RSK Acoustics

British Museum Gallery 33

Plant Noise Assessment

Report 206/0622/R1

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Report 206/0622/R1

British Museum

Great Russell Street
London
WC1B 3DG

Revision	Description	Date	Prepared	Approved
0	First Issue	22nd October 2021	Fred Davies	Andy Emery

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Plant Noise Assessment

1 Introduction

1.1 It is proposed to install new ventilation mechanical services plant at the British Museum which will serve Gallery 33.

1.2 This report details a noise survey undertaken at the site to quantify the existing noise climate and derive atmospheric plant noise limits in accordance with the requirements of the Local Authority. A subsequent assessment of the plant noise emission levels of the proposed installation has been undertaken to determine if any mitigation is required to meet the plant noise limits.

2 Site Description

2.1 The site is located at the British Museum, Great Russell Street, London WC1B 3DG. The site and its surrounds are illustrated on the attached site plan 206/0622/SP1.

2.2 The site is bounded by Montague Place to the northwest and Russell Street to the southeast. Terraced properties neighbour the site to the northeast and southwest which face onto Montague Street and Bedford Square/Bloomsbury Street respectively.

2.3 Mechanical service items are to be installed in lightwells adjacent to Gallery 33 towards the north-eastern side of the museum. These areas are highlighted in the attached site plan 206/0622/SP1.

2.4 The nearest residential receiver to these proposed installations is to the west of the site on Bedford Square which overlook a garden area associated with the museum.

2.5 The site is within the jurisdiction of the London Borough of Camden.

3 Environmental Noise Survey

3.1 **Methodology and Instrumentation**

3.1.1 An unattended noise survey was undertaken at the site between 1300 hours on Thursday 21st October and 1300 hours on Friday 22nd October 2021.

3.1.2 Spot check measurements were also taken to quantify the existing noise climate within the lightwells in which plant is to be installed or modified.

3.1.3 Measurements of noise levels were taken from two measurement positions indicated on the attached site plan 206/0622/SP1 and described below:

- MP1: Free-field measurement position in a garden area in the northwest corner of the British museum, approximately 1.5 m above local ground level and 6 m from the façade of the nearest noise sensitive receptor.

- MP2: At the base of the lightwell to the northwest, representative of the nearest museum gallery window.

3.1.4 Measurements of L_{Aeq}, L_{A90}, L_{Amax} were recorded over consecutive 15-minute periods (see Glossary of Acoustic Terms for an explanation of the noise units used) for the duration of the unattended survey at MP1 using the equipment listed within table T1 below. The same equipment was utilised for a spot check measurement at MP2 shortly before commencement of the unattended survey.

Item	Manufacturer	Type
Sound Level Analyser	Rion	NL-52
Acoustic Calibrator	Rion	NC-74
Weatherproof windshield	Rion	WS-15

T1 Equipment used during noise survey.

3.1.5 The microphone was enclosed within a weatherproof windshield and the sound level meter was calibrated before and after the survey to confirm an acceptable level of accuracy. No significant drift was noted to have occurred.

3.1.6 The weather conditions when setting up and collecting the equipment were clear, cool and sunny with a light breeze.

3.2 Results

3.2.1 The results of the noise survey measurements are presented within the attached time-history graph 206/0622/TH1.

3.2.2 The measured background noise levels derived following guidance in BS 4142:2014+A1:2019[1] can be seen in table T2 below.

[1] British Standard BS4142:2014 - Methods for rating and assessing industrial and commercial sound

Location	Representative Measured Background Noise Level, dB(A)	
	Daytime (0700-2300)	Night time (2300-0700)
MP1: Garden area to the northwest	47	45

T2 Representative measured background noise levels, $L_{A90,15min}$.

3.2.3 The noise climate within this garden area was dominated by road noise from the surrounding roads, with some contribution from various existing plant items.

3.2.4 At position MP2 within the lightwell, the representative background noise level is 51 dB L_{A90}. The noise climate within the lightwell was constant and was dominated by existing mechanical services plant.

