RBA ACOUSTICS

20-24 KIRBY STREET, LONDON, EC1N 8TS

External Acoustic Assessment

Reference: 10789.RP03.EBF.0
Prepared: 17 October 2022
Revision Number: 0

Morgan Capital
25 Watling Street
London
EC4M 9BR

External Acoustic Assessment

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	17 October 2022	Andrew Heath	Helen Sheldon

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

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Contents

1.0 INTRODUCTION

RBA Acoustics have been appointed to provide acoustic advice in relation to the refurbishment and extension of the existing offices space at 20-24 Kirby Street, London, EC1N 8TS.

It is understood that the project involves the strip out of the existing office space back to shell and the fit out of new Category A office accommodation, including new mechanical and electrical systems internally and externally an extension to create a 5th floor.

This report identifies acoustic design requirements for the development on the following key acoustic areas.

- External Building Fabric
- Building Services Noise and Vibration for External Plant Items

This report is produced with consideration of relevant construction information received.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

Monitoring of the prevailing background noise was undertaken between Friday 25 June and Monday 28 June 2021.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. There were some periods of rain, particularly on the morning of Monday 28 June however for the remainder of the survey the weather was generally considered satisfactory it being predominantly dry with little wind.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration.

2.2 Measurement Locations

To determine the existing noise climate around the site measurements were taken at the front and rear of the building at roof level. The microphones were positioned on tripods at a height of 1.5m above the existing roof level. The measurement positions are illustrated on the Site Plan in Figure 1 and Photographs in Figures 3 & 4 in Appendix D.

The prevailing noise climate was noted to mainly consist of traffic noise from the surrounding road networks.

2.3 Instrumentation

Details of the instrumentation used to undertake the survey are provided in Appendix B.

The sound level meters were calibrated both prior to and on completion of the survey with no significant calibration drifts observed.

3.0 RESULTS

The noise levels measured are shown as time-histories on the attached Graphs 1 to 4 in Appendix C. The typical L_{A90} and the period averaged L_{Aeq} dB noise levels measured are summarised below.

Table 1 – Measured Levels – Position 1 (Kirby Street Elevation)

Measurement Period	L_{90} (dBA)	L_{eq} (dBA)
Daytime (07:00 – 19:00)	45	56
Evening (19:00 – 23:00)	47	54
Night-time (23:00 – 07:00)	43	50

Table 2 – Measured Levels – Position 2 (Rear Elevation)

Measurement Period	L_{90} (dBA)	L_{eq} (dBA)
Daytime (07:00 – 19:00)	45	53
Evening (19:00 – 23:00)	46	52
Night-time (23:00 – 07:00)	40	49

4.0 EXTERNAL BUILDING FABRIC

4.1 Acoustic Criteria

Recommended internal L_{Aeq} noise levels during office hours are outlined in BS8233:2014 as summarised in Table 3.

Table 3 – Recommended Internal Noise Levels

Location	Design Range $L_{Aeq,T}$
Meeting room / training room	35-45
Executive office	35-40
Open plan office	45-50
Corridor, circulation space	45-55

While there are no specific internal spaces identified at this stage of the design due to the Shell and Core / Cat A fit-out nature of the project, we have designed to the 'worst-case' (lowest) target noise levels outlined in Table 3, i.e. we have assumed that Executive offices will be present on the worst affected facades of the building.

4.2 Acoustic Performance Specification

An acoustic performance specification detailing the sound reduction index requirements for the glazed sections of the external building fabric is included in Table 4. This can be appended to the main cladding specification.

It is assumed that the external walls will comprise the existing masonry for the existing floors with lightweight cladding for the upper floors.

The performance specifications for the glazed sections apply to the system as a whole inclusive of glazing, framing, opening lights, glazed spandrel sections, doors etc. The performance of the glazing system will depend on many factors such as the configuration, size of window panels, quality of framing, quality of sealing, etc. For guidance purposes, however, we would typically expect the glazing configurations detailed below to be capable of achieving the performance specifications:

All Elevations

Acceptable internal L_{Aeq} noise levels during office hours are achievable within office spaces with standard thermal double glazing, such as 6mm glass / 12mm airspace / 8mm glass.

PLEASE NOTE – The guidance constructions are given for costing purposes only. All glazing systems should be capable of meeting the performance specifications, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a glazing configuration will meet the performance specification.

4.3 Glazing Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2010:

Table 4 – Façade Acoustic Performance

Location	Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R_w (dB)
	63	125	250	500	1k	2k	4k	8k	
All Elevations	23	23	23	29	36	36	41	43	34

Note: R_w is the "overall weighted sound reduction index" tested in a laboratory.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems should be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

New areas of lightweight cladding should be specified with a minimum acoustic performance of R_w 40 dB as tested in general accordance with BS EN ISO 10140-2:2010.

4.4 Ventilation

It is assumed that the building will be mechanically serviced, and windows will generally not be required to be opened for ventilation purposes.

4.5 Flanking Performance

Section 4.3 refers to external noise intrusion through the external walling to internal areas. Wall and floor sound insulation can often be compromised by lightweight or curtain walling systems. It is thus important that should any areas of curtain walling or lightweight cladding be proposed, an additional specification be introduced which will limit the amount of sound transfer across wall and floor lines through the external walling system.

The following guidance should be incorporated within any other packages which could affect the transmission of flanking sound at wall and floor lines. The supplier shall demonstrate by the provision of previous test reports (and comparative calculations if required) that the specification can be achieved.

