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9 Northington Street Camden London WC1N 2ES

Noise Impact Assessment Report
Report 27846.NIA.01 Rev.C

MHL Limited

Report 27846.NIA.01 Revision History			
First Issue Date: 12/02/2024			
A	22/02/2024 Revised to include details of the proposed ASHP installation.	D	
B	22/02/2024 Revised to include full plant assessment.	E	
C	01/03/2024 Revised following comments from the clients.	F	

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1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by MHL Limited, to assess the suitability of the site at 9 Northington Street, Camden, London, WC1N 2ES for a residential development with regards to a change of use development from Class B1 office spaces to residential apartments (C3).

This report presents the results of internal noise surveys undertaken in order to measure the current internal noise climate for compliance with current guidance, and presents the results of the external environmental surveys undertaken in order to measure the prevailing background noise levels.

2.0 SITE SURVEYS

2.1 Site Description

The site is bounded by Northington Street to the north, commercial and residential properties to the west, residential gardens to the south, and residential properties to the east. Entrance to the site is located to the north. At the time of the survey, the background noise climate was dominated by road traffic noise from surrounding roads.

Local commercial properties to the proposed site have been identified in Figure 2.1 below. To ensure the potential noise impact is considered, the measurement positions have been chosen to encapsulate the worst-case noise on the property.

Figure 2.1 Site location plan (Image Source: Google Maps)

2.2 Internal Noise Survey Procedure

Noise surveys were undertaken within internal areas of the building in order to assess worst-case levels with the current external building fabric configuration.

Continuous automated monitoring was undertaken for the duration of the survey between 12:15 on 19/01/2024 09:00 on 23/01/2024

Microphones installed internally were positioned within the diffuse field of the room, ensuring the microphone was at least 1.5m from any reflective surface. Noise measurement positions are detailed in Table 2.1 and shown in Figure 2.1.

2.3 Environmental Noise Survey Procedure

External noise surveys were undertaken on the proposed site as shown in Figure 2.1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources, including those from nearby commercial premises.

Continuous automated monitoring was undertaken for the duration of the survey between 12:15 on 19/01/2024 09:00 on 23/01/2024.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

Measurement positions are as described within Table 2.1 and shown within Figure 2.2.

Icon	Descriptor	Location Description
1	Noise Measurement Position 1	The microphone was installed on a window on the 1st floor of the north façade, as shown in Figure 2.2. The microphone was positioned within 1.5 metres from the nearest surface, and therefore a correction of 3dB has been considered.
2	Noise Measurement Position 2	The microphone was installed on a window on the 1st floor of the south façade, as shown in Figure 2.2. The microphone was positioned within 1.5 metres from the nearest surface, and therefore a correction of 3dB has been considered.
A	Internal Noise Measurement Position A	Located on the ground floor of the building within a room on the north façade. The microphone was installed on a tripod at a distance of 1.5m from the window on the external façade and 1.5m above ground floor.
B	Internal Noise Measurement Position B	Located on the 2nd floor of the building within a room on the south façade. The microphone was installed on a tripod at a distance of 1.5m from the window on the external façade and 1.5m above ground floor.

Table 2.1 Measurement positions and descriptions

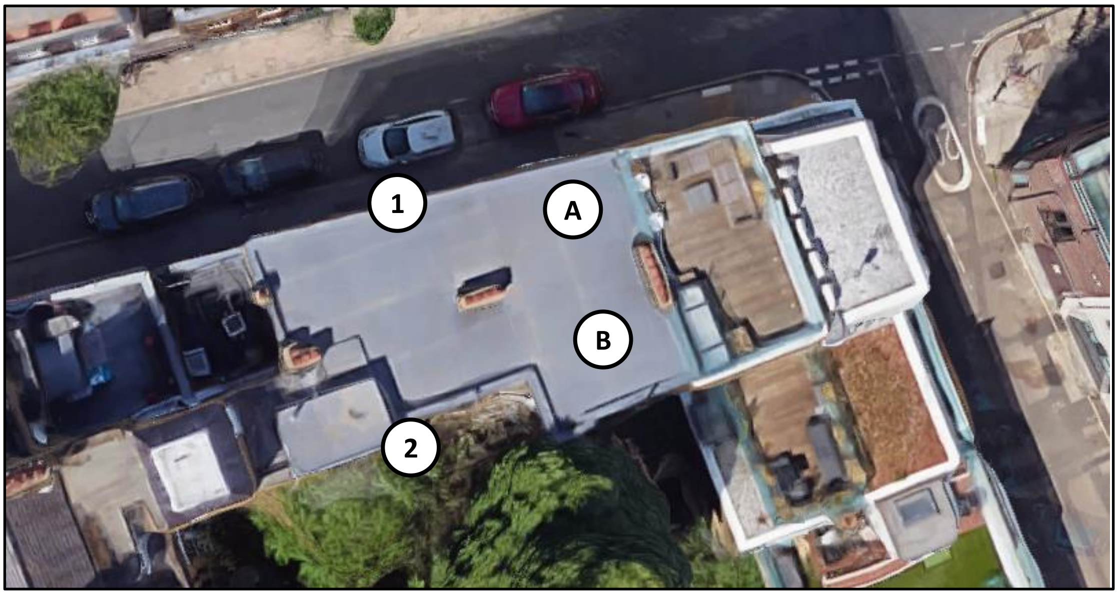

Figure 2.2 Site measurement positions (Image Source: Google Maps)

