24
	Appendix C – Specifications	35
	Mitsubishi FDC121KXZEN1	35
	References	36

Tables and Figures

Tables

Table 3.1: Equipment Details.....	8
Table 3.2: Background sound level survey results	13
Table 4.1: HVAC Units 1 - 4 to Empire Court (East) (Distance 15 m, Q=4)	15
Table 4.4: HVAC Units 3 - 5 to Empire Court (North East) (Distance 27 m, Q=4)	16
Table 4.5: Assessment of Noise from HVAC Units	16

Figures

Figure 3.1: Location of the background sound level survey	9
Figure 3.2: Photo of Background sound level survey – Empire Court (North East)	10
Figure 3.3: Background Sound Level Chart – $L_{A90,15 \text{ min}}$	11
Figure 3.4: $L_{A90,1 \text{ hr}}$ Sound Statistical Distribution – Opening Hours (07:00 – 23:00 hrs)	12
Figure 3.5: $L_{A90,1 \text{ hr}}$ Sound Statistical Distribution – Opening Hours (08:00 – 18:00 hrs)	12
Figure 4.1: HVAC Location Plan	14

1 Introduction

Goodhand Acoustics Ltd has been commissioned by AB and V Limited to undertake a noise assessment to accompany a planning application to operate a heating, ventilation and air-conditioning system (HVAC) at Magnolia House Dental Practice, 27 East Street, Havant, Hampshire (APP/24/00743), which involve 4 external condenser units to be installed at the rear of the building.

The local authority's Environmental Health Officer raised concerns that two of the wall-hung units were 7 to 10 m from the nearest residential windows and the other three units were 25 m from other residential receptors. Initially, the officer recommended that planning permission be refused due to a lack of information but also suggested that a condition could be imposed if permission were granted. Since then, a decision has been made, partially on noise grounds, to remove the two wall hung units and install 4 units in total at the rear of the property on the wall facing the car park. An initial noise report was submitted in December 2024 and then revised to address comments from the local authority's pollution team.

This report summarises the results of the desktop assessment undertaken, including attended baseline monitoring, with reference to the Chartered Institute of Environmental Health and Institute of Acoustics Heath Pumps Professional Advice Note (1) and BS 4142 (2).

This report was prepared by Daniel Goodhand. With over 20 years of experience in noise and vibration management, Mr. Goodhand advises on projects across the UK, ranging from commercial and residential developments to major infrastructure. Goodhand Acoustics is a member of the Association of Noise Consultants. Mr Goodhand also serves as a director and trustee of the Institute of Acoustics.

2 Planning Condition

2.1 Havant Borough Local Plan (Core Strategy) 2011

The Local Plan (3) sets out the Havant Borough Council's (HBC) strategy and policies that are used to set out a strategy for the area and determine applications for planning permission. Policy DM10 addresses noise.

DM10 Pollution

Development that may cause pollution of water, air or soil or pollution through noise, smell, smoke, fumes, gases, steam, dust, vibration, light, heat, electromagnetic radiation and other pollutants will only be permitted where all of the following relevant criteria can be met:

1. The health and safety of existing and future users of the site, or nearby occupiers and residents is not put at risk.

[...]

2.2 National Planning Policy Framework

The Local Plan has been developed to be consistent with the National Planning Policy Framework (NPPF) (4). The NPPF is also supported by Noise Policy Statement for England (NPSE) as well as online guidance (5). Whilst the Local Plan and the NPPF set out objectives, they do not prescribe specific numerical acoustic standards or approach to addressing noise.

2.3 Environmental Health Advice

The following advice was given by the environmental health officer on 15 October 2024:

Observations / Comments:

I refer to the above application under the Town & Country Planning Acts passed to this Service for comment.

I have some concern with respect to the potential for noise issues associated with the new air conditioning units proposed to be installed at the above premises. The nearest neighbouring residential windows are approximately 7 to 10 metres from the two wall hung units. Other residential receptors are within 25 metres of the other 3 units intended to be installed elsewhere on the property.

I would recommend refusal of this application at this time, as insufficient information has been provided about the proposed air conditioning / condensing units, for this office to make an informed decision as to the potential for noise nuisance.

If you were minded to consent, I would ask that the following condition be attached to any consent granted:

Condition 1:

The applicant shall provide an acoustic assessment to show that the rating level of any air conditioning plant will be at least 5 dB below the existing background levels, which must be submitted to and approved in writing by the Local Planning Authority. The assessment must be carried out by a suitably qualified acoustic consultant / engineer and be in accordance with BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.

Background levels shall be established at nearest residential receptors.

Reason: In order to safeguard the amenities of adjoining residential occupiers and having due regard to policy DM10 of the Havant Borough Local Plan (Core Strategy) 2011 and the National Planning Policy Framework.

Bearing in mind the type of commercial business that will likely be operating from this site, it would also be helpful if some indications were given as to the proposed times of usage of the airconditioning units e.g. 08:00 to 17:00 Monday to Friday and 08:00 to 13:00 on a Saturday, which would indicate that the units would probably not be in use overnight.

The Environmental Health Officer was consulted as part of this assessment on 12 November 2024. It was confirmed that there was less concern now the 2 of the units had been moved from the wall to the rear of the property but that there was still a risk of cumulative noise effects. The methodology of this report was agreed. The email summary of the consultation in Appendix A.

An initial noise report was submitted (dated 20 December 2024) and lead Environmental Health Officer made 5 comments. The environmental health officer was consulted and this report has been revised to address those comments.

3 Sound Level Survey Details

3.1 Equipment and Location

Sound levels were measured using NTi Audio XL2-TA precision integrating Class 1 sound level meters.

Table 3.1 summarises details of the equipment used, and calibration certificates are included in Appendix B.

Table 3.1: Equipment details

Sound Level Meter	NTi Audio XL2-TA			
Microphone	NTi Audio M2230			
Serial Numbers	Meter	A2A-15954-E0	Microphone	3066
Date Calibrated	04/07/2023			
Field Calibrator	Larson Davis CAL200			
Serial Number	10032			
Date Calibrated	01 March 2024			
Sound Level Meter Field Calibration Check	All calibration checks were within acceptable drift of the reference level.			