Horizontal Flanking

Where any internal partitions abut areas of lightweight façade, the sound insulation it provides between horizontally adjacent rooms needs to be such that it does not undermine the sound insulation provided by internal walls.

We are not aware of any specific requirements for this development so we refer to refer to guidance outlined in BCO: Guide to Specification which recommends that flanking sound transmission horizontally across cladding mullions (For Cat A) at potential fit-out partitions should be capable of demonstrating a Weighted Normalized Flanking Level Difference ($D_{n,f,w}$) of 45 dB when tested in a laboratory in general accordance with BS EN ISO 10848-2:2006 and rated in accordance with BS EN ISO 717-1:2020.

Vertical Flanking

Where any internal floors abut areas of lightweight cladding, the sound insulation it provides between vertically adjacent rooms needs to be such that it does not undermine the sound insulation provided by the separating floor.

Again, are not aware of any specific requirements for this development so for guidance we refer to BCO. BCO recommends that the sound level difference between individual office floors should be at least $D_{nT,w}$ 48 dB if fitted to Cat A standard when tested in accordance with BS EN ISO 16283-1:2014 and rated in accordance with BS EN 717-1: 2020.

Upgraded Performances

The above performances are based on the separation between standard office floors. Where potentially noisier spaces are adjacent to office areas, a higher flanking performance may be appropriate.

4.6 Self-Noise

Noise from movement, e.g. thermal, wind, etc. should be controlled by appropriate specification clauses. Flexible elements and movement joints are likely to be required which should be incorporated by the cladding contractor.

Where relevant, consideration should be given to potential audible effects as a result of airflow across any externally elements that may give rise to wind induced noise. Noise generated by wind on façade elements will ultimately depend on wind speed, direction and shape of the facades and should be considered by the cladding contractor.

Noise from rainfall, particularly on lightweight horizontal or near horizontal sections of cladding, will need to be controlled by appropriate specification clauses. Where relevant, compressed mineral fibre insulation or a suitable damping material on the inside of lightweight cladding panels would be a typical means of control. This should be developed further at Technical Design Stage.

5.0 PLANT NOISE

The rooftop plant area is indicated on Figure 2 in Appendix C.

The requirements of the London Borough of Camden Environmental Health Department regarding new building services plant are outlined in the 2017 Camden Local Plan as summarised below.

Policy A1 states:

> *Where uses sensitive to noise are proposed close to an existing source of noise or when development that is likely to generate noise is proposed, the Council will require an acoustic report to accompany the application.*

Policy A4 states:

> *Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:*
>
> *a. development likely to generate unacceptable noise and vibration impacts; or*
> *b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*
>
> *We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.*

Appendix 3 of the plan outlines the appropriate assessment methods as follows:

> *A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).*

Table C of Appendix 3 is reproduced below:

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

For this site, any noise generated by new building services plant should be designed to a level 10dB below the lowest background L_{A90} 15-minute sample during operational hours, as measured 1m outside the nearest affected residential window, garden or balcony.

There are understood to be residences at high level in adjacent buildings on Saffron Hill and Kirby Street.

In line with the above requirements we would propose items of mechanical services be designed so that noise emissions from the plant do not exceed the following LOAEL levels when assessed at the nearest noise sensitive location:

- Daytime (07:00 – 19:00) 35 dBA
- Evening (19:00 – 23:00) 36 dBA
- Night-time (23:00 – 07:00) 30 dBA

In line with BS 4142: 2014 and Appendix 3 of the 2017 Camden Local Plan, should the proposed plant be identified as having intermittent or tonal characteristics, a further 5dB penalty should be subtracted from any of the above proposed noise emission limits.

5.1 Emergency Criteria

It is understood that a relaxation is considered reasonable for plant that operates only for emergency / life safety reasons such as standby emergency generators. Such plant will only operate under emergency conditions or for short periods of daytime testing (around 15-30 minutes every few months would be typical).

Such plant will therefore be designed to achieve a level 10 dB above the prevailing daytime background noise summarised in Table 2.

Limits for emergency plant should therefore not exceed a level of 55 dBA at the nearest noise sensitive windows.

6.0 PLANT NOISE ASSESSMENT

This assessment has been based on the information provided to RBA by BTP Consultants, the project M&E Consultants and is described in the following sections.

6.1 Proposed Plant Items

The following plant is proposed for the scheme:

Table 5 – Plant Types

Ref.	Manufacturer/Model/Duty	Plant Type
COND	8No. Daikin REYQ12U	Condenser Unit
AHU	Flakt Group Central AHU	Air Handling Unit
GEN	Standby Emergency Generator	Standby Emergency Generator

6.2 Plant Locations

All plant is located on the 6th floor roof. The equipment positions are indicated on the site plan in Figure 2.

6.3 Plant Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturer of the unit. The associated plant noise levels are detailed as follows:

Table 6 – Plant Noise Levels – Normally Operating Plant

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
COND	L_p @1m	64	66	61	57	53	51	54	44
AHU – Intake	L_w	70	66	53	47	45	47	48	45
AHU – Exhaust	L_w	82	78	68	64	61	67	67	65

Review of the octave band data provides no indication of any tonal characteristics associated with the proposed plant.

Table 7 – Plant Noise Levels – Emergency Plant

Unit	Parameter	Sound Level (dBA)
GEN	L_p @1m	78

6.4 Mitigation

AHU Silencers

In-duct silencers are proposed for AHU units, the performance of which are given below.

