KP Acoustics Ltd.
info@kpacoustics.com
1 Galena Road, W6 0LT London, UK
+44 (0) 208 222 8778
www.kpacoustics.com

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Mr John McGirl
24 Old Burlington Street
Mayfair
London
W1S 3AW

Dear John,

20528: 52 BATHURST MEWS, LONDON, W2 2SB

Further to my recent site visit, the following letter outlines the findings of the commissioning measurements undertaken on site for the newly installed air source heat pump.

In order to determine the impact of the unit in relation to background noise levels in the area, a site visit has been undertaken where both an automated 24 hour survey, and manual measurements of the plant and background noise, have been undertaken. The survey took place between 17:16 on 23/02/21 and 17:01 24/02/21, and manual measurements were undertaken between 16:54 and 17:07 on 23/02/21 and between 17:07 and 17:17 on 24/02/2021, with suitable weather conditions for the measurement of environmental noise.

It should be noted that it was only possible to operate the plant at maximum power and switch it off completely for 15 minute time periods on 23/02/21 and 24/02/21 respectively, due to heating requirements for recently installed tiled walking surface within the property.

Measurements of both ambient background noise levels ($L_{Aeq:1min}$) and noise levels with the unit operating at maximum power ($L_{Aeq:1min}$) were taken 1m above the receiver window and additional plant noise measurements were carried out 1m from the unit. It would be expected that the ambient noise levels would vary negligibly between the two measurement locations. The measurement positions are shown in figure 1. Additionally, it would be predicted that noise levels directly outside the receiver window would be lower than as measured at position 1 due to screening from the building envelope.

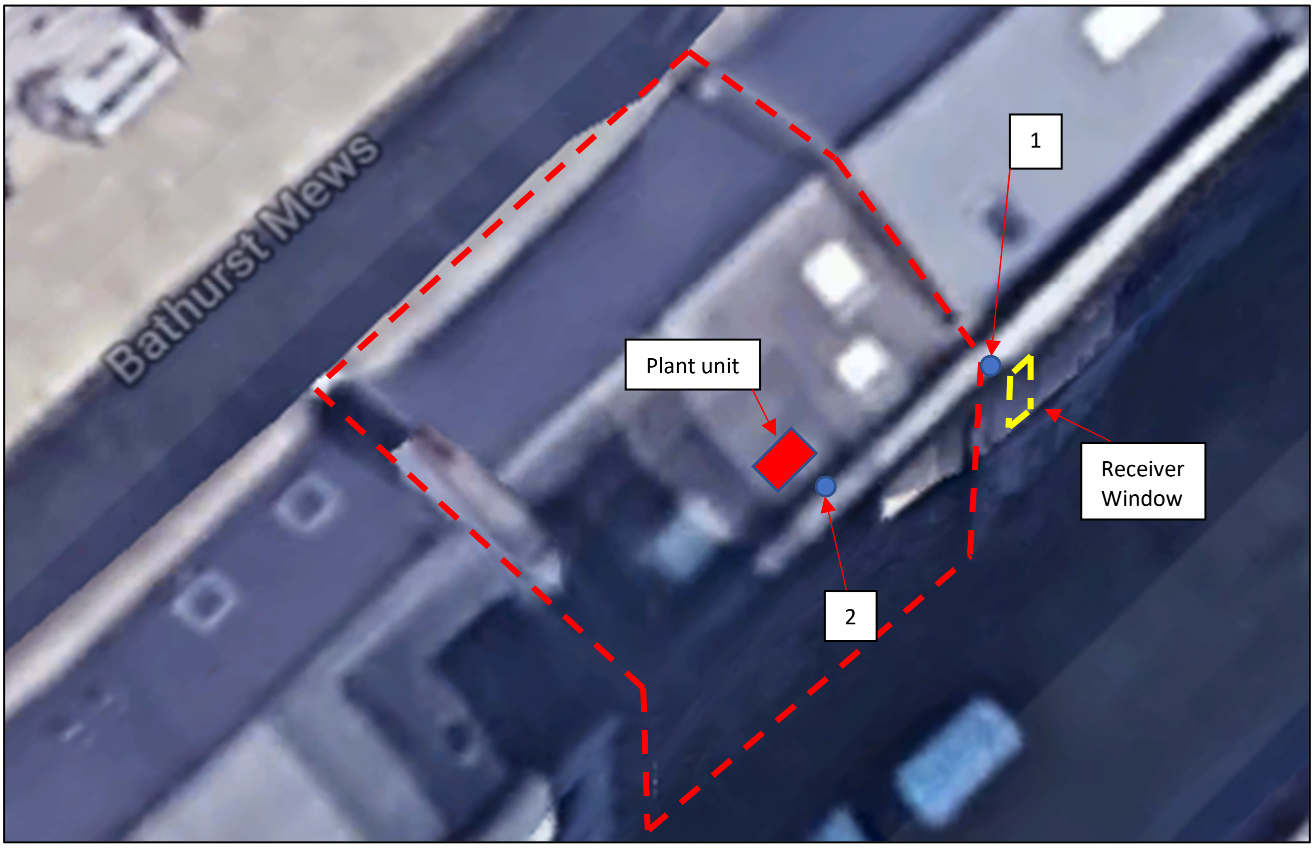

Figure 1: Site Measurement position, identified receiver and proposed plant unit installation (Image Source: Google Maps)

The results of the measurements taken are shown in Table 1.