A background sound level survey was mounted on a tripod to the rear of Magnolia House Dental Practice at a height of 4.25 m. The measurement location was at the freefield. The survey was unattended for over 25.5 hours from 13:31 hrs on 27 February 2025 until 17:04 hrs on Thursday 28 February 2025. The location of the survey is shown in Figure 3.1 and Figure 3.2 below.



Figure 3.1: Location of the background sound level survey



Figure 3.2: Photo of background sound level survey – Empire Court (north east)

3.2 Sound Level Results

The measurement was primarily to establish background sound levels for the BS 4142 assessment of the HVAC units. Background sound level refers to the L_{A90} metric. This typically the sound level that exists in the absence of noise events such as car movements or aircraft. A graph of the background sound levels is shown in Figure 3.3, Figure 3.4, and Figure 3.5 show the distribution of L_{A90} measurements. In this instance was considered to use the lowest representative value as the representative background sound level highlighted in orange in Figure 3.4 and Figure 3.5. Analysing the background sound level in this manner is detailed the methodology contained in BS 4142 (2) and the ANC Technical Note (6).

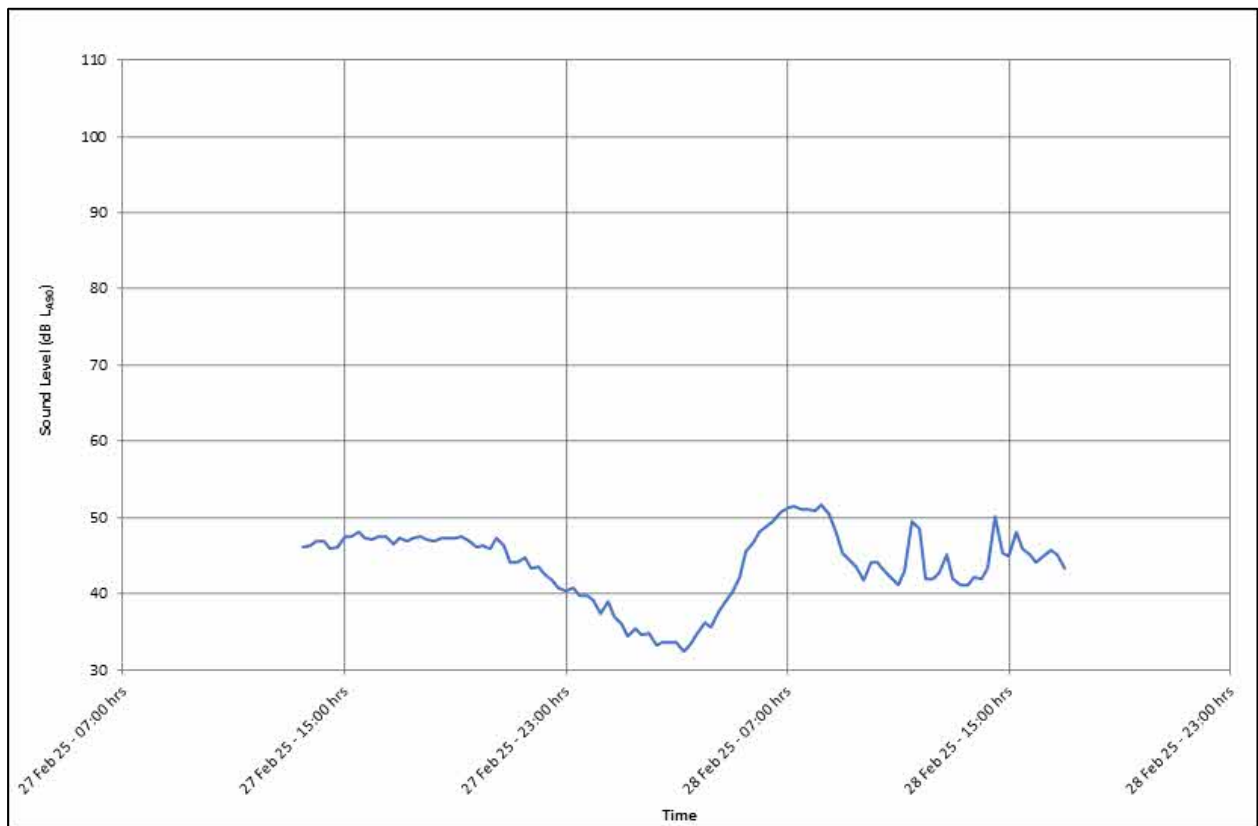


Figure 3.3: Background sound level chart – $L_{A90,15 \text{ min}}$

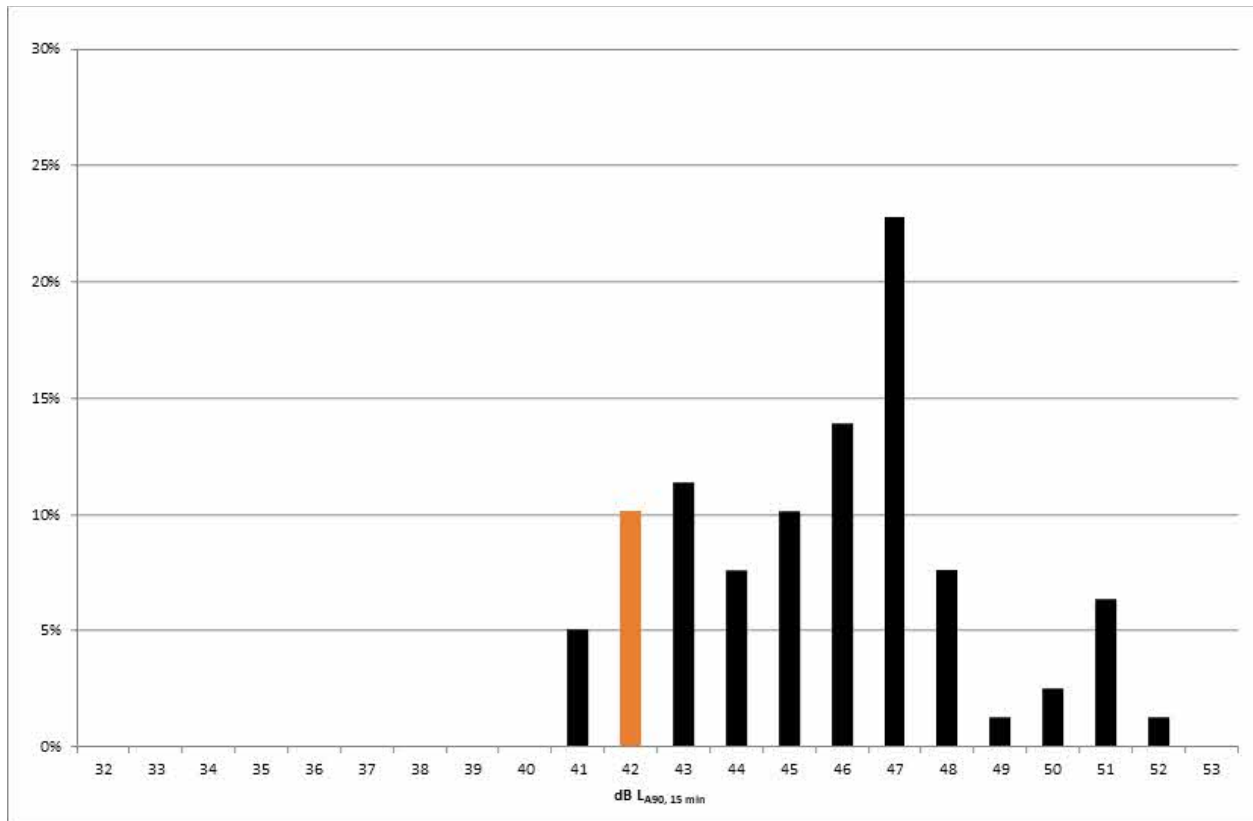


Figure 3.4: L_{A90.1hr} Sound level statistical distribution – opening hours (07:00 – 23:00 hrs)

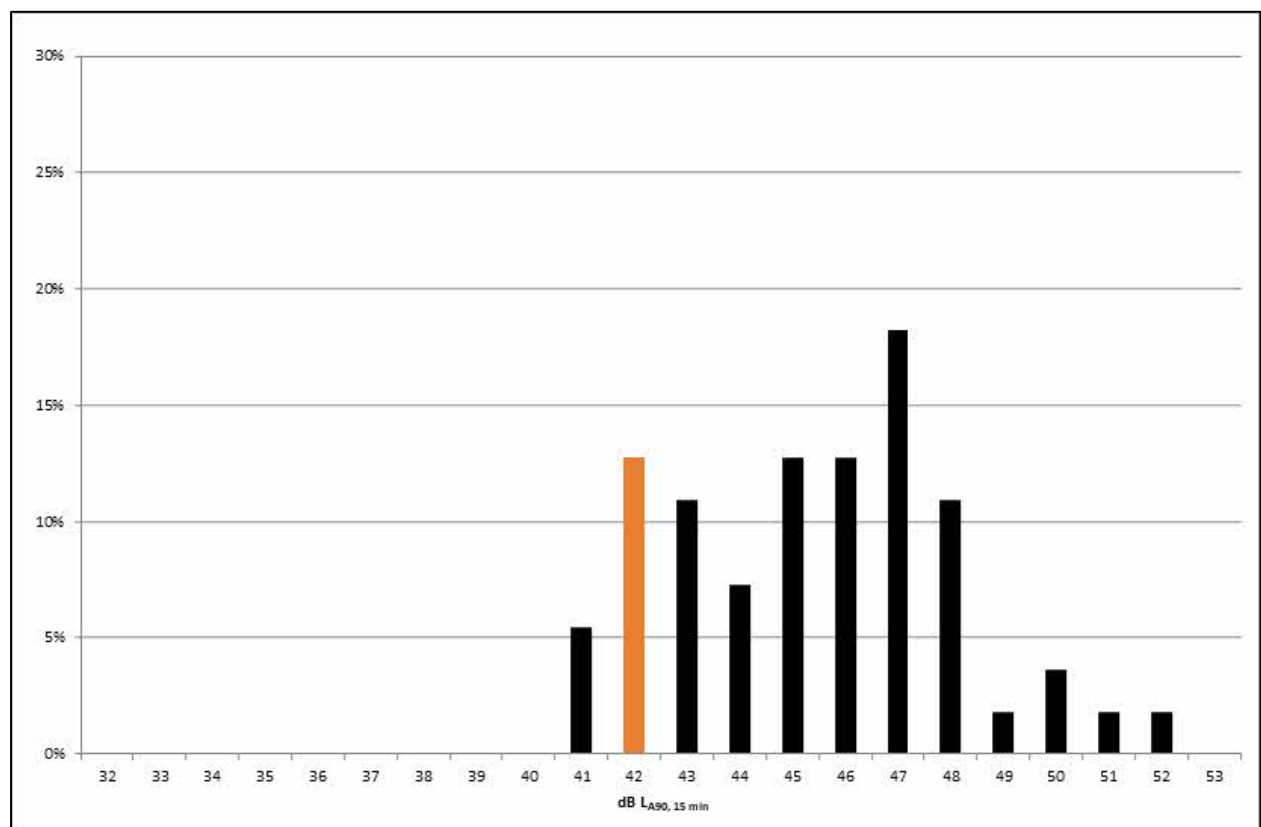


Figure 3.5: L_{A90.1hr} Sound level statistical distribution – opening hours (08:00 – 18:00 hrs)

Table 3.2: Background sound level survey results

Period	Times	Mode $L_{A90,15 \text{ min}}$ (dB)	Median $L_{A90,15 \text{ min}}$ (dB)	Mean $L_{A90,15 \text{ min}}$ (dB)	Lowest Representative Background Sound Level L_{A90} (dB)
Day	07:00 – 23:00 hrs	47	46	46	42
Opening Hours	08:00 – 18:00 hrs	47	46	45	42

4 Noise Calculation and Assessment

4.1 Proposed Development

It is proposed to install 4no Mitsubishi FDC121KXZEN1 heating, ventilation and air-conditioning units (HVAC). The units will be operated from 08:00 hrs to 18:00 hrs and will be controlled by a timer so that they cannot accidentally be left on overnight. Nevertheless, Table 3.2 shows that the representative background sound level is the same between 07:00 hrs to 23:00 hrs. Therefore, the units can be run during these extended hours without a difference in the noise impact assessment.