Table 8 – In-duct Silencers

Unit	Length & Typical free area	Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
AHU – Exhaust	1200mm 35%	5	11	19	29	36	37	29	18
AHU – Intake	600mm 40%	3	5	9	13	15	16	11	9

Night-Time Operation

The condenser units will only operate between 07:00 and 23:00, they will be switched off at night.

Rooftop Parapet Wall

The rooftop parapet will comprise a louvred panel with a solid, imperforate backing. The louvre will be backed by material with a mass per unit area of 15 kg/m^2 such as 12mm Cement particle board, 1.5mm steel or 28mm marine plywood.

6.5 Location of the Nearest Noise-Sensitive Receptors

Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptors to the proposed plant to be as follows:

Receptor 1 – 30 Kirby Street

Residential properties are located on the upper levels of 30 Kirby Street approximately 20m to the west of the proposed rooftop plant area. This property is shown in the photo in Figure 3.

Receptor 2 – 44 Saffron Hill

Residential properties are located on the upper levels of Da Vinci House, 44 Saffron Hill approximately 20m to the east of the proposed rooftop plant area. This property is shown in the photo in Figure 4.

6.6 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

Our calculation method for predicting noise levels from the proposed plant at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SPL / SWL
- Distance Attenuation
- Directivity
- Screening

Calculation sheets are attached for further information in Appendix C.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 9 – Predicted Noise Levels – Normally Operating Plant

Operating Period	Noise Level (dB) at Receptor 1 – 30 Kirby Street		Noise Level (dB) at Receptor 2 – 44 Saffron Hill	
	Prediction	Criterion	Prediction	Criterion
Daytime (07:00 – 23:00)	32	35	32	35
Night-time (23:00 – 07:00)	17	30	29	30

Table 10 – Predicted Noise Levels – Emergency Plant

Operating Period	Noise Level (dB) at Receptor 1 – 30 Kirby Street		Noise Level (dB) at Receptor 2 – 44 Saffron Hill	
	Prediction	Criterion	Prediction	Criterion
Anytime (00:00 – 24:00)	50	55	50	55

Noise from the proposed plant with the mitigation measures incorporated is within the Local Authority criteria.

7.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that all plant be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

8.0 CONCLUSION

Measurements of the existing noise levels at 20-24 Kirby Street, London have been undertaken.

The resultant noise levels have been used in the assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233:2014. Target specifications for new glazing are included herein.

The resultant noise levels have also been used to determine the required criteria for atmospheric noise emissions from the proposed plant installations.

The following mitigation measures are proposed within this report in Section 6.4 which include:

- Atmosphere-side attenuators to AHUs
- Condenser Units will not operate at night (23:00 to 07:00)
- A 15kg/m^2 backing plate will be implemented to the rear of the rooftop louvres.

Provided the above mitigation measures are included in the design and installation, the results of the assessment indicate atmospheric noise emissions from the proposed plant are within the criteria required by Camden Council as outlined in the 2017 Camden Local Plan and, as such, can be considered acceptable in terms of noise.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B - Instrumentation

The following equipment was used for the measurements

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406258	U37479	24 March 2023
Norsonic Pre Amplifier	1209	20490		
Norsonic ½" Microphone	1225	225526	37478	24 March 2023
Norsonic Sound Calibrator	1251	34397	U37477	24 March 2023
Norsonic Type 1 Sound Level Meter	Nor140	1406255	U37581	7 April 2023
Norsonic Pre Amplifier	1209	20491		
Norsonic ½" Microphone	1225	225529	37580	7 April 2023
Norsonic Sound Calibrator	1251	34391	U37579	7 April 2023

Appendix C – Plant Calculations

Table C1 – Example Calculation, COND1 to 30 Kirby Street

Parameter	Octave-band Noise Levels (dB) at Octave-band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
Daikin REYQ12U Lp @1m	64.0	66.0	61.0	57.0	53.0	51.0	54.0	44.0	61
8No. units	+9	+9	+9	+9	+9	+9	+9	+9	
Distance losses @ 15m	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	
Screening	-7.6	-9.3	-11.7	-14.5	-17.4	-20.0	-20.0	-20.0	
Noise level at receiver	41.9	42.2	34.8	28	21.1	16.5	19.5	9.5	32

Table C2 – Summary Noise Levels to 30 Kirby Street

Unit	Received noise level (dB) at 1m from Receptor 1
COND	32
AHU1 – Intake	17
AHU1 – Exhaust	6
Total Received Level	32