2.4 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 21	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21099-E0	21/07/2022	UK-22-064
	Free-field microphone NTI Acoustics MC230A	A23571		
	Preamp NTI Acoustics MA220	10996		
	NTI Audio External Weatherproof Shroud	-	-	-
Noise Kit 25	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21141-E0	21/07/2022	UK-22-069
	Free-field microphone NTI Acoustics MC230A	A23583		
	Preamp NTI Acoustics MA220	10992		
	NTI Audio External Weatherproof Shroud	-	-	-
Noise Kit 37	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21302-E0	12/09/2023	UK-23-103
	Free-field microphone NTI Acoustics MC230A	A23082		

Measurement instrumentation		Serial no.	Date	Cert no.
	Preamp NTI Acoustics MA220	13798		
	NTI Audio External Weatherproof Shroud	-	-	-
B&K Type 4231 Class 1 Calibrator		2147411	05/06/2023	UCRT23/1739

Table 2.2 Measurement instrumentation

3.0 RESULTS

3.1 Internal Noise Surveys

The $L_{Aeq: 5min}$ and $L_{Amax: 5min}$ acoustic parameters were measured throughout the duration of the internal noise surveys. Measured levels are shown as time histories in Figures 27846.TH1-2 for internal monitoring positions 1 and 2 respectively. Measured noise levels are representative of noise exposure levels expected to be experienced in all spaces on the all facades of the development, and are shown in Table 3.1.

Time Period	Measured Noise level – dBA	
	Internal Noise Measurement Position A	Internal Noise Measurement Position B
Daytime $L_{Aeq,16hour}$	33	31
Night-time $L_{Aeq,8hour}$	26	28

Table 3.1 Current internal average noise levels for daytime and night time

3.2 External Noise Surveys

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as time histories in Figures 27846.TH3-4. Measured noise levels are representative of noise exposure levels expected to be experienced by the all facades of the development, and are shown in Table 3.2.

Time Period	Measured Noise level – dBA	
	External Noise Measurement Position 1	External Noise Measurement Position 2
Daytime $L_{Aeq,16hour}$	58	50
Night-time $L_{Aeq,8hour}$	53	48

Table 3.2 Site average noise levels for daytime and night time

Please note that the measurement positions were located at a distance less than 1.5 metres from the nearest reflective surface and therefore a 3dB correction has been applied to the results in Table 3.2 to obtain a free-field measurement as per ISO1996 Part 2.

4.0 NOISE ASSESSMENT GUIDANCE

4.1 Noise Policy Statement for England 2024

The National Planning Policy Framework (NPPF) has superseded and replaces Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England. Paragraph 180 of NPPF 2024 states that planning policies and decisions should aim to:

- preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

In addition, Paragraph 191 of the NPPF states that '*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should'*:

- Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the aim to 'Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

Noise Policy Statement England (NPSE) noise policy aims are as follows:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life*

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

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

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason, and allow flexibility in the policy until further guidance is available.

4.2 BS8233:2014

BS8233:2014 *'Sound insulation and noise reduction for buildings'* describes recommended internal noise levels for residential spaces. These levels are shown in Table 4.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB(A)	-
Dining	Dining Room/area	40 dB(A)	-
Sleeping (daytime resting)	Bedrooms	35 dB(A)	30 dB(A)

Table 4.1 BS8233 recommended internal background noise levels

5.0 DISCUSSION

As shown in Table 3.1, internally measured noise levels commensurate with the design criteria of BS8233:2014. If the surrounding area were to remain unchanged, the existing external building fabric would be sufficient in controlling noise break-in from commercial sources and would provide a suitable residential environment.

6.0 PLANT NOISE ASSESSMENT

6.1 Proposed Plant Location

It is understood that an installation of Air Source Heat Pumps will be located on the site towards the west of the development, as shown in Figure 6.1 below.