4 Noise Emission Criteria

4.1 Local Authority Criteria

4.1.1 Policy A4 of the London Borough of Camden's *Local Plan 2017* relates specifically to noise:

'We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity.

Planning conditions will be imposed to require that plant and equipment which may be a source of noise is kept working efficiently and within the required noise limits and time restrictions.

Conditions may also be imposed to ensure that attenuation measures are kept in place and are effective throughout the life of the development.'

4.1.2 With regard to noise from new mechanical services plant, Appendix 3 of the Local Plan sets out the following:

'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 (15 dB if tonal components are present) should be considered as the design criterion).'

4.1.3 This states that noise emission from the proposed plant should not exceed 10 dB below the existing background noise level at the nearest residential property or 15 dB for plant items that contain a tonal characteristic.

4.2 BS 4142 Guidance

4.2.1 When considering noise emission from the proposed plant to the nearest on-site museum gallery window, it may not be possible and will not be necessary for planning to achieve the limit required by the Local Authority at off-site residential receivers. Therefore, it is normal to follow guidance in BS 4142:2014 when setting noise limits. Section 1.1 of this standard states the following:

This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;

b) sound from fixed installations which comprise mechanical and electrical plant and equipment

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

4.2.2 The methodology in the standard compares the measured or calculated rating level of the noise from the source and compares it to the representative existing measured L_{A90} background noise level for the period concerned.

4.2.3 The higher the excess of rating level over background noise level, the greater the likelihood of an adverse noise impact. BS4142:2014 gives the following guidance:

Typically, the greater this difference, the greater the magnitude of the impact.

A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4.2.4 To minimise risk of disturbance to the museum itself, we recommend that plant noise at the closest gallery window be designed to a rating level 5 dB below the existing representative L_{A90} background noise levels recorded at MP2 within the proposed plant area.

4.3 Noise Emission Limits

4.3.1 Based on the results of the background noise survey set out within table T2 above in addition to the guidance set out in Sections 4.1 and 4.2 above, the following plant noise limits are recommended to apply at the nearest noise sensitive locations, denoted as positions AP1 and AP2 in 206/0622/SP1.

Location	Noise Emission Limit, $L_{Ar,Tr}$ dB (for plant with no distinguishing feature) Daytime (0700-2300 only)	Night time (24-hour)
AP1 - Nearest residential receivers	37	35
AP2 - Nearest museum gallery window	46	N/A

T3 Plant noise emission limits at the nearest residential properties.

4.3.2 These limits are to apply to all plant items running simultaneously in the representative time periods when running at design duty, at 1 m from the outside the relevant windows.

5 Noise Assessment

5.1 Proposed Installation

5.1.1 A new extraction fan with external noise emissions is proposed to be installed within the northwest lightwell indicated on the attached site plan 206/0622/SP1. This is defined below:

- Extract Fan - *Vent Axia* ACQ31514HD

5.1.2 The noise data for the planned plant item can be seen in the attached plant noise schedule 206/0622/PNS1. This noise data was provided by the manufacturer and suggests no signs of tonality, intermittency, impulsivity or any other attention drawing characteristic.

5.1.3 Modifications are also proposed to room side ducting on the existing supply air ventilation system within the northeast lightwell highlighted within the attached site plan 206/0622/SP1. These modifications are not expected to have any effect on the atmospheric side of the ventilation system so noise levels from existing unit are not considered within this report.

5.1.4 It is assumed that the ventilation systems will only be required to run during museum opening times.

5.2 Methodology

5.2.1 Noise levels have been calculated to two assessment positions representing the nearest and most exposed noise sensitive receivers to the proposed plant. The assessment positions are labelled in the attached site plan 206/0622/SP1 and detailed below:

- AP1: A residential window on the 2nd floor of 1B Montague Place, facing the site.
- AP2: A window to Gallery 33, facing the lightwell containing the proposed plant installation.

5.2.2 The noise levels generated by the mechanical services plant at the assessment position have been calculated by correcting for radiation losses, façade reflections, distance and screening losses, where appropriate.