Appendix D – Graphs, Site Plans & Photographs

20-24 Kirby Street, London

L_{Aeq} Time History

Measurment Position 1 - Kirby Street

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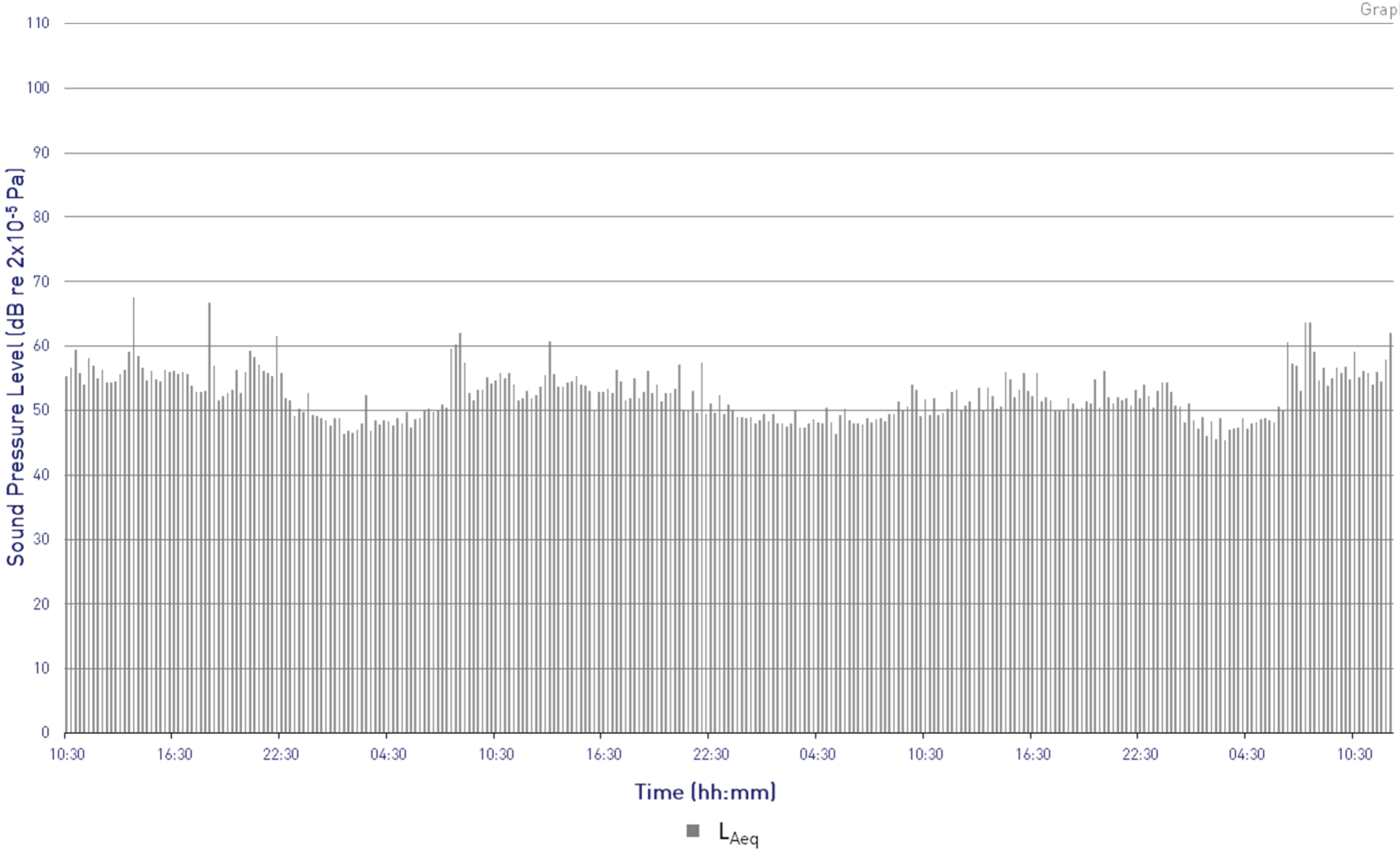
Graph 1



20-24 Kirby Street, London

$L_{Amax,f}$ and L_{A90} Time History

Measurment Position 1 - Kirby Street

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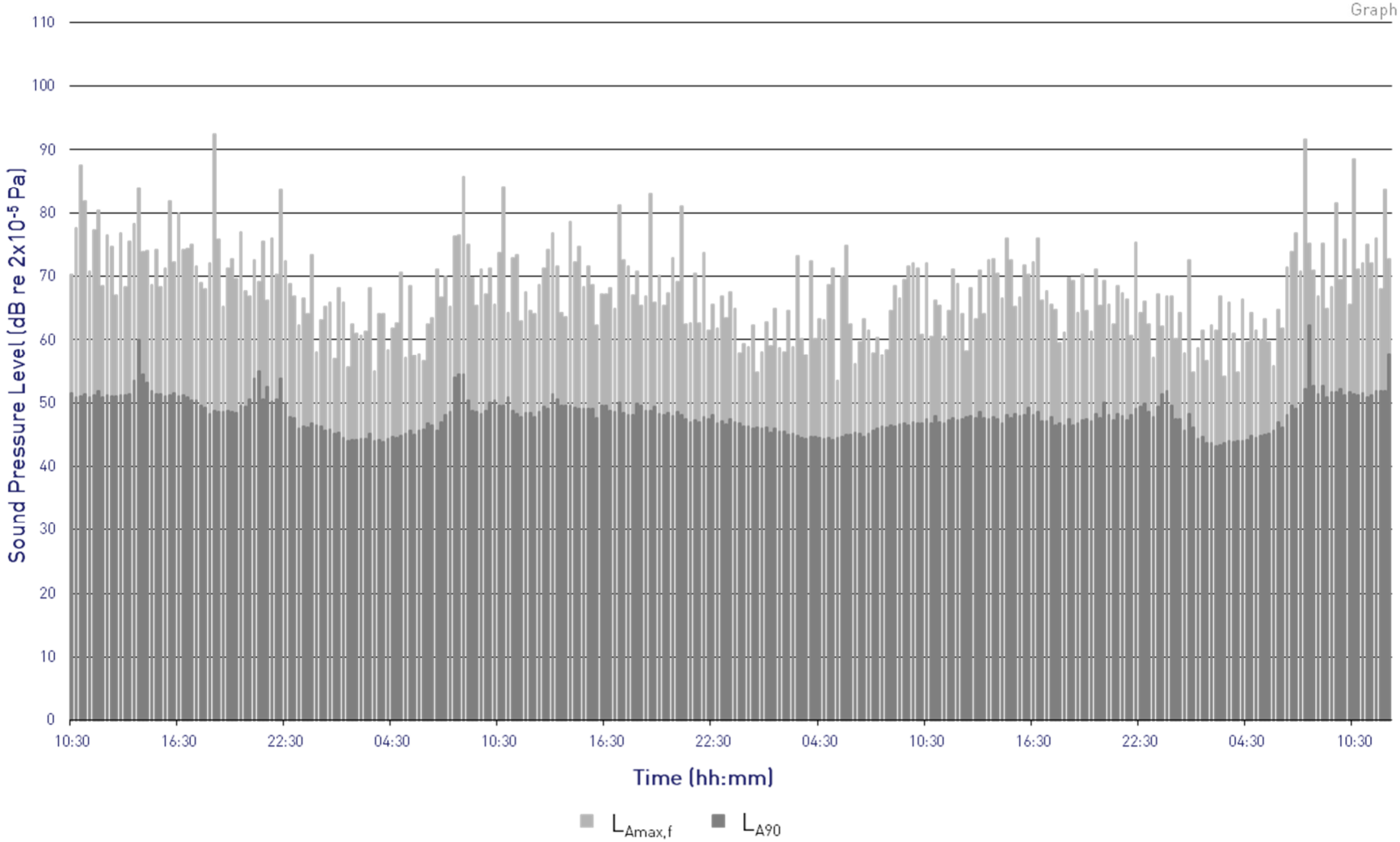
Graph 2