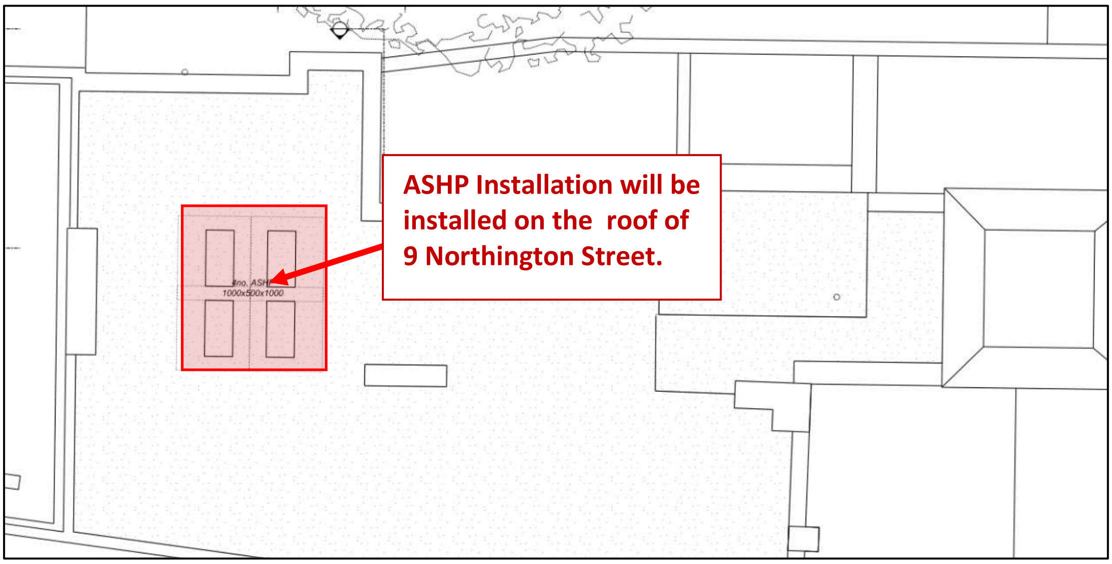

Figure 6.1 Identified area for the installation of air source heat pumps.

6.2 Closest Noise Sensitive Receivers

The closest noise sensitive receivers relative to the proposed plant installation location are described within Table 6.1 and shown within Figures 6.2 and 6.3.

Icon	Descriptor	Location Description
	Nearest noise sensitive receptors	**NSR 1** – 3rd Floor window, Front Façade, Residential window, 7 Northington Street. **NSR 2** – 3rd Floor window, Rear Façade, Residential window, 7 Northington Street.
	Proposed plant installation location	Proposed plant installations are outlined in Section 6.5

Table 6.1 Description of identified noise sensitive receivers and proposed plant installation

Figure 6.2 Noise sensitive receiver 1 and 9roposed plant installation location

Figure 6.3 Noise sensitive receiver 2 and proposed plant installation location

6.3 Local Authority Guidance

The guidance provided by The London Borough of Camden for noise emissions of new plant in this instance is as follows:

The noise criteria, as per the Local Plan 2017 of London Borough of Camden, British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' should be considered as the main reference document for the assessment. The resultant 'Rating Level' would be considered as follows:

Period	Assessment Location	Rating Level Acceptability Range		
		Green: noise is considered to be at an acceptable level	**Amber:** noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development	**Red:** noise is observed to have a significant adverse effect.
Daytime (7:00-23:00)	Garden used for main amenity (free field) and Outside living or dining or Bedroom window (façade)	10dB below background	9 dB below and 5dB above background	5dB above background
Night-time (23:00-7:00)	Outside bedroom window (façade)	10dB below background and no events exceeding 57dB L_{Amax}	9db below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	5dB above background and/or events exceeding 88dB L_{Amax}

Table 6.2 Camden noise criteria for plant and machinery

6.4 Noise Emissions Criterion

Noise measurement position 1, as referenced in Table 2.1, has been deemed representative to the noise levels expected at noise sensitive receiver 1 with noise measurement position 2 being deemed representative to the noise levels expected at noise sensitive receiver 2.

The $L_{A90:\ 5min}$ acoustic parameter was measured throughout the duration of the survey. Representative background noise levels are shown in table 6.3 for daytime and night-time.

Time Period	Representative background noise level L_{A90} dB(A)	
	External Noise Measurement Position 1	External Noise Measurement Position 2
Daytime (07:00-23:00)	55	45
Night-time (23:00-07:00)	51	43

Table 6.3 Representative background noise levels

As the plant units could be used anytime during the day or night, the criterion has been set as shown in Table 6.4 in order to comply with the requirements presented within section 6.1

Time Period	Representative background noise level L_{A90} dB(A)	
	External Noise Measurement Position 1	External Noise Measurement Position 2
Night-time (23:00-07:00)	41	33

Table 6.4 Proposed noise emissions criterion

6.5 Proposed Plant Installations

It is understood that the proposed plant installation is comprised of the following units:

- 4 No. Mitsubishi PUZ-WM112VAA Air Source Heat Pumps

The noise emission levels as provided by the manufacturer for the units are shown in Table 6.5.