5.3 Required Mitigation

5.3.1 The results of the assessment indicate that mitigation of noise emissions from the extract fan will be required to meet to noise limits set for the closest gallery window within Section 4.3 above. It will be necessary to install an attenuator onto the atmospheric outlet of the extract fan.

5.3.2 This attenuator must meet the insertion losses in each octave band as defined in table T4 below:

Attenuator	Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
ATT-01 – Extract Outlet	3	5	7	16	21	22	16	15

T4 Attenuator insertion loss requirements (atmospheric side).

5.3.3 We would expect the insertion losses required for the attenuator ATT-01 to be achievable with a silencer of 600 mm length and 315 mm diameter which can be supplied by Vent-Axia or other acoustic hardware manufacturer.

5.3.4 To minimise any regenerated noise, any pressure drops from the attenuator and any duct termination device should be limited to no more than 25 Pa.

5.3.5 The extract fan should be mounted on suitable anti-vibration mounts to minimise any structure borne noise transfer.

5.4 Assessment Results

5.4.1 With the specified mitigation measures in place, we have assessed the following noise levels at each respective assessment position in table T5 below. Results can also be seen in the attached summary calculations sheets 206/0622/CS1 to CS6.

Location	**Rating Noise Level, dB(A)** *(Limit)*
	Museum Opening Times (1000-1700)
AP1 – 1B Montague Place	13 *(37)*
AP2 – Gallery Window	45 *(46)*

T5 Plant noise emission levels at the nearest noise sensitive receivers.

6 Conclusions

6.1 It is proposed to install new ventilation mechanical services plant at the British Museum which will serve Gallery 33.

6.2 This report has provided details of a noise survey conducted at the site and has set noise emission limits for the proposed plant item in line with BS4142:2014+A1:2019 and the local authority requirements.

6.3 A noise impact assessment has been conducted of noise from the proposed plant items. The assessment has shown that an attenuator fixed to the extract fan outlet will be required for the plant noise limits set to be achieved.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

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Figure 206/0622/SP1

Title:

Site plan showing the site location and the measurement and assessment positions.

Key:

- Measurement Position
- Assessment Position
- Approximate Site Boundary
- Areas containing mechanical services plant

North

Project:

British Museum Gallery 33

Date: October 2021

Revision: -

Scale:

Not to scale

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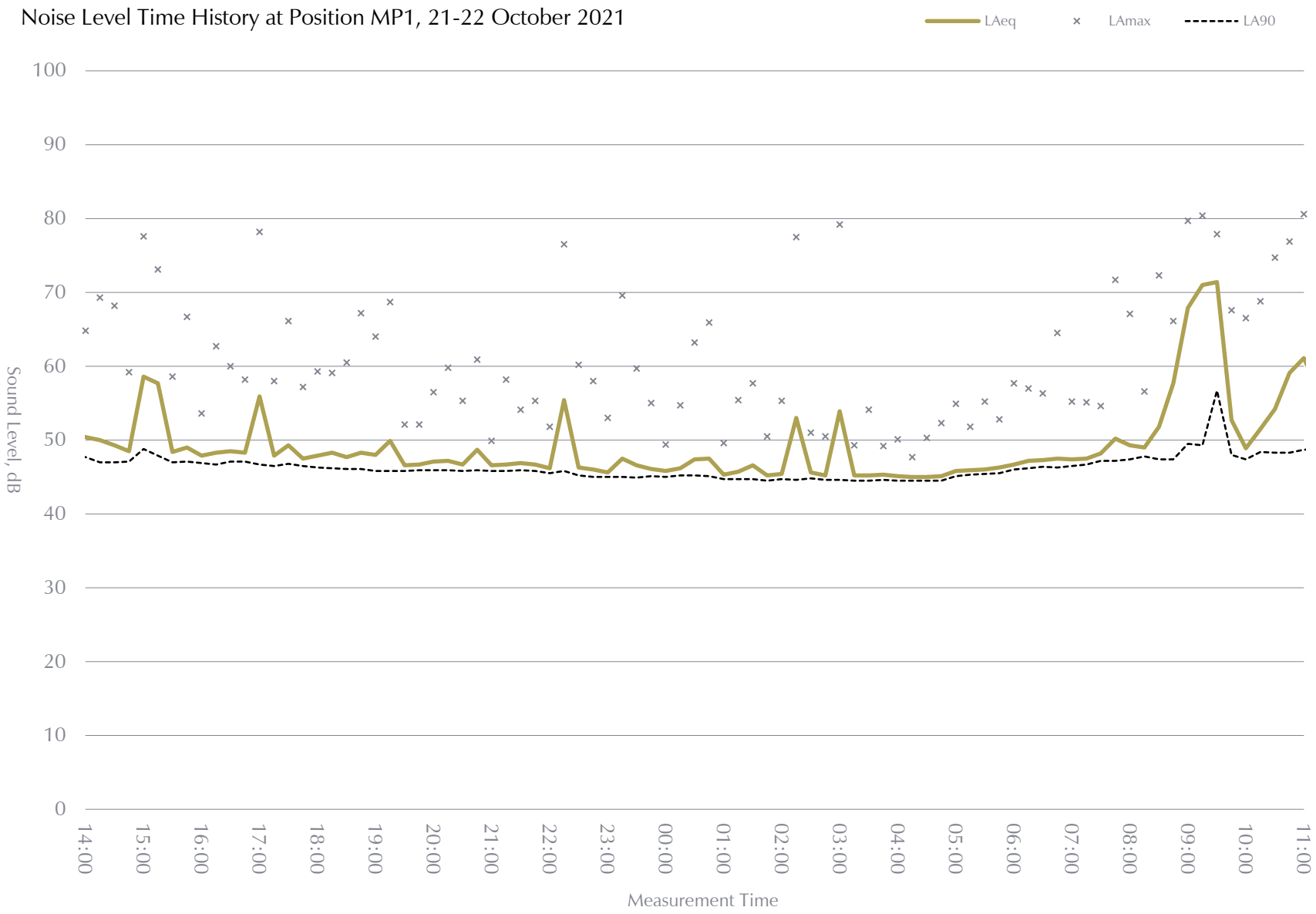


Figure 206/0622/TH01

Schedule of Plant and Air Handling Equipment Sound Levels, dB

Reference	Description	Data Source [1]	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
Breakout	Vent Axia - ACQ31514HD	Man	Sound Power, Lw	53.0	67.0	61.0	52.0	47.0	41.0	34.0	33.0
Outlet	Vent Axia - ACQ31514HD	Man	Sound Power, Lw	67.0	75.0	77.0	71.0	69.0	62.0	56.0	49.0

Notes

1 - Man refers to data supplied by the equipment manufacturer or supplier, Emp refers to data calculated using empirical formulae, and Meas refers to data measured by RSK Acoustics.

Calculation Sheet 206/0622/CS1

Outlet to AP1

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - Outlet									
Sound Power Levels		**67.0**	**75.0**	**77.0**	**71.0**	**69.0**	**62.0**	**56.0**	**49.0**
Silencer									
Silencer - ATT-01									
		-3.0	*-5.0*	*-8.0*	*-16.0*	*-21.0*	*-22.0*	*-16.0*	*-15.0*
End Reflection									
Width/Diameter (m)	0.8								
Length (m)	0.8								
Rec or Circ - Rectangular									
Free or Flush - Free Space									
		-7.9	*-2.5*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	75.0								
		-37.5	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*
Screening									
Reflection (dB)	-10.0								
		-10.0	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*
Facade Reflection									
Reflection (dB)	3.0								
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
External Receiver								
External Receiver - AP1								
Levels after correction	**6.7**	**18.0**	**19.5**	**5.5**	**-1.5**	**-9.5**	**-9.5**	**-15.5**