20-24 Kirby Street, London

L_{Aeq} Time History

Measurment Position 2 - Rear Elevation

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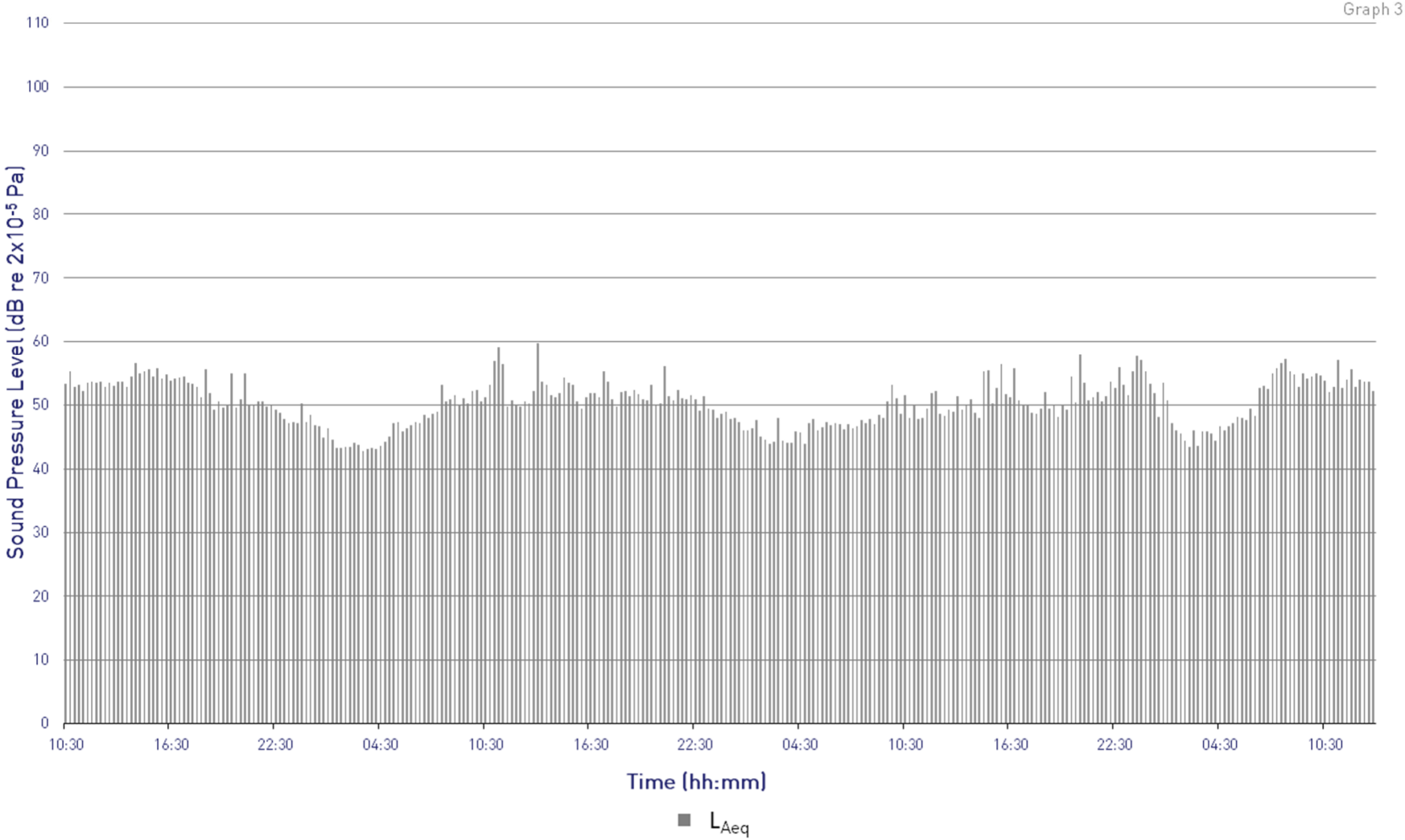
Graph 3