The location of the units and their respective distance to the closest receptors are shown in Figure 4.1 below. Specification excerpts can be found in Appendix C.



Figure 4.1: HVAC location plan

4.2 Noise Predictions

The sound power level used for predictions was sourced from the Mitsubishi technical manuals, which do not indicate any tonal or impulsive elements in the sound. Therefore, no acoustic feature corrections have been applied in the BS 4142 assessment. Additionally, guarantees will be sought from the supplier

to ensure that the installed units do not exhibit tonal or impulsive characteristics and will be maintained accordingly throughout their operational lifespan. While no tonal corrections are applied in this assessment, if tonal or impulsive characteristics are identified post-installation, mitigation measures will be considered to ensure compliance with BS 4142 criteria.

Noise modelling was conducted using distance and barrier attenuation calculations in a spreadsheet, following the method of calculation provided in ISO 9613-2 (7). For the purposes of this assessment, the two receptors considered to be the worst affected by noise impact were identified as:

Empire Court (north east) – located approximately 25 m from the HVAC units

Empire Court (east) – located approximately 15 m from the HVAC units

The residential receptors to the east do not have direct line of sight to the units because of the walls that the units will be mounted on face away from these receptors. A simplified barrier attenuation of 10 dB has been assumed in line with guidance from BS 5228-1:2009+A1:2014 (Annex F, section F.2.2.2.1(c), Figure F.3) (8), which states that when a noise source is completely obscured by a barrier, an attenuation of approximately 10 dB can be expected. While ISO 9613-2:2024 provides a method for calculating barrier attenuation, it does not prescribe fixed values. However, in practice, a 10 dB reduction is commonly assumed for full line-of-sight obstructions, making this a reasonable and conservative estimate for planning purposes. Given that the HVAC units will be located on the rear wall of the building, with the nearest receptor positioned such that this wall fully blocks direct sound paths, the 10 dB attenuation assumption provides a reasonable and conservative estimate for planning purposes without the need for a more detailed barrier analysis.

For ease of modelling, the sound pressure levels were accumulated into a single value and modelled as a point source. The total sound level from all units is then assessed in the Section 4.3.

Table 4.1 shows the predicted noise levels from the HVAC, calculated at Empire Court (east).

Table 4.1: HVAC units sound level at Empire Court (East) (distance 15 m, Q=4)

	L _{Aeq} (dB)
SPL at 1 m	56
Number of units correction	+6
Reflection at source correction	+6
Distance correction 1 m to 15 m	-24
Barrier attenuation	-10
SPL at receptor	35

Table 4.2 shows the predictions of noise from the HVAC at the nearest habitable windows of Empire Court (north east). Unlike Empire Court (East), the receptors at Empire Court (North) have a direct line

of sight to the HVAC units. Therefore, no barrier attenuation has been applied, ensuring a conservative prediction.

Table 4.2: HVAC units sound level at Empire Court (North) (distance 27 m, Q=4)

	L _{Aeq} (dB)
SPL at 1 m	56
Number of units correction	+6
Reflection at source correction	+6
Distance correction 1 m to 15 m	-29
Barrier attenuation	-
SPL at receptor	39

4.3 BS 4142 Assessment

Table 4.3 show a BS 4142 assessment using the predictions summarised in Section 4.2.

Table 4.3: Assessment of noise from HVAC units

Parameter	Empire Court (East)	Empire Court (North East)	Commentary
Specific noise level at assessment location (total from all units)	35 dB	39 dB	From Section 4.2
Acoustic feature correction	+0		No acoustic feature correction.
Rating level	L _{Ar,hr} = 35 dB	L _{Ar,hr} = 39 dB	
Background sound level	L _{A90,1hr} = 42 dB		Measured at a position representative of the nearest receptor. See Figure 3.5 and Table 3.2.
Excess of rating over background sound level	(35 – 42) dB = -7 dB	(39 – 42) dB = -3 dB	
After taking context into account, assessment indicates that the noise levels measured are not likely to be an adverse impact	The HVAC units operate during normal working hours and so would not have an impact on sleep or relaxation in the evening hours. Additionally, the noise is not expected to be particularly noticeable.		

The BS 4142:2014+A1:2019 assessment concludes that there is a low probability of a significant impact at Empire Court, with predicted rating levels remaining below background levels. The site is located within a mixed-use area containing commercial units, where low-level noise from HVAC systems is typically expected. Given that the units will operate only during daytime hours and are positioned at the rear of the building, the noise is unlikely to be intrusive or distinctive. Additionally, the absence of tonal or impulsive characteristics reduces the likelihood of perceptibility at the receptor locations. Therefore, when considering the context, the assessment indicates a low risk of adverse impact and aligns with the recommended condition advised by the Environmental Health Officer.

5 Uncertainty

This chapter discusses the uncertainty associated with noise predictions undertaken for this report, based on calculations using ISO 9613 and BS 4142. A short background sound level survey was conducted on-site; however, the prediction process relied on manufacturer-provided data and conservative assumptions where necessary.

5.1 Sources of Data

Acoustic performance data for the HVAC were provided directly by the manufacturer. These data are assumed to be measured under controlled laboratory conditions, which may differ from real-world performance due to environmental and operational factors. Ultimately, the units will not be running a full power continuously and it is expected that the sound levels are likely to be lower on average.

5.2 Prediction Methodology

ISO 9613 – Outdoor Propagation

Noise propagation was predicted using ISO 9613-2, which provides a general method for calculating sound pressure levels in the far field. Key assumptions include:

Atmospheric conditions are favourable for sound propagation, including a mild temperature inversion or a following wind.