Unit	Descriptor	Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Mitsubishi PUZ-WM112VAA	SPL@1m (dB)	55	56	47	48	42	40	34	26	49

Table 6.5 Plant Units Noise Emission Levels as provided by the manufacturer

It should be noted the proposed plant unit would be out of line of sight of the receiving windows due to screening from the building envelope.

6.6 Calculations

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest residential windows from the proposed plant unit installation would be as shown in Table 6.6. Detailed calculations are shown in Appendix B.

Receiver	Criterion	Noise Level at 1m From the Closest Noise Sensitive Window
NSR1 - 3rd Floor window, Front Façade, Residential window, 7 Northington Street.	41dB(A)	31dB(A)
NSR2 - 3rd Floor window, Front Façade, Residential window, 7 Northington Street.	33dB(A)	29dB(A)

Table 6.6 Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B and Table 6.6, transmission of noise to the nearest sensitive windows due to the effects of the ASHP unit installation satisfies the emissions criterion of the Camden council.

6.7 Anti-Vibration Mounting Strategy

In the case of all plant units, appropriate anti-vibration mounts should be installed in order to ensure that vibrations do not give rise to structure-borne noise. Appendix C outlines detailed advice in order to ensure that the system installer selects the appropriate anti-vibration mount for the installation.

It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail.

7.0 CONCLUSION

Internal noise surveys and environmental noise surveys have been undertaken at 9 Northington Street, Camden, London, WC1N 2ES allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

Noise levels measured internally demonstrate that the existing external building fabric would be sufficient in providing a suitable residential environment, and existing noise levels meet the design criteria of BS8233:2014.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

Manufacturer’s noise data of proposed plant units has been used to obtain Specific and Rated Noise Level at the nearest noise sensitive receiver in accordance with British Standard BS4142:2014 for compliance with the Camden council’s requirements.

The rating level was compared with the representative background noise level to assess the likelihood of impact considering the environmental noise context of the area as per the requirements of BS4142:2014.

It has been concluded that noise emissions from the proposed plant units would not have an adverse impact on the nearest residential receivers.