20-24 Kirby Street, London

$L_{Amax,f}$ and L_{A90} Time History

Measurment Position 2 - Rear Elevation

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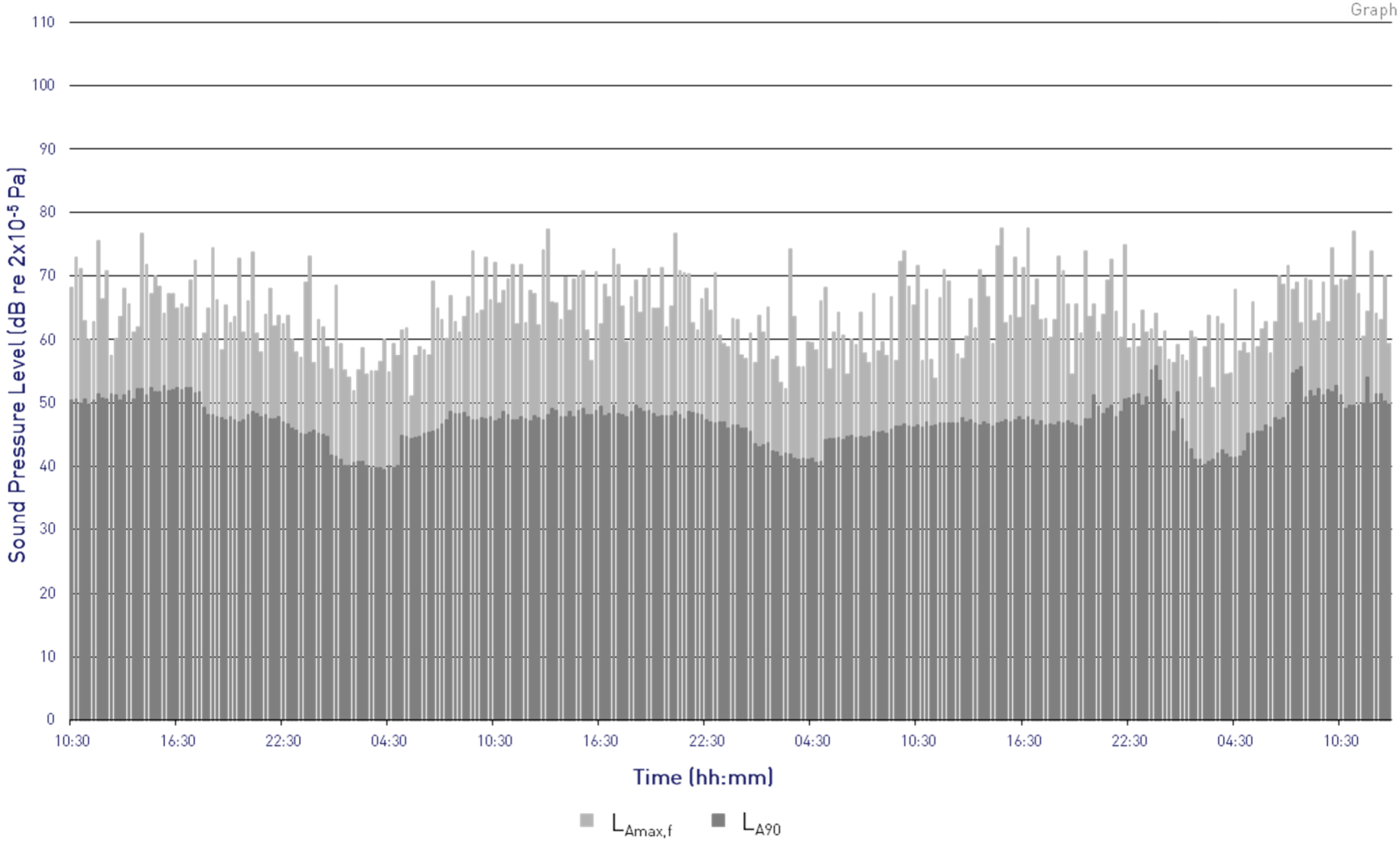
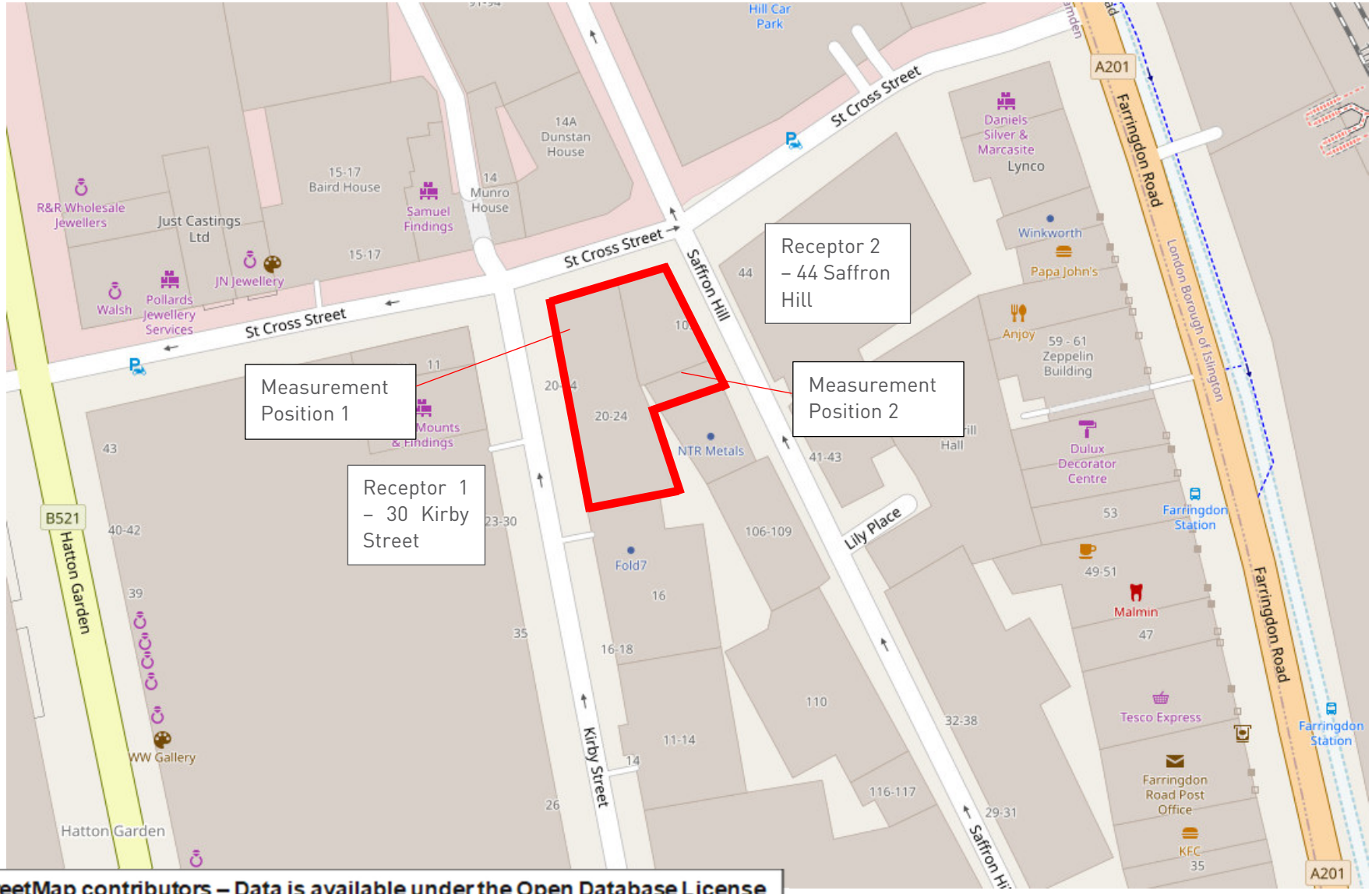
Graph 4