Ground attenuation was considered negligible.

Barrier attenuation for the east receptors was assumed to be 10 dB, a conservative estimate based on accepted methods outlined in BS 5228-1:2009+A1:2014

The sound sources were assumed to be a point source.

These assumptions are mostly considered appropriate and represent a conservative approach to ensure predictions err on the side of caution.

5.3 Measurement Uncertainty

Uncertainty introduced during measurement can be due to the following factors:

barrier effects and reflections due to the placement of the sound level meter;

variations in the sound environment; and

inaccuracies introduced by the sound level meter.

Barriers and Reflections

The effects of barriers and reflections were minimised by careful placement of the sound level meter. The sound level meter was positioned in freefield conditions. The location was chosen as representative of the nearest noise sensitive receptors.

Sound Environment

The sound level survey was undertaken in typical daytime conditions and nothing unusual was noted during the monitoring period. A 2-hour attended survey was considered appropriate due to the relatively low risk of where the external HVAC condenser units are now located.

Sound Level Meter

The sound level meters are Class One and laboratory calibrated every two years. Additionally, a field calibration check was made of the sound level meter before and after the sound level survey and no significant drift was measured. Therefore, it is considered that the equipment did not introduce a significant amount of uncertainty.

5.4 Mitigation of Uncertainty

To manage uncertainty, conservative assumptions were deliberately used throughout the prediction process. This ensures that the noise levels presented represent a worst-case scenario, providing a safety margin for compliance with applicable standards and guidelines.

6 Summary and Conclusion

Goodhand Acoustics Ltd has been commissioned by AB and V Limited to undertake a noise assessment to accompany a planning application to operate a heating, ventilation and air-conditioning system (HVAC) at Magnolia House Dental Practice 27 East Street, Havant, Hampshire (APP/24/00743), which involve 4 external condenser units to be installed at the rear of the building.

The local authority's Environmental Health Officer raised concerns that two of the wall-hung units were 7 to 10 m from the nearest residential windows and the other three units were 25 m from other residential receptors. Initially, the officer recommended that planning permission be refused due to a lack of information but also suggested that a condition could be imposed if permission were granted. Since then, a decision has been made, partially on noise grounds, to remove the two wall hung units and install 4 units in total at the rear of the property on the wall facing the car park. An initial noise report was submitted in December 2024 and then revised to address comments from the local authority's pollution team.

This report summarises the results of the desktop assessment undertaken, including attended baseline monitoring, with reference to the Chartered Institute of Environmental Health and Institute of Acoustics Heath Pumps Professional Advice Note (1) and BS 4142 (2).

The assessment shows that the HVAC should not result in a significant impact for the worst affected properties. On that basis, the planning permission should not be refused on grounds of noise.

Appendix A – Email with Environmental Health Officer

19/12/2024, 14:22

Goodhand Acoustics Mail - RE: Magnolia House, 27 East Street - APP/24/00743

**RE: Magnolia House, 27 East Street - APP/24/00743**

1 message

13 November 2024 at 10:25

Good day Daniel

I think we managed to cover all the aspects once I was aware that all 5 of the units are now to be grouped together at the rear of the property. As stated the nearest residential receptors to the north are approximately 25 m NE from the N façade of the outbuilding at 27 & approx. 15 m to the E but in the shadow of the AC positions (both the above being part of Empire Court). To the NW at rear of 21 East St, residential flats which form part of Elmore Court are approx. 19 m from the AC point. Directly to the rear of 27 is a Council car park and to the W of that is the Bear Hotel Car park.

Should you need to query anything else in relation not application, please feel free to call me.

Regards

Mark Moss

Regulatory Officer

Environmental Health Pollution team

Havant Borough Council

Direct Tel: 02392 – 446666

E-mail: mark.moss@havant.gov.ukwww.havant.gov.ukwww.facebook.com/havantboroughcouncilwww.twitter.com/havantboroughYour privacy matters, go to www.havant.gov.uk/privacy-policy

Information in this message is confidential and may be privileged. It is intended solely for the person to whom it is addressed. If you are not the intended recipient please notify the sender and delete the message from your system immediately.

From: [REDACTED]
Sent: Tuesday, November 12, 2024 4:30 PM<https://mail.google.com/mail/u/0/?ik=e9cf3207cc&view=pt&search=all&permthid=thread-a:r1677873918033682274%7Cmsg-f:1815602585063348...> 1/2

19/12/2024, 14:22

Goodhand Acoustics Mail - RE: Magnolia House, 27 East Street - APP/24/00743

To: Moss, Mark [REDACTED]
Subject: Magnolia House, 27 East Street - APP/24/00743

CAUTION: This email came from outside of the council - only open links and attachments that you're expecting.

Dear Mark,

Thank you for taking the time to discuss the Magnolia House project with me a moment ago. I wanted to summarise our conversation to ensure we have a shared understanding moving forward.

During our call, we discussed the location of the air conditioning units. I mentioned that, in the latest draft drawings, the two units initially proposed to be attached to the rear façade of the main building are now planned to be moved to ground floor level at the request of the conservation officer. I also confirmed that these units would be operating during daytime hours only. Upon learning this, I noted that you felt less concerned about noise impact than you initially were, given the original proposal's proximity to neighbouring properties (approximately 7 m from the two units). Nevertheless, you highlighted the risk of a cumulative impact given that there were 5 units potentially running in parallel.

You mentioned that the main noise source in the area is road traffic from East Street, with some additional noise contributed by the car park at the rear.

We agreed that, for this project, we will conduct attended daytime monitoring to establish background sound levels at the rear over a period of approximately one to two hours. The baseline survey will be carried out during the day outside of rush hour to obtain representative measurements.

Please let me know if there's anything I missed or if any other concerns come to mind. I appreciate your insights on this project.