Measurement Description	Position	Octave Band (Hz) Sound Pressure Levels (dB)								
		63	125	250	500	1K	2K	4K	8K	dB(A)
24H Automated Survey (Daytime)	1	59	56	54	52	47	41	36	30	52
24H Automated Survey (Night-time)	1	52	48	44	41	38	31	25	20	42
Direct Plant Noise Measurement 1	2	59	57	54	47	45	39	35	29	49
Direct Plant Noise Measurement 2	2	59	57	58	47	44	40	34	27	51
Plant noise 1m from receiver	1	55	52	49	46	43	37	33	26	48
Ambient Noise	1	55	52	47	45	42	37	34	27	47

Table 1: Measurement results

Comparing the ambient and plant noise levels measured 1m from the receiver, it is evident that the operation of the heat pump unit presents no tangible change in noise levels at the receiver, with only marginal increases of 1-2dB in the spectral noise levels observed in the 250Hz, 500Hz, and 1kHz frequency bands when the plant was in operation. This can be attributed to variations in background noise profile. This indicates that the received noise level, as a result of the unit operation is sufficiently low as to have no influence over the ambient noise profile during daytime.

Furthermore, examining the time history from the 24-hour survey, and specifically considering the representative L_{A90} results (this parameter refers to the ambient noise level exceeded 90% of the time), it is clear that the plant operating at a medium capacity had no impact on the background noise profile. Heat pump noise emissions are steady and constant. Therefore if the plant had had an impact on the background noise profile one would expect to see a flat L_{A90} line in the time history graph at times when the unit had had an impact on the ambient noise profile, however no such line is observed, even during night-time.

Subjectively, it was noted that the unit was almost entirely inaudible when operating at maximum power at position 1.

In addition to the analysis provided above, one can also assess the plant noise against the noise emissions criterion established in the previously issued planning compliance review.

By comparing the average noise levels measured at position 2 with the plant in operation, with the ambient noise levels measured at position 1, the plant source noise levels can be evaluated, factoring out all ambient noise. These values are given in Table 2, alongside the manufacturer issued data for the same measurement. It should be noted that both the manufacturer provided levels and extrapolated on-site measured levels would be expected to be 3dB lower in free-field conditions due to surface reflections.

Mitsubishi PUHZ-W85VAA (heating mode) noise emissions	Octave Band (Hz) Sound Pressure Levels (dB)								
	63	125	250	500	1000	2000	4000	8000	dB(A)
Manufacturer provided data	48	47	49	44	36	34	27	20	45
On-site measured level corrected for background noise and surface reflections	56	55	56	42	40	37	25	21	45

Table 2: Manufacturer provided plant noise emissions, and measured source noise levels

As shown in table 2, source noise levels are broadly similar to those provided by the manufacturer for the plant, with higher noise levels especially at low frequencies, and lower noise levels in the 500Hz and 4000Hz spectral bands. The overall plant noise level is 4dB greater for the extrapolated on-site measured value, but some variation in these levels would be expected due to uncontrollable, natural changes in the background noise profile.

To clarify noise emissions from the unit in relation to planning requirements, calculations have been undertaken considering the measured source noise level of the units at 1m, against the noise emissions criterion originally determined in the plant noise impact assessment.

Detailed calculations for the plant unit installation are shown in Appendix B.2.

Receiver	Criterion	Noise Level at 1m From the Closest Noise Sensitive Window
Rear Facade. 2nd Floor window of No.51 Bathurst Mews	30dB(A)	27dB(A)

Table 3: Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B.2 and Table 3, transmission of noise to the nearest sensitive windows due to the effects of the air source heat pump unit installation satisfies the emissions criterion of Westminster City Council, without any further mitigation measures in place.

It is therefore our professional opinion that no negative impact will occur on neighbouring receivers as a result of the air source heat pump installation at 52 Bathurst Mews.

We trust that the above information is sufficient with regards to answering the key issues raised, and remain available should there be any further queries.