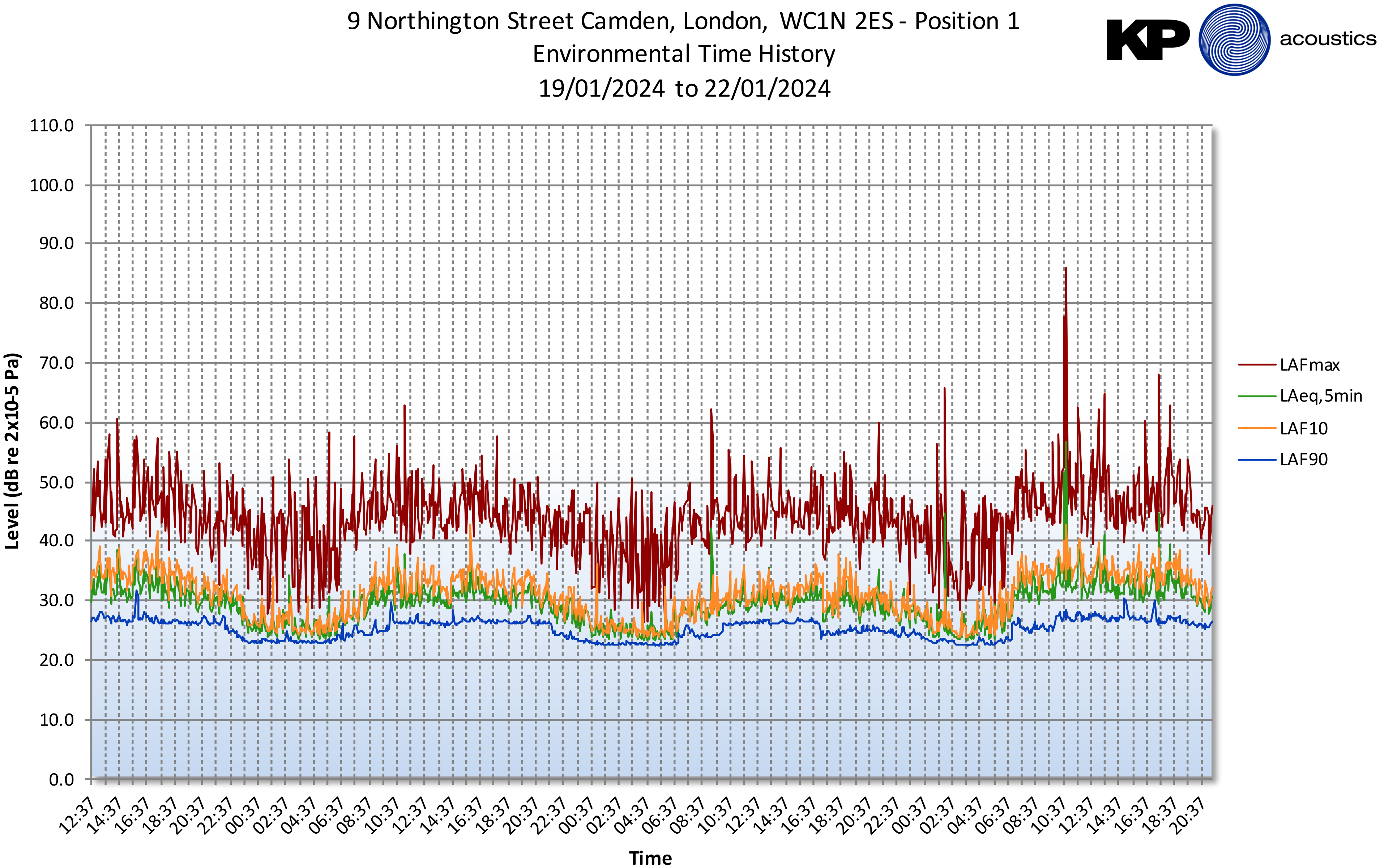

Figure 27846.TH1

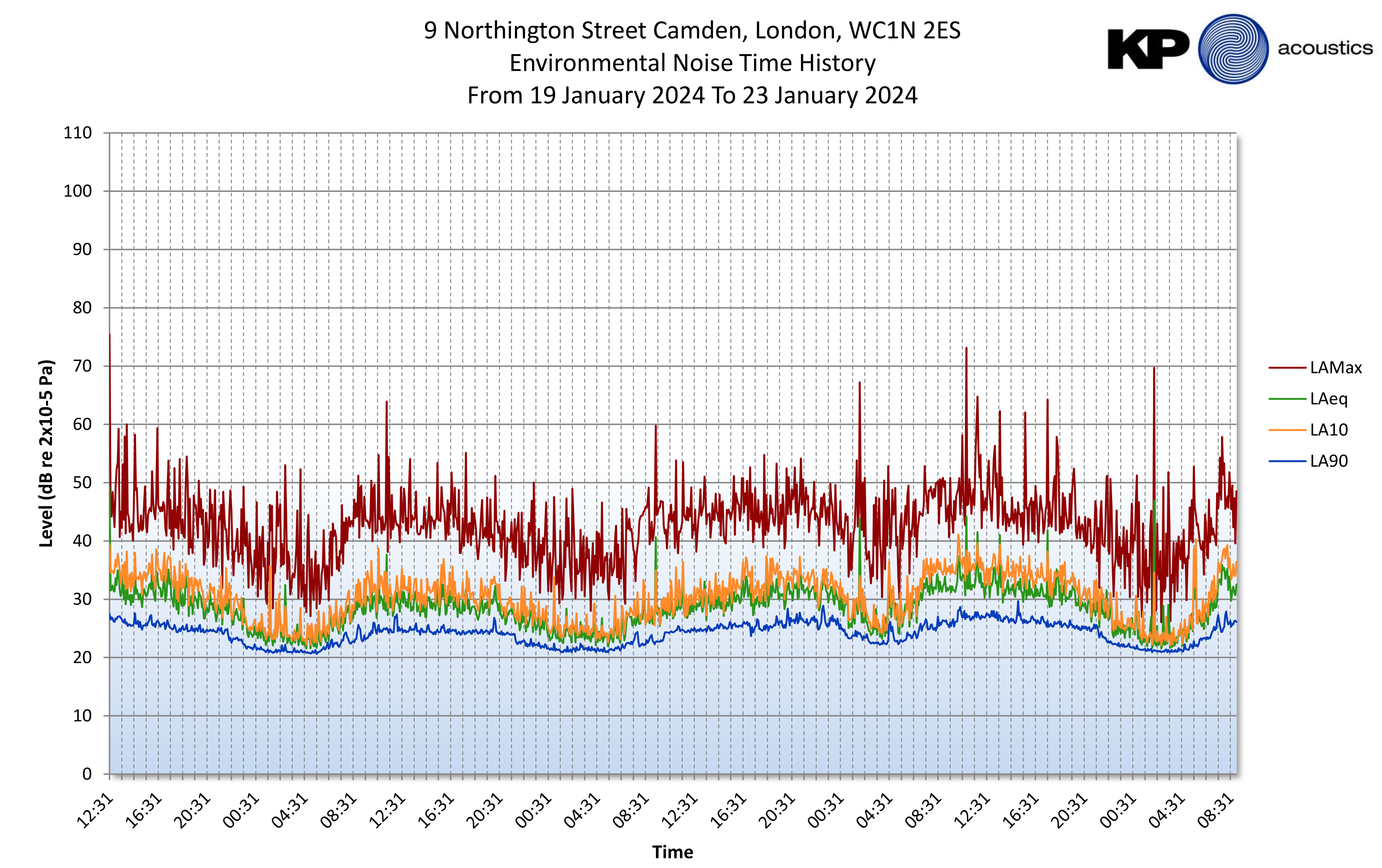

Figure 27846.TH2

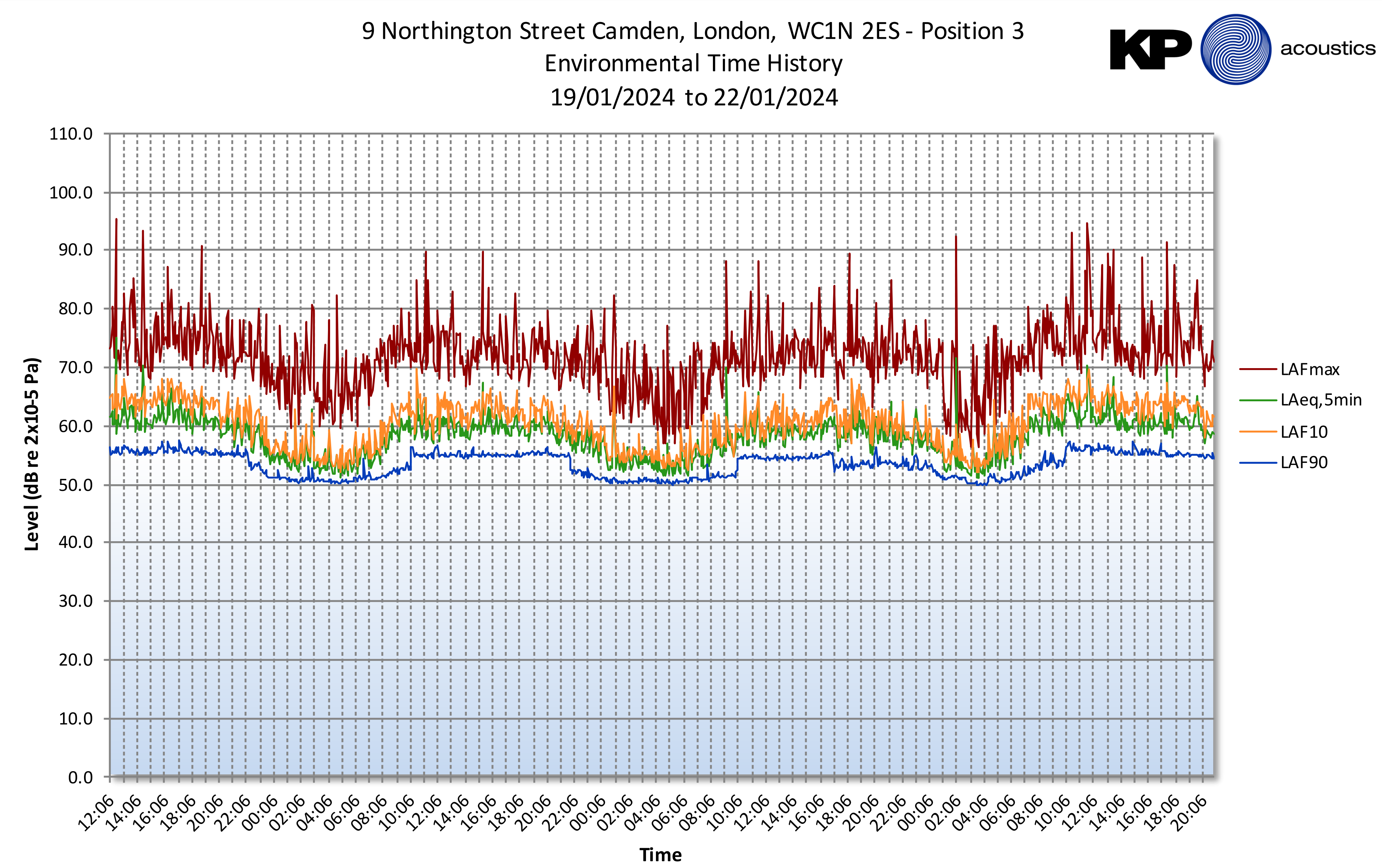

Figure 27846.TH3

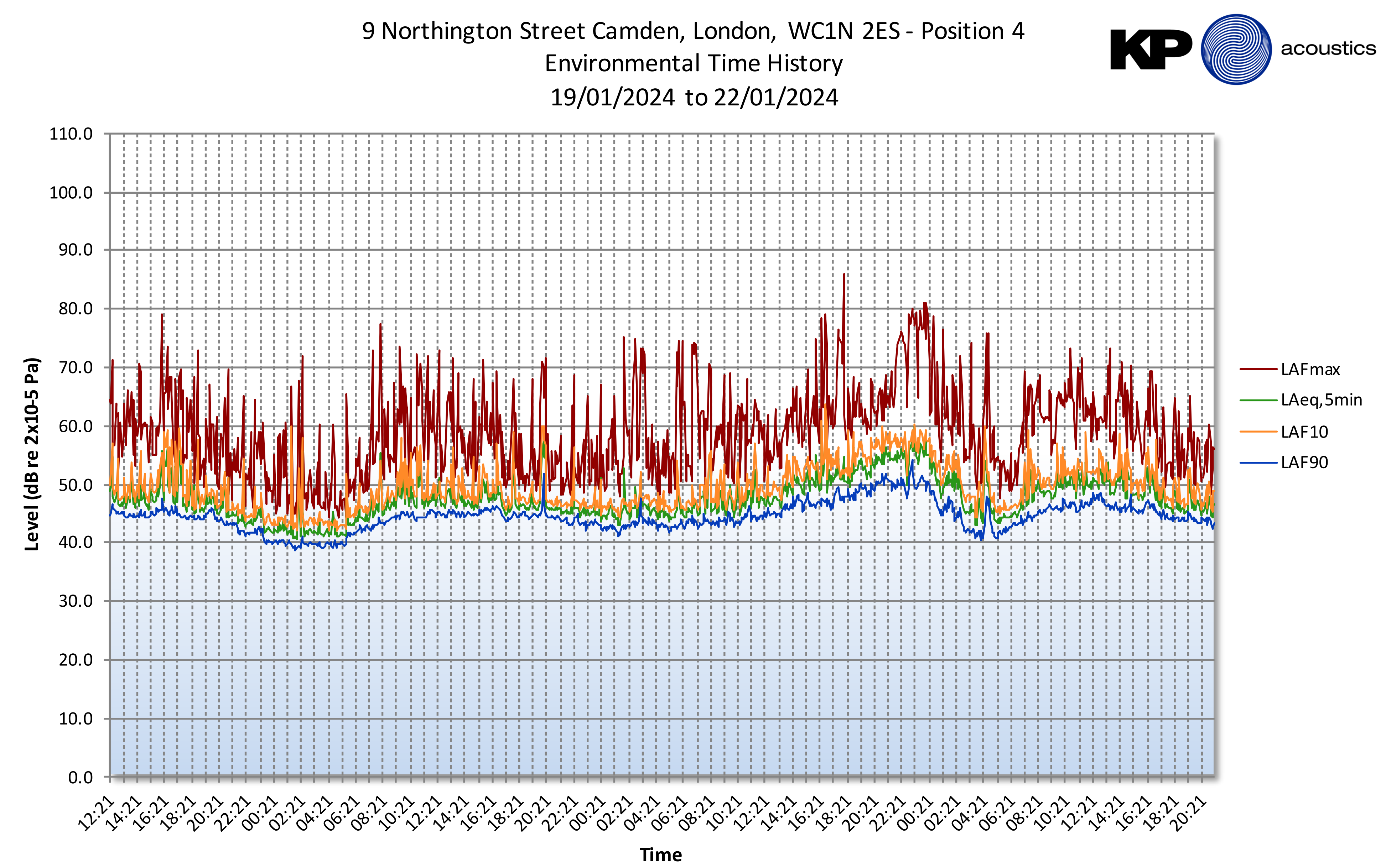

Figure 27846.TH4

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

9 Northington Street, Camden, London, WC1N 2ES

PLANT NOISE EMISSIONS CALCULATIONS

Source: ASHP Installation serving 9 Northington Street Receiver: Noise Sensitive Receiver 1	*Frequency, Hz* *63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Mitsubishi PUZ-WM112VAA (Sound Pressure Level @1m)	55	56	47	48	42	40	34	26	49
Correction for number of units (4),dB	6	6	6	6	6	6	6	6	
Correction due to surface reflections (1), dB	3	3	3	3	3	3	3	3	
Minimum attenuation due to building envelope, dB	-7	-9	-11	-14	-16	-19	-20	-20	
Minimum attenuation provided by distance (5m), dB	-14	-14	-14	-14	-14	-14	-14	-14	
Total Specific Level of all Plant Unit Installations at Receiver	43	42	31	29	21	16	9	1	31
BS4142 Acoustic Feature Corrections									
Tonality	0	0	0	0	0	0	0	0	
Impulsivity	0	0	0	0	0	0	0	0	
Intermittency	0	0	0	0	0	0	0	0	
Total Rating Noise Level of all Plant Unit Installations at Receiver	**43**	**42**	**31**	**29**	**21**	**16**	**9**	**1**	**31**

