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FLATS 4 – 6, 113 GLOUCESTER TERRACE
LONDON

NOISE IMPACT ASSESSMENT

Report **17142-NIA-01 RevA**

Prepared on 16 June 2022

Issued For:

Mercham House

25-27 The Burroughs

Hendon

London

NW4 4AR

Executive Summary

This noise impact assessment has been undertaken in order to assess a proposed plant installation for residential use at 113 Gloucester Terrace, London to serve Flats 4 – 6.

The plant installation comprises the following plant units, with two existing and two proposed:

- 4 No. Daikin Condenser Units.

A background noise survey has been undertaken as detailed in the report, in order to determine an appropriate noise emission criterion, in accordance with the requirements of City of Westminster.

Calculations were undertaken for the nearest identified receivers, identified as 111 & 115 Gloucester Terrace. It should be noted that if there are closer receivers that Clement Acoustics is not aware of, a reassessment will be necessary, and this should therefore be confirmed by the Client.

It has been demonstrated that compliance with the established criterion is feasible, dependant on the following material considerations:

- The plant could be in use at any time over a 24 hour period.
- The noise emissions data for the proposed & existing units as obtained from available manufacturer information
- Plant and receiver locations are as established in this report and marked on the attached site plan
- Mitigation is applied as recommended in this report, in the form of louvred enclosures.

If there is any deviation from the above, Clement Acoustics must be informed, in order to establish whether a reassessment is necessary.

Clement Acoustics has used all reasonable skill and professional judgement when preparing this report. The report relies on the information as provided to us at the time of writing and the assumptions as made in our assessment.

This report is designed to be suitable to discharge typical plant noise planning conditions, as per our original scope of work. The report should not be relied upon for further reasons, such as the detailed design of mitigation measures.

Contents

List of Attachments

Document Revision	Date of Revision	Reasons for Revision	Revision By
0	22/11/2021	First Issue	Daniel Hagan AMIOA
RevA	16/06/2022	Updated to reflect plant relocation	Duncan Martin MIOA

1.0 INTRODUCTION

Clement Acoustics has been commissioned by Drawing and Planning to measure existing background noise levels at 113 Gloucester Terrace, London W2 3HB. Measured noise levels have been used to determine noise emissions criteria for a proposed and existing plant installation in agreement with the planning requirements of the City of Westminster.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

An acoustic terminology glossary is provided in Appendix A.

2.0 SITE DESCRIPTION

The site is located on Gloucester Terrace with Upbrook Mews to the rear. The surrounding area is predominantly residential in nature.

Current proposals are to move two existing Daikin units from rooftop level to a first floor terrace area, with two additional units of the same model to be installed in a similar location.

The 3rd floor rear windows of 111 & 115 Gloucester terrace have been identified as the nearest affected receivers that are not part of the application site. It is understood the terraces are level with the roofs of houses on Upbrock Mews to the west, and there are therefore no windows to habitable rooms facing the proposed plant location.

The nearest noise sensitive receivers were identified through observations on-site. If there are any receivers closer to that identified within this report then a further assessment will need to be carried out. Therefore, the closest noise sensitive receiver should be confirmed by the client before the plant is installed or any noise mitigation measures are implemented.

Locations are shown in attached site plan 17142-SP1 RevA.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Unattended Noise Survey Procedure

Measurements were undertaken at one position as shown on indicative site drawing 17142-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest affected receiver.

The surroundings and position used for the monitoring location are described in Table 3.1.

Position No.	Description
1	The microphone was mounted on a tripod at the rear terrace of the building. [1]

Table 3.1: Description of unattended monitoring locations

Note [1]: The position was considered to be free-field according to guidance found in BS 4142: 2014, and a correction for reflections has therefore not been applied.

Continuous automated monitoring was undertaken for the duration of the survey between 10:20 on 22 October 2021 and 11:20 on 25 October 2021.

The measurement procedure generally complied with BS 7445: 1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.

The locations of the measurement positions are shown on attached site plan 17142-SP1 RevA.

3.2 Weather Conditions

At the time of set-up and collection of the monitoring equipment the weather conditions were generally dry with light winds. It is understood that the weather conditions during the unattended survey were of the same nature.

It is considered that the weather conditions did not significantly adversely affect the measurements and are therefore considered suitable for the measurement of environmental noise.

3.3 Equipment

The equipment calibration was verified, by means of a field verification check, before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 958 Class 1 Sound Level Meter
- Rion Type NC-74 Class 1 Calibrator

4.0 RESULTS

4.1 Unattended Noise Survey Results

The $L_{Aeq:\ 5min}$, $L_{AFmax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured at the location shown in site drawing 17142-SP1 RevA.

Measured noise levels are shown as a time history in Figure 17142-TH1, with average ambient and minimum background noise levels summarised in Table 4.1.

