

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Alberton House, Manchester

Planning noise report

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

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A	26 Oct 21	Initial issue	Christian Clark	James Atha
B	10 Dec 21	Deliveries section added	Christian Clark	James Atha
C	6 May 22	Updates to noise egress assessments	Christian Clark	James Atha
D	21 Jun 22	Updates following comments from Deloitte	Christian Clark	James Atha
E	29 Jun 22	Updates following comments from Deloitte	Christian Clark	James Atha

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Summary

Sandy Brown has been commissioned by Bruntwood RB Limited to provide acoustic advice in relation to the proposed development at Alberton House in Manchester.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was carried out between 12:00 on 1 October 2021 and 12:00 on 11 October 2021.

The survey results have been used to set appropriate limits for atmospheric noise emissions from building services plant, operational noise and amplified sound in line with the requirements of Manchester City Council.

Measured ambient noise levels were in the range $L_{Aeq,15min}$ 55 to 60 dB during the day, and $L_{Aeq,15min}$ 52 to 57 during the night. The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 42 dB at night.

The noise data collected has been used to determine the following plant noise limits:

- L_{Aeq} 52 dB during the daytime at 1 m from the facade of Century Buildings and Cardinal House.
- L_{Aeq} 49 dB during the night at 1 m from the facade of Century Buildings.
- L_{Aeq} 49 dB during the daytime at 1 m from the facade of Albert Bridge House and No 2 St Mary's Parsonage.

Criteria for operational noise associated with use of the terrace spaces have been suggested. It is considered that an external noise limit of $L_{Aeq,1hr}$ 55 dB between 07:00 – 23:00 hrs would be appropriate outside nearby noise sensitive receptors due to people speaking on the terrace. The predicted worst-case levels meet this outside the nearest commercial receptors and are significantly below this outside the nearest residential premises. Manchester City Council does not normally support use of the external terrace after 11pm or amplified sound on the external terrace. If this is proposed, further assessment will be required.

Limits to amplified sound egress has been advised in octave bands based on the requirements of Manchester City Council. This will need to be considered further as the design progresses, particularly if the retail unit proposed includes any loud amplified sound.

Contents

1	Introduction.....	5
2	Site description	5
3	EIA scoping response	6
4	Noise survey method	7
5	Noise survey results	8
6	Plant noise egress assessment	14
7	Operational noise.....	16
8	Construction noise and vibration assessment.....	24
9	Conclusion	25
	Appendix A	26
	Survey details.....	26
	Appendix B	29
	Results of unattended measurements at Location 7.....	29
	Appendix C	31
	Results of unattended measurements at Location 8.....	31

1 Introduction

Sandy Brown has been commissioned by Bruntwood RB Limited to provide acoustic advice in relation to the proposed development at Alberton House.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing sound levels on and around the site to allow appropriate limits for noise egress from the development to be set in line with the requirements of Manchester City Council.

This report presents the survey method and results, and appropriate limits for noise egress from the development.

2 Site description

2.1 The site and its surrounding

The site is shown in relation to its existing surroundings in Figure 1.

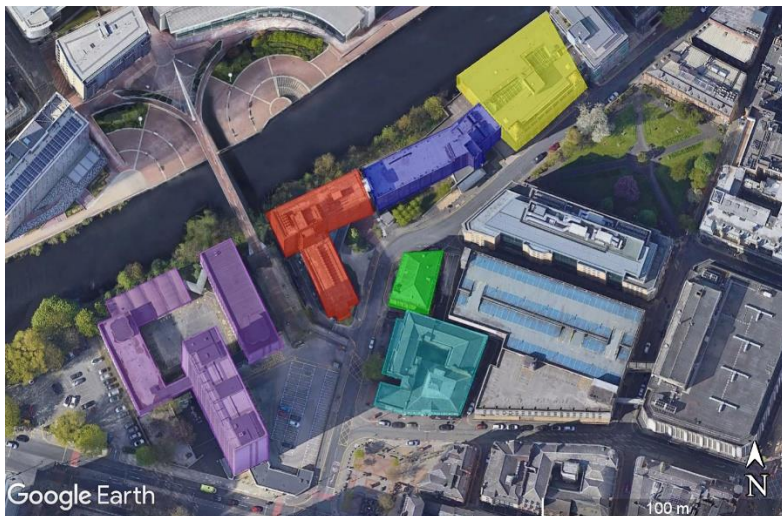


Figure 1 Aerial view of site (courtesy of Google Earth Pro)

There is an existing building on the site (shown in red) which is to be demolished and is proposed to be replaced with a new 19 storey office block, including retail use at ground floor level, a basement gym, wellness centre on levels 17 & 18, and rooftop amenity space, including an internal events space. External terrace areas are proposed as part of the development.

The site is adjacent to commercial premises including Albert Bridge House (shown in purple in Figure 1), Cardinal House (shown in blue), Reedham House (shown in cyan) and No 2 St Mary's Parsonage (shown in green) which all contain commercial office accommodation.

Also adjacent to the site is residential premises in the Century Buildings (shown in yellow). The Lowry Hotel is located across the River Irwell to the north.

3 EIA scoping response

The EIA scoping responses received from Manchester City Council for the development are provided below. This report is intended to address each of these.

- I. Internal noise levels need to meet the criteria set out in MCC's Planning Noise Guidance document and consider details of the maximum internal noise