Yours sincerely,

John Gray

KP Acoustics Ltd

Bathurst Mews, London
Environmental Noise Time History
From 23 February 2021 To 24 February 2021

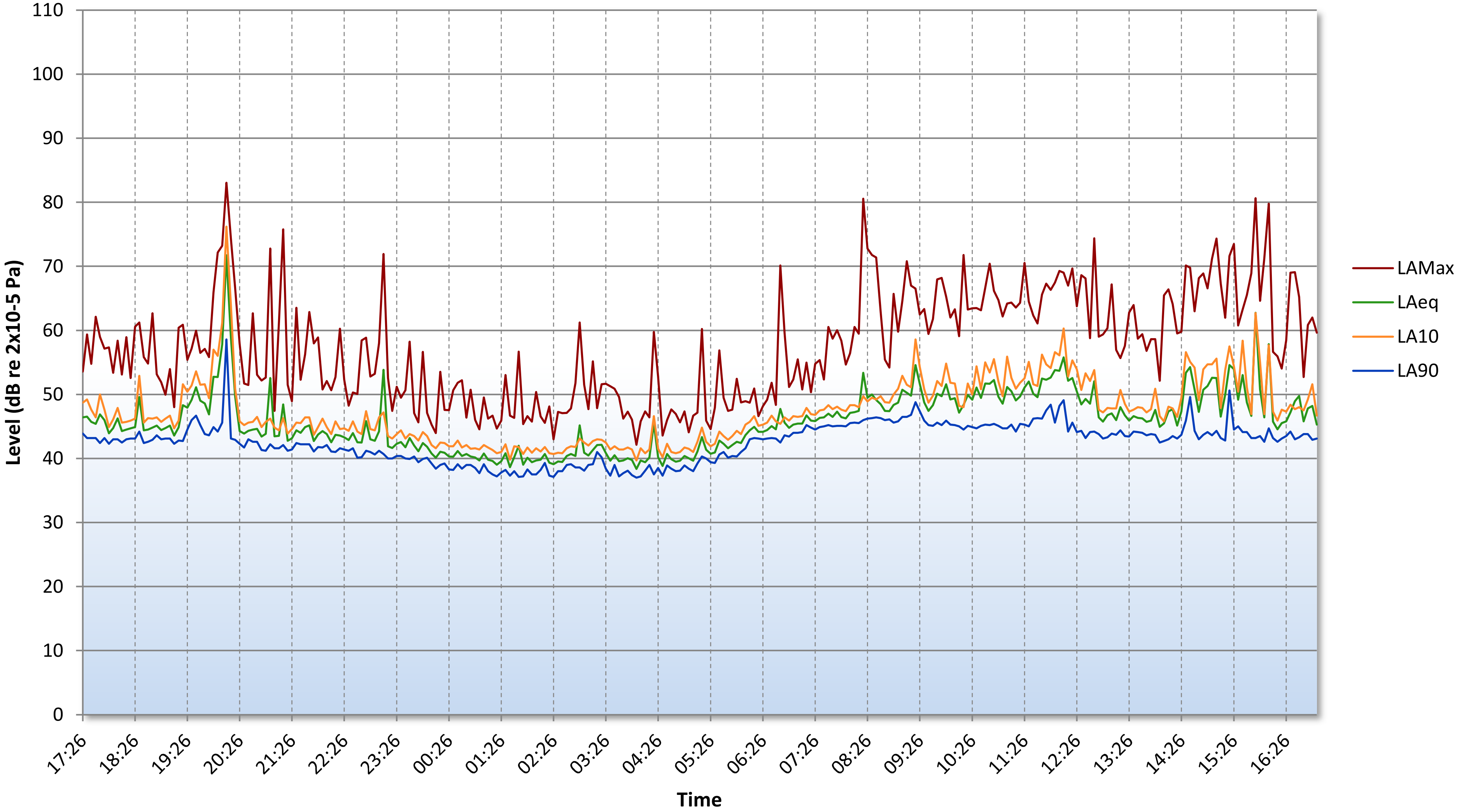

Figure 20528.TH2

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.2

52 Bathurst Mews, London, W2 2SB

PLANT NOISE EMISSIONS CALCULATIONS

Source: Heat Pump installed on the roof of 52 Bathurst Mews Receiver: Rear 2nd floor window of 51 Bathurst Mews	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Mitsubishi PUHZ-W85VAA (Sound Pressure Level @1m)	56	55	56	42	40	37	25	21	49
Correction for number of units (1),dB	0	0	0	0	0	0	0	0	
Correction due to surface reflections (1), dB	0	0	0	0	0	0	0	0	
Minimum attenuation due to building envelope, dB	-6	-7	-8	-10	-13	-15	-15	-15	
Minimum attenuation provided by distance (5m), dB	-14	-14	-14	-14	-14	-14	-14	-14	
Sound Pressure Level at Receiver, dB	**37**	**34**	**34**	**18**	**13**	**8**	**0**	**0**	**27**

Design Criterion	**30**