It should be noted that an atypical event occurred between 23:00 – 01:15 on 23rd / 24th, therefore the data summarised below excludes this period of the survey.

Time Period	Average ambient noise level $L_{eq:\ T}$	Minimum background noise level $L_{90:\ 5min}$
Daytime (07:00 - 23:00)	46 dB(A)	36 dB(A)
Night-time (23:00 - 07:00)	39 dB(A)	31 dB(A)

Table 4.1: Average ambient and minimum background noise levels

5.0 NOISE CRITERIA

5.1 Relevant Local Policy

The assessment and recommendations in this report have been undertaken in accordance with Policy D14 of the London Plan 2021, which contains the following relevant sections:

"*D14. In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

> *5) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses*".

The adopted Westminster City Plan 2019-2040 contains the following policy, which has been considered throughout this assessment:

"*33. C Development should prevent adverse effects of noise and vibration and improve the noise environment in compliance with the council's Noise Thresholds, with particular attention to:*

> *2. minimising noise from plant machinery and internal activities*".

The above policies from the adopted plan and adopted city plan have been considered when determining suitable criteria for noise emissions from plant.

5.2 Local Authority Criteria

In this instance, the Westminster City Council criteria for noise emissions are as follows:

> *"If the existing external ambient noise levels do not exceed the WHO guidelines of L_{Aeq} 55 dB over periods of daytime (07.00-23.00hrs) and L_{Aeq} 45 dB at night-time (23.00-07.00hrs), then the 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at any time exceed a value of 5 dB below the minimum external background noise at the nearest noise sensitive properties.*
>
> *If the existing external ambient noise levels exceed the WHO guidelines of L_{Aeq} 55 dB over periods of daytime (07.00-23.00hrs) and L_{Aeq} 45 dB at night-time (23.00-07.00hrs), then the 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at*

any time exceed a value of 10 dB below the minimum external background noise at the nearest noise sensitive properties."

It is understood that the proposed plant unit will be for residential use and therefore potentially operational at any time.

As shown in Table 4.1, the L_{Aeq} noise levels measured for both daytime and night-time periods do not exceed 55 dB and 45 dB respectively as mentioned in the Westminster City Council criteria. Therefore, the criteria for the noise emissions from the plant at the nearest noise sensitive receiver will be set at a value of 5 dB below minimum external background levels.

Based on the results of the environmental noise survey and requirements of the Westminster City Council, Table 5.1 presents the proposed plant noise emission criteria to be achieved at 1 m from the nearest noise sensitive receiver:

Period	Plant Noise Emission Limit $L_{eq:T}$
Daytime (07:00 - 23:00)	31 dB(A)
Night-time (23:00 - 07:00)	26 dB(A)

Table 5.1: Plant noise emission limits

6.0 PLANT NOISE IMPACT ASSESSMENT

6.1 Proposed & Existing Installation

The proposed and existing plant installation comprises 4 No. Daikin 4MXM80N9 condenser units (two existing units relocated & two proposed)

Noise emissions for the proposed and existing plant units, as provided by the manufacturer, are shown in Table 6.1. Loudest modes of operation have been used in order to present a robust worst-case assessment.

Plant Unit	Sound Pressure Levels (at 1 meter, dB) in each Frequency Band								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Plant unit	50	52	50	47	43	38	31	27	49

Table 6.1: Manufacturer provided noise emissions levels

The proposed plant locations are located on 1st floor terraces at the rear of the building, as shown on indicative site plan 17142-SP1 RevA.

6.2 Proposed Mitigation Measures

Proposals include the installation of acoustic enclosures to all relocated and proposed units.

In order to meet the proposed criteria stated in Section 5.0, it is recommended that enclosures should provide sufficient attenuation to achieve a maximum sound pressure level of 42 dB(A) from either enclosure, when measured at 1 m in all directions.

Based on the information provided, enclosures meeting the sound reduction indices as stated in Table 6.2 should be suitable to achieve this.

Mitigation	*Required Attenuation (dB) in each Frequency Band*							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Enclosures for All Units	6	7	10	12	18	18	14	13

Table 6.2: Required attenuation from mitigation

6.3 Noise Impact Assessment

The closest receivers have been identified as the following:

- Receiver 1: Rear window of 111 Gloucester Terrace:
  - 7 m from Units C1 & C2
  - 15 m from Units C3 & C4
- Receiver 2: Rear window of 117 Gloucester Terrace:
  - 18 m from Units C1 & C2
  - 7 m from Units C3 & C4

Direct line of sight has been assumed for all calculations.

Taking into account all necessary acoustic corrections, the resulting noise level at the identified residential windows would be as shown in Table 6.3. Detailed calculations are shown in Appendix B.