20-24 Kirby Street, London, EC1N 8TS
Site plan indicating measurement locations
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Figure 1
17 October 2022
Not to Scale

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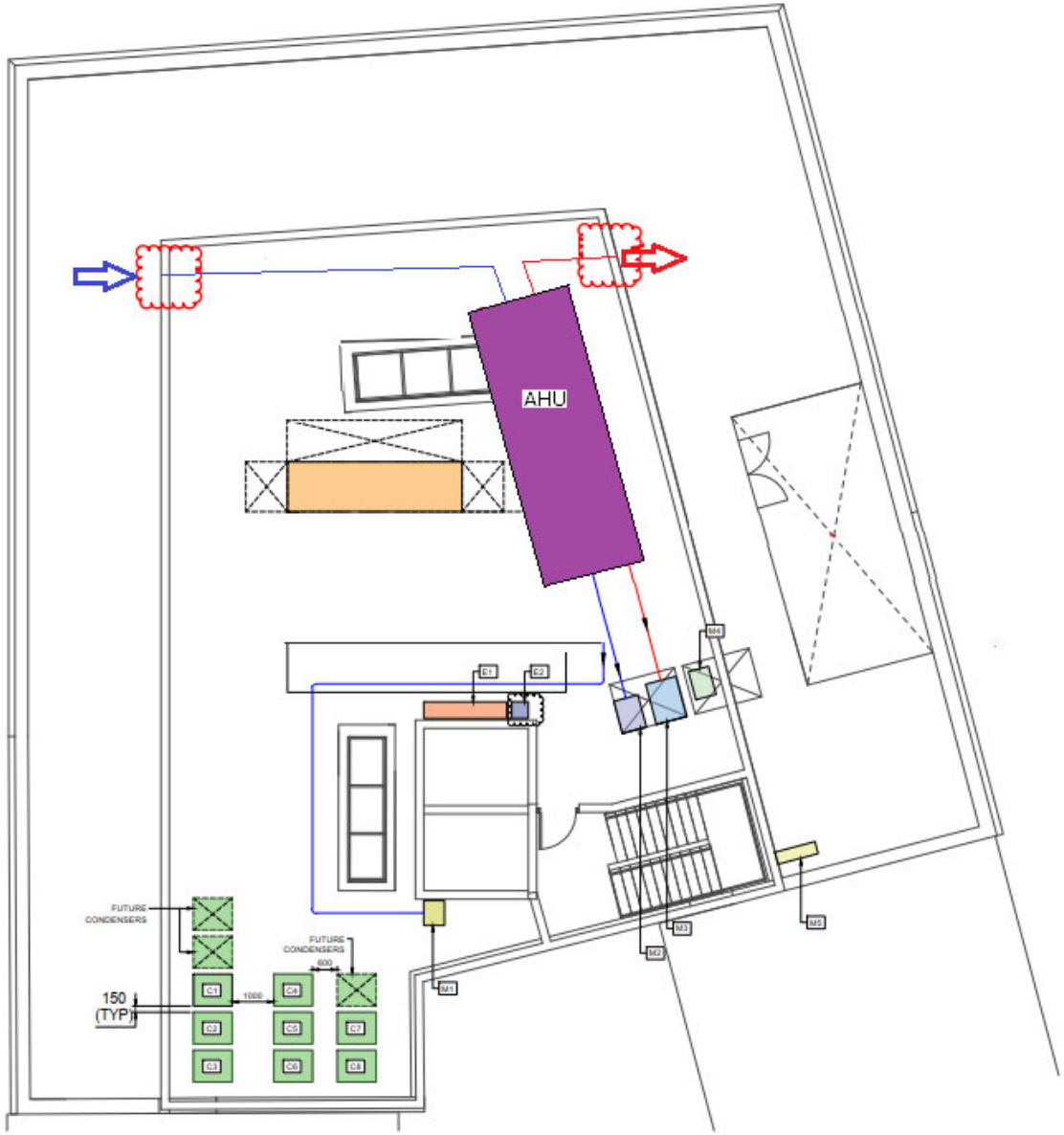