Regards

Daniel Goodhand
Goodhand Acoustics
01273 915910

daniel@goodhandacoustics.co.uk

www.goodhandacoustics.co.uk



<https://mail.google.com/mail/u/0/?ik=e9cf3207cc&view=pt&search=all&permthid=thread-a:r1677873918033682274%7Cmsg-f:1815602585063348...> 2/2

Appendix B – Calibration Certificates



Manufacturer Calibration Certificate

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3. All tests are traceable in accordance with ISO/IEC 17025.

This model of sound level meter submitted for periodic testing successfully completed the applicable pattern-evaluation tests given in IEC 61672-2. The pattern approval certificate is available at www.nti-audio.com/XL2.

Sound Level Meter

Manufacturer	NTi Audio		
Type	XL2-TA	S/N	A2A-15471-E0
Firmware	V4.21		
Microphone Model	M2230		
Preamplifier	MA220	S/N	7937
Microphone Capsule	MC230A	S/N	A16225
Performance class	Class 1		
Customer Inventory Nr.			

Customer

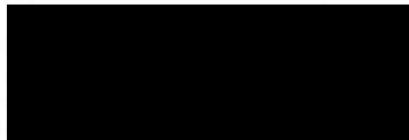
Goodhand Acoustics
4 Saint Augustines Apartments
1A Florence Road
Brighton
East Sussex

Date 28 June 2023

Certificate UK-23-072

Results **PASSED**
(for detailed report see next pages)

Operator



NTi Audio UK Ltd • Office 33C Julians Road • Stevenage
Hertfordshire, SG1 3ES, UK • uk@nti-audio.com



Certificate: UK-23-072

Measurement equipment

Test System

Model	NTi Audio FX100, S/No. 11095
Last Calibration	25 October 2022
Cal Certificate	FX100 Cal #7000
Next Calibration	25 October 2023

Reference Microphone

Model	M2230 S/N #9565, Mic Capsule MC230A S/No. #A19844
Last Calibration	22 October 2021
Cal Certificate	44491-9565-M2230
Next Calibration	22 October 2022

Sound Calibrator

Model	Norsonic 1255 S/No. #125525354
Reference Level	114.21 dB
Calibration Frequency	1000 Hz
Last Calibration	04 March 2022
Cal Certificate	#40365
Next Calibration	03 March 2024

Environmental conditions

Temperature	24.4 °C
Humidity	49 %
Pressure	1006 hPa

Notes

- This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the international Systems of Units (SI).
- The user is obliged to have the object recalibrated at appropriate intervals.
- This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.
- All limits listed in this report are acceptance limits in accordance with IEC61672.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the regulations of the GUM.



Certificate: UK-23-072

1. Indication at the calibration check frequency

The indication of the sound level meter at the calibration check frequency is checked by application of the sound calibrator and adjusted, if necessary, to indicate the required sound level for the environmental conditions under which the tests are performed. All levels in [dB].

Sensitivity before calibration	Sensitivity after calibration	Meas level	Limit -	Limit +	Uncert.	Status
37.0 mV/Pa	37.0 mV/Pa	114	113.21	115.21	0.2	Passed

2. Self-generated noise

2.1 Microphone cartridge installed

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level with frequency-weighting A and an averaging time of 30 seconds. All levels in [dB].

Weight- ing	Meas level	Limit +	Uncert.	Status
A	17.4	18.0	0.1	Passed

2.2 Microphone cartridge replaced by the capsule replacement NTI-K65-15

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level for all frequency-weightings and an averaging time of 30 seconds. All levels in [dB] referenced to $S = 42$ mV/Pa.

Weight- ing	Meas level	Limit +	Uncert.	Status
A	9.9	13.0	0.1	Passed
C	12.9	16.0	0.1	Passed
Z	19.3	24.0	0.1	Passed

3. Acoustic signal tests of a frequency weighting

The frequency weighting is tested for frequency-weighting A, using an acoustic test facility. The sound level meter is set to a fast time-weighted sound level in the reference level range. All levels in [dB].

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
125	69.8	69.8	0.0	-1.0	1.0	0.4	Passed
250	77.4	77.3	-0.1	-1.0	1.0	0.4	Passed
500	82.7	82.3	-0.4	-1.0	1.0	0.4	Passed
1000	86.0	85.9	-0.1	-0.7	0.7	0.4	Passed
2000	87.2	87.2	0.0	-1.0	1.0	0.4	Passed
4000	87.0	87.3	0.3	-1.0	1.0	0.4	Passed
8000	84.9	85.7	0.8	-2.5	1.5	0.4	Passed

3 / 8



Certificate: UK-23-072

4. Electric signal tests of frequency weightings

Frequency weightings are determined relative to the response at 1 kHz using steady sinusoidal electrical input signals. The sound level meter is set to display F-time-weighted sound level in the reference level range. All available frequency weightings provided in the sound level meter are verified. All levels in [dB].

4.1 A-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.1	0.1	-0.7	0.7	0.1	Passed
63	106.2	79.9	-0.1	-1.0	1.0	0.1	Passed
125	96.1	79.9	-0.1	-1.0	1.0	0.1	Passed
250	88.6	80.0	0.0	-1.0	1.0	0.1	Passed
500	83.2	80.0	0.0	-1.0	1.0	0.1	Passed
2000	78.8	80.0	0.0	-1.0	1.0	0.1	Passed
4000	79.0	80.0	0.0	-1.0	1.0	0.1	Passed
8000	81.1	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	84.3	79.8	-0.2	-2.5	1.5	0.1	Passed
16000	86.6	79.7	-0.3	-2.5	1.5	0.1	Passed

4.2 C-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.8	80.0	0.0	-1.0	1.0	0.1	Passed
125	80.2	80.0	0.0	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.1	0.1	-1.0	1.0	0.1	Passed
2000	80.2	80.1	0.1	-1.0	1.0	0.1	Passed
4000	80.8	80.0	0.0	-1.0	1.0	0.1	Passed
8000	83.0	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	86.2	79.8	-0.2	-2.5	1.5	0.1	Passed
16000	88.5	79.7	-0.3	-2.5	1.5	0.1	Passed

4.3 Z-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
125	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
2000	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
4000	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
8000	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed
16000	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed



Certificate: UK-23-072

5. Frequency and time weightings at 1kHz

While injecting a constant steady signal at the reference frequency of 1 kHz the F-time-weighted sound level, S-time-weighted sound level and time-averaged sound level are verified with frequency weighting A. Additionally the F-time-weighted sound level for frequency weightings C and Z is measured. The first measurement serves as reference and differences in the reading with respect to this first one are determined. All levels in [dB].