Receiver	Night-time Hours Criterion	Noise Level at Receiver (due to proposed & existing plant)
Receiver 1	26 dB(A)	26 dB(A)
Receiver 2		26 dB(A)

Table 6.3: Noise levels and project criterion at noise sensitive receivers

As presented in Table 6.3 and Appendix B, the proposed and existing plant installation with acoustic enclosures would be expected to meet the requirements of the proposed criteria.

6.4 British Standard Requirements

Further calculations have been undertaken to assess whether the noise emissions from the proposed and existing plant units would be expected to meet recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS 8233: 2014 recommends 30 dB(A) as being acceptable internal sleeping conditions during night-time.

With loudest external levels of 26 dB(A), acceptable internal conditions would be met without taking the attenuation of the window itself into consideration. According to BS 8233: 2014, a typical building facade with a partially open window offers 15 dB attenuation.

It can therefore be predicted that, in addition to meeting the requirements of the set criteria, the emissions from the proposed and existing plant would be expected to meet the most stringent recommendations of the relevant British Standard, with neighbouring windows partially open. Predicted levels are shown in Table 6.4.

Receiver	Recommended Target – *For sleeping conditions in a bedroom, in BS 8233: 2014*	Noise Level at Receiver (due to plant installation)
Inside Receiver 1	30 dB(A)	11 dB(A)
Inside Receiver 2		11 dB(A)

Table 6.4: Noise levels and BS 8233: 2014 criteria inside nearest residential space

7.0 CONCLUSION

An environmental noise survey has been undertaken at 113 Gloucester Terrace, London W2 3HB. The results of the survey have enabled criteria to be set for noise emissions from the proposed and existing plant in accordance with the requirements of the City of Westminster.

A noise impact assessment has then been undertaken using manufacturer noise data to predict the noise levels, due to the plant units, at the nearby noise sensitive receivers.

Calculations show that noise emissions from the proposed and existing units should meet the requirements of the City of Westminster with the recommended mitigation installed as stated herein.

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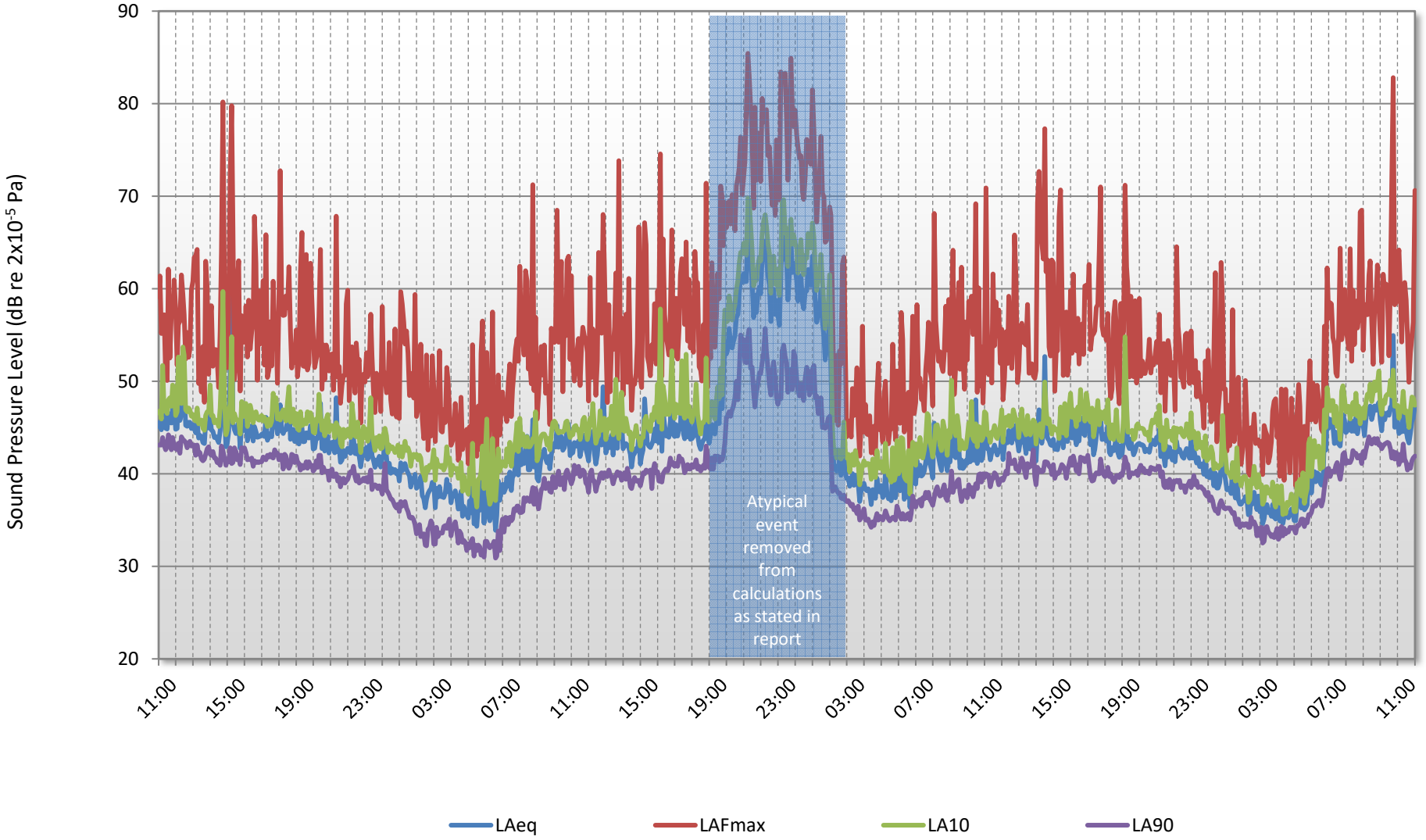
Reviewed	**Andrew Thomas** Senior Consultant BSc (Hons) MIOA		16 June 2022
Approved	**Duncan Martin** Director BSc (Hons) MIOA		16 June 2022