Design Criterion	**41**

Source: ASHP Installation serving 9 Northington Street Receiver: Noise Sensitive Receiver 2	*Frequency, Hz* *63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Mitsubishi PUZ-WM112VAA (Sound Pressure Level @1m)	55	56	47	48	42	40	34	26	49
Correction for number of units (4),dB	6	6	6	6	6	6	6	6	
Correction due to surface reflections (1), dB	3	3	3	3	3	3	3	3	
Minimum attenuation due to building envelope, dB	-7	-9	-12	-15	-17	-19	-20	-20	
Minimum attenuation provided by distance (6m), dB	-16	-16	-16	-16	-16	-16	-16	-16	
Total Specific Level of all Plant Unit Installations at Receiver	42	40	29	27	18	14	7	-1	29
BS4142 Acoustic Feature Corrections									
Tonality	0	0	0	0	0	0	0	0	
Impulsivity	0	0	0	0	0	0	0	0	
Intermittency	0	0	0	0	0	0	0	0	
Total Rating Noise Level of all Plant Unit Installations at Receiver	**42**	**40**	**29**	**27**	**18**	**14**	**7**	**-1**	**29**

Design Criterion	**33**

APPENDIX C

ANTI-VIBRATION MOUNTING SPECIFICATION REFERENCE DOCUMENT

1.0 General

1.1 All mountings shall provide the static deflection, under the equipment weight, shown in the schedules. Mounting selection should allow for any eccentric load distribution or torque reaction, so that the design deflection is achieved on all mountings under the equipment, under operating conditions.

1.2 It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail. Particular attention should be paid to mountings which will be exposed to atmospheric conditions to prevent corrosion.

1.3 All mountings shall be colour coded, or otherwise marked, to indicate their load capacity, to facilitate identification during installation.

Where use of resilient supports allows omission of pipe flexible connections for vibration/noise isolation, it shall be the Mechanical Service Consultant's or Contractor's responsibility to decide whether such devices are required to compensate for misalignment or thermal strain.

2.1 Type A Mounting (Caged Spring Type)

2.1.1 Each mounting shall consist of cast or fabricated telescopic top and bottom housings enclosing one or more helical steel springs as the principle isolation elements, and shall incorporate a built-in levelling device. The housing should be designed to permit visual inspection of the springs after installation, i.e. the spring must not be totally enclosed.

2.1.2 The springs shall have an outside diameter of not less than 75% of the operating height, and be selected to have at least 50% overload capacity before becoming coil-bound.

2.1.3 The bottom plate of each mounting shall have bonded to it a rubber/neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.1.4 Mountings incorporating snubbers or restraining devices shall be designed so that the snubbing, damping or restraining mechanism is capable of being adjusted to have no significant effect during the normal running of the isolated machine.

2.1.5 All nuts, bolts or other elements used for adjustment of a mounting shall incorporate locking mechanisms to prevent the isolator going out of adjustment as a result of vibration or accidental or unauthorised tampering.

2.2 Type B Mounting (Open Spring Type)

2.2.1 Each mounting shall consist of one or more helical steel springs as the principal isolation elements, and shall incorporate a built-in levelling device.

2.2.2 The springs shall be fixed or otherwise securely located to cast or fabricated top and bottom plates, shall have an outside diameter of not less than 75% of the operating height, and shall be selected to have at least 50% overload capacity before becoming coil-bound.

2.2.3 The bottom plate shall have bonded to it a rubber/ neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.3 Type C Mounting (Rubber/Neoprene Type)

Each mounting shall consist of a steel top plate and base plate completely embedded in oil resistant rubber/neoprene. Each mounting shall be capable of being fitted with a levelling device, and should have bolt holes in the base plate and a threaded metal insert in the top plate so that they can be bolted to the floor and equipment where required.

3.0 Plant Bases

3.1 **Type A Bases (A.V. Rails)**

An A.V. Rail shall comprise a steel beam with two or more height-saving brackets. The steel sections must be sufficiently rigid to prevent undue strain in the equipment and if necessary should be checked by the Structural Engineer.

3.2 **Type B Bases (Steel Plant Bases)**

Steel plant bases shall comprise an all-welded steel framework of sufficient rigidity to provide adequate support for the equipment, and fitted with isolator height saving brackets. The frame depth shall be approximately 1/10 of the longest dimension of the equipment with a minimum of 150 mm. This form of base may be used as a composite A.V. rail system.

3.3 **Type C Bases (Concrete Inertia Base: for use with steel springs)**

These shall consist of an all-welded steel pouring frame-work with height saving brackets, and a frame depth of approximately 1/12 of the longest dimension of the equipment, with a minimum of 100 mm. The bottom of the pouring frame should be blanked off, and concrete (2300 kg/m^3) poured in over steel reinforcing rods positioned 35 mm above the bottom. The inertia base should be sufficiently large to provide support for all parts of the equipment, including any components which over-hang the equipment base, such as suction and discharge elbows on centrifugal pumps.