Level	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LAS	114.0	113.8	-0.2	-0.7	0.7	0.1	Passed
LAeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed



6. Level linearity on the reference level range

The level linearity on the reference level range is determined by applying steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A and fast time-weighting. All levels in [dB].

Exp abs level	Meas. level	Abs dev	Abs Limit -	Abs Limit +	Exp rel level	Rel dev	Rel Limit -	Rel Limit +	Uncert.	Status
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
119.0	119.0	0.0	-0.8	0.8	119.0	0.0	-0.3	0.3	0.1	Passed
124.0	124.0	0.0	-0.8	0.8	124.0	0.0	-0.3	0.3	0.1	Passed
125.0	125.0	0.0	-0.8	0.8	125.0	0.0	-0.3	0.3	0.1	Passed
126.0	126.0	0.0	-0.8	0.8	126.0	0.0	-0.3	0.3	0.1	Passed
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
109.0	109.0	0.0	-0.8	0.8	109.0	0.0	-0.3	0.3	0.1	Passed
104.0	104.0	0.0	-0.8	0.8	104.0	0.0	-0.3	0.3	0.1	Passed
99.0	99.0	0.0	-0.8	0.8	99.0	0.0	-0.3	0.3	0.1	Passed
94.0	94.0	0.0	-0.8	0.8	94.0	0.0	-0.3	0.3	0.1	Passed
89.0	89.0	0.0	-0.8	0.8	89.0	0.0	-0.3	0.3	0.1	Passed
84.0	84.0	0.0	-0.8	0.8	84.0	0.0	-0.3	0.3	0.1	Passed
79.0	79.0	0.0	-0.8	0.8	79.0	0.0	-0.3	0.3	0.1	Passed
74.0	74.0	0.0	-0.8	0.8	74.0	0.0	-0.3	0.3	0.1	Passed
69.0	69.0	0.0	-0.8	0.8	69.0	0.0	-0.3	0.3	0.1	Passed
64.0	64.0	0.0	-0.8	0.8	64.0	0.0	-0.3	0.3	0.1	Passed
59.0	59.0	0.0	-0.8	0.8	59.0	0.0	-0.3	0.3	0.1	Passed
54.0	54.0	0.0	-0.8	0.8	54.0	0.0	-0.3	0.3	0.1	Passed
49.0	49.0	0.0	-0.8	0.8	49.0	0.0	-0.3	0.3	0.1	Passed
44.0	44.0	0.0	-0.8	0.8	44.0	0.0	-0.3	0.3	0.1	Passed
39.0	39.0	0.0	-0.8	0.8	39.0	0.0	-0.3	0.3	0.1	Passed
34.0	34.2	0.2	-0.8	0.8	34.0	0.2	-0.3	0.3	0.1	Passed
33.0	33.2	0.2	-0.8	0.8	33.2	0.0	-0.3	0.3	0.1	Passed
32.0	32.2	0.2	-0.8	0.8	32.2	0.0	-0.3	0.3	0.1	Passed
31.0	31.3	0.3	-0.8	0.8	31.2	0.1	-0.3	0.3	0.1	Passed



Certificate: UK-23-072

7. Level linearity including the level range control

The test is performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter set for frequency weighting A and fast time weighting. With the input signal level kept constant, the indicated signal level is recorded for all level ranges where the applied signal level is displayed. All levels in [dB].

Starting Range	Source level	Low Range		Mid Range		High Range		Uncert.	Status
		Dev	Limit +/-	Dev	Limit +/-	Dev	Limit +/-		
Low	94	0.0	0.40	0.0	0.15	0.0	0.15	0.1	Passed
Mid	114			0.0	0.40	0.0	0.15	0.1	Passed
High	134					0.0	0.40	0.1	Passed
Low	29	0.1	0.40					0.1	Passed
Mid	36			0.1	0.40			0.1	Passed
High	58					0.2	0.40	0.1	Passed

8. Toneburst response

The response of the sound level meter to short-duration signals is tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter is set for frequency weighting A. All levels in [dB].

The continuous signal level is 123 dB.

Burst signal	Burst duration [ms]	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	200	122.0	121.9	-0.1	-0.5	0.5	0.2	Passed
LAF	2	105.0	104.9	-0.1	-1.5	1.0	0.2	Passed
LAF	0.25	96.0	95.8	-0.2	-3.0	1.0	0.2	Passed
LAS	200	115.6	115.5	-0.1	-0.5	0.5	0.2	Passed
LAS	2	96.0	95.9	-0.1	-3.0	1.0	0.2	Passed
LAeq10s	200	106.0	105.9	-0.1	-0.5	0.5	0.2	Passed
LAeq10s	2	86.0	85.9	-0.1	-0.5	0.5	0.2	Passed
LAeq10s	0.25	77.0	76.8	-0.2	-0.5	0.5	0.2	Passed

7 / 8



Certificate: UK-23-072

9. C-weighted peak sound level

The sound level meter is tested on the least-sensitive level range with fast time weighting and C frequency weighting. The test signals are a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings. All levels in [dB].

Burst signal	Source level	Exp LCp-LCF	Meas LCp-LCF	Dev	Limit -	Limit +	Uncert.	Status
8kHz	114.0	3.4	2.2	-1.2	-2.0	2.0	0.2	Passed
500Hz +	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed
500Hz -	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed

10. Overload Indication

Overload indication is tested on the least-sensitive level range with the sound level meter set to A-weighted, time-averaged sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz are used. All levels in [dB].