17142-SP1 RevA Site plan indicating proposed plant locations, noise monitoring position and nearest noise sensitive receivers

Date: 16 June 2022

Flats 4, 5 & 6, 113 Gloucester Terrace, London

Environmental Noise Time History
22 November 2021 to 25 November 2021



APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and 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 not 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 not 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 10 such octave bands whose centre frequencies are defined in accordance with international standards.

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 one alone and 10 sources produce a 10 dB 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 3 dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception 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 reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B1 - Receiver 1 Assessment

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Flats 4, 5 & 6, 113 Gloucester Terrace

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Receiver 1
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1 metre									
Daikin 4MXM80N9 (C1 & C2)	50	52	50	47	43	38	31	27	49
Correction for no. of units (2)	3	3	3	3	3	3	3	3	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (7 m) [1]	-17	-17	-17	-17	-17	-17	-17	-17	
Attenuation from Proposed Louvred Enclosure, dB	-6	-7	-10	-12	-18	-18	-14	-13	
Sound Pressure Level from Units C1 & C2 outside Receiver 1	**33**	**34**	**29**	**24**	**14**	**9**	**6**	**3**	25
Daikin 4MXM80N9 (C3 & C4)	50	52	50	47	43	38	31	27	
Correction for no. of units (2)	3	3	3	3	3	3	3	3	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (15 m) [1]	-24	-24	-24	-24	-24	-24	-24	-24	
Attenuation from Proposed Louvred Enclosure, dB	-6	-7	-10	-12	-18	-18	-14	-13	
Sound Pressure Level from Units C3 & C4 outside Receiver 1	**26**	**27**	**22**	**17**	**7**	**2**	**-1**	**-4**	18
Cumulative sound pressure level at Receiver 1	**34**	**35**	**30**	**25**	**15**	**10**	**7**	**4**	**26**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**26**

BS 8233 ASSESSMENT CALCULATION

Receiver: Receiver 1
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	34	35	30	25	15	10	7	4	26
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside Receiver 1	**19**	**20**	**15**	**10**	**0**	**-5**	**-8**	**-11**	**11**

Design Criterion	**30**

APPENDIX B2 - Receiver 2 Assessment

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Flats 4, 5 & 6, 113 Gloucester Terrace

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Receiver 2
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1 metre									
Daikin 4MXM80N9 (C1 & C2)	50	52	50	47	43	38	31	27	49
Correction for no. of units (2)	3	3	3	3	3	3	3	3	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (18 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Attenuation from Proposed Louvred Enclosure, dB	-6	-7	-10	-12	-18	-18	-14	-13	
Sound Pressure Level from Units C1 & C2 outside Receiver 2	**25**	**26**	**21**	**16**	**6**	**1**	**-2**	**-5**	17
Daikin 4MXM80N9 (C3 & C4)	50	52	50	47	43	38	31	27	
Correction for no. of units (2)	3	3	3	3	3	3	3	3	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (7 m) [1]	-17	-17	-17	-17	-17	-17	-17	-17	
Attenuation from Proposed Louvred Enclosure, dB	-6	-7	-10	-12	-18	-18	-14	-13	
Sound Pressure Level from Units C3 & C4 outside Receiver 2	**33**	**34**	**29**	**24**	**14**	**9**	**6**	**3**	25
Cumulative sound pressure level at Receiver 2	**34**	**35**	**30**	**25**	**15**	**10**	**7**	**4**	**26**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**26**

BS 8233 ASSESSMENT CALCULATION

Receiver: Receiver 2
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	34	35	30	25	15	10	7	4	26
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside Receiver 2	**19**	**20**	**15**	**10**	**0**	**-5**	**-8**	**-11**	**11**

Design Criterion	**30**