Calculation Sheet 206/0622/CS2

Breakout to AP1

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - Breakout									
Sound Power Levels		**53.0**	**67.0**	**61.0**	**52.0**	**47.0**	**41.0**	**34.0**	**33.0**
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	75.0								
		-37.5	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*	*-37.5*
Screening									
Reflection (dB)	-10.0								
		-10.0	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*	*-10.0*
Facade Reflection									
Reflection (dB)	3.0								
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*
External Receiver									
External Receiver - AP1									
Levels after correction		**3.5**	**17.5**	**11.5**	**2.5**	**-2.5**	**-8.5**	**-15.5**	**-16.5**

Outlet to AP2

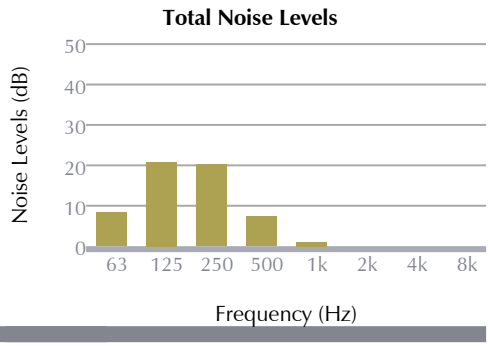
		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Outlet									
Sound Power Levels		**67.0**	**75.0**	**77.0**	**71.0**	**69.0**	**62.0**	**56.0**	**49.0**
Silencer									
Silencer - ATT-01									
		-3.0	*-5.0*	*-8.0*	*-16.0*	*-21.0*	*-22.0*	*-16.0*	*-15.0*
End Reflection									
Width/Diameter (m)	0.8								
Length (m)	0.8								
Rec or Circ - Rectangular									
Free or Flush - Free Space									
		-7.9	*-2.5*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
Width (m)	0.8								
Height (m)	0.8								
Vertical (°)	60.0								
Horizontal (°)	0.0								
		0.5	*1.0*	*1.5*	*1.5*	*2.0*	*1.5*	*1.5*	*1.5*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	7.0								
		-16.9	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Facade Reflection									
Reflection (dB)	3.0								
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*
External Receiver									
External Receiver - AP2									
Levels after correction		**37.8**	**49.6**	**51.6**	**37.6**	**31.1**	**22.6**	**22.6**	**16.6**

Breakout to AP2

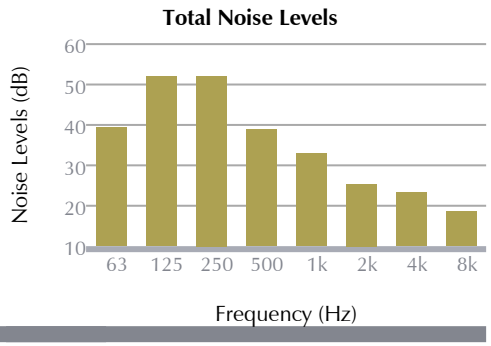
		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - Breakout									
Sound Power Levels		**53.0**	**67.0**	**61.0**	**52.0**	**47.0**	**41.0**	**34.0**	**33.0**
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	7.0								
		-16.9	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*	*-16.9*
Facade Reflection									
Reflection (dB)	3.0								
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*
External Receiver									
External Receiver - AP2									
Levels after correction		**34.1**	**48.1**	**42.1**	**33.1**	**28.1**	**22.1**	**15.1**	**14.1**

Project Name	British Museum Gallery 33
Project Reference	206/0622
Receiver Reference	AP1
Description	1 Montague Place
Noise Limit	37
dBA	13.4



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Outlet	6.7	18.0	19.5	5.5	-1.5	-9.5	-9.5	-15.5
Breakout	3.5	17.5	11.5	2.5	-2.5	-8.5	-15.5	-16.5

Project Name	British Museum Gallery 33
Project Reference	206/0622
Receiver Reference	AP2
Description	Gallery Window
Noise Limit	46
dBA	45.1



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Breakout	34.1	48.1	42.1	33.1	28.1	22.1	15.1	14.1
Outlet	37.8	49.6	51.6	37.6	31.1	22.6	22.6	16.6

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