Start level	OV +	OV -	Dev	Limit -	Limit +	Uncert.	Status
138.1	140.3	140.3	0.0	-1.5	1.5	0.3	Passed

CALIBRATION CERTIFICATE

Issued By AcSoft Limited Calibration Laboratory

Date Of Issue: 01-03-2024

Certificate No: [REDACTED]

Calibrated By: W. Jay

Approved By: W. Jay

AcSoft
Noise, Vibration & Air Quality

CUSTOMER

Goodhand Acoustics Ltd

INSTRUMENT DETAILS

Manufacturer: Larson Davis
Model: CAL200
Serial No.: 10032
Description: Acoustic Calibrator accuracy class 1 with nominal level of 94 dB and 114 dB, and nominal frequency of 1000 Hz

P/O NUMBER

N/A

DATE RECEIVED

29-02-2024

DATE CALIBRATED

01-03-2024

ENVIRONMENTAL CONDITIONS

Temperature: 21.4 °C
Humidity: 44.8 %rh
Pressure: 101.21 kPa

CALIBRATION RESULTS

The calibrator submitted for testing has successfully completed the Periodic tests of IEC 60942:2003 (BS EN 60942:2003) (Annex B), for class 1 sound calibrators, for the environmental conditions under which the tests were performed.

REPORTED RESULTS

The results contained in this Certificate refer only to the measurements made at the time of test for the instrument detailed above. These results do not reflect the instrument's ability to maintain calibration.

MEASUREMENT TRACEABILITY

The instrument under test was calibrated using the following equipment:
Svantek SV30A Acoustic Calibrator, ACS023, Certificate No. 06397/1
GRAS 40AG Reference Microphone, ACS009, Certificate No. 06448/2
LAB-EL LB-706B Thermo-Barometer, ACS029, Certificate No. 1148624

Page 1 of 2

This calibration was performed by AcSoft Ltd, 11 Abbey Court, Fraser Road,
Priory Business Park, Bedford, MK44 3WH
T: 01234 639550 W: www.acsoft.co.uk E: sales@acsoft.co.uk

(AP 04/01/2024 Issue No. 3)

CALIBRATION CERTIFICATE

Issued By AcSoft Limited Calibration Laboratory

Date Of Issue: 01-03-2024

Certificate No

AcSoft
Noise, Vibration & Air Quality

NOTES

1. The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.
2. The measurements in this document are traceable to GUM (Central Office of Measures), Poland
3. This calibration certificate shall not be reproduced except in full, without written permission from AcSoft Ltd.

CALIBRATION RESULTS ARE AS FOLLOWS:

SPL

	Measured Level	Deviation From Nominal	Uncertainty	Tolerance (dB)	
	dB	dB	dB	class 1	class 2
1	94.03	0.03	0.15	±0.25	±0.4
2	114.04	0.04			

Frequency

	Measured Frequency	Deviation From Nominal	Uncertainty	Tolerance (%)	
	Hz	Hz	Hz	class 1	class 2
1	1000.22	0.22	0.1	±0.7 (±7Hz)	±17 (±17Hz)
2	1000.22	0.22			

THD+N

	Measured Distortion	Uncertainty	Tolerance (%)	
	%	%	class 1	class 2
1	0.26	0.1	2.5	3.0
2	0.32			

Page 2 of 2

This calibration was performed by AcSoft Ltd, 11 Abbey Court, Fraser Road,
Priory Business Park, Bedford, MK44 3WH
T: 01234 639550 W: www.acsoft.co.uk E: sales@acsoft.co.uk

(AP 04/01/2024 Issue No. 3)

Appendix C – Specifications

Mitsubishi FDC121KXZEN1

Noise level

Measured based on JIS B 8616

Mike position as highest noise level in position as below

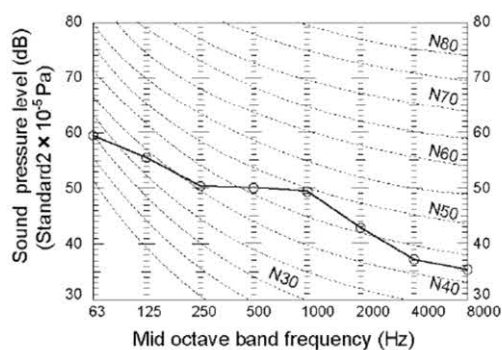
Distance from front side 1m

Height 1m

FDC121KXZEN1, 121KXZES1

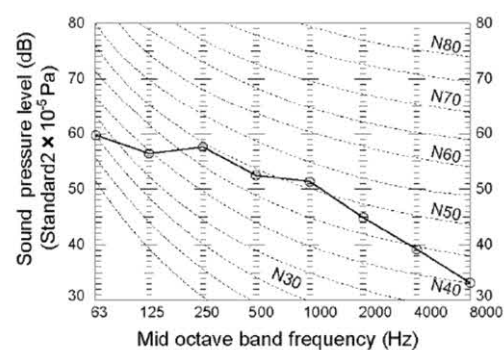
Cooling

Noise level 53 dB (A)



Heating

Noise level 56 dB (A)



References

1. Chartered Institute of Environmental Health and Institute of Acoustics. CIEH Website. [Online] November 2022. [Cited: 21 08 2024.] <https://www.cieh.org/media/7539/heat-pumps-briefing-note.pdf>.
2. British Standards Institution. BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound. s.l. : BSI Standards Limited, 2019. ISBN 978 0 539 02069 4.
3. Havant Borough Council. Havant Borough Core Strategy March 2011. 1 March 2011.
4. Ministry of Housing, Communities & Local Government. National Planning Policy Framework. London : Ministry of Housing, Communities & Local Government, 2023.
5. —. Guidance Noise. GOV.UK. [Online] 22 July 2019. [Cited: 01 10 2021.] <https://www.gov.uk/guidance/noise--2>.
6. Association of Noise Consultants. BS 4142:2014+A1:2019 Technical Note Version 1.0. March 2020.
7. British Standards Institution. BS ISO 9613 Acoustics - Attenuation of sound during propagation outdoors. Part 2: Engineering method for the prediction of sound pressure levels outdoors. 2024. BS ISO 9613-2:2024.
8. —. BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise. s.l. : BSI Standards Limited, 2014. ISBN 978 0 580 77749 3.