20-24 Kirby Street, London, EC1N 8TS
Indicative site plan and section showing rooftop plant area
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Figure 2
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Not to Scale

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20-24 Kirby Street, London, EC1N 8TS
Photograph – Measurement Position 1
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Figure 3
17 October 2022
Not to Scale

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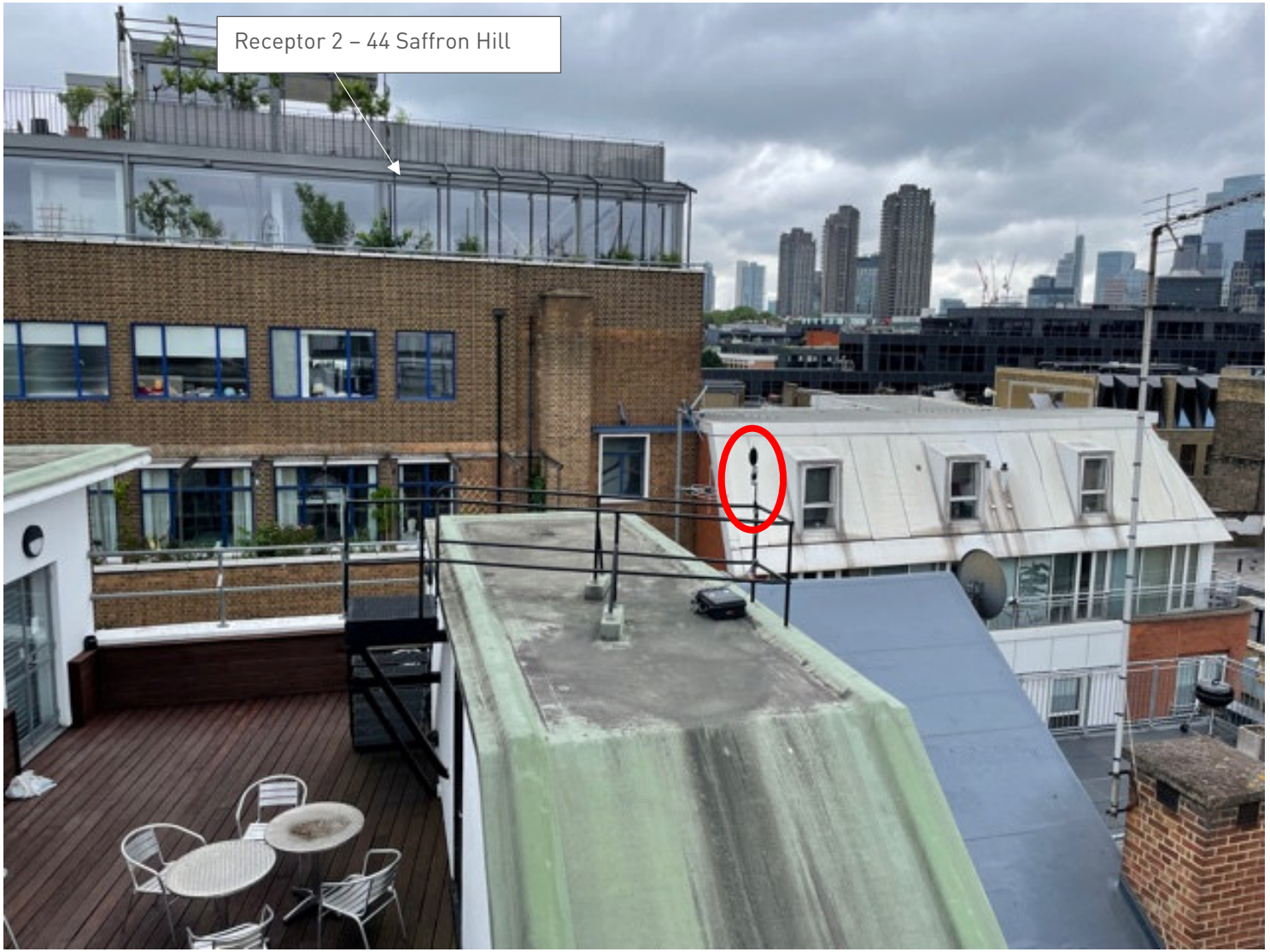

20-24 Kirby Street, London, EC1N 8TS
Photograph – Measurement Position 2
Project 10789

Figure 4
17 October 2022
Not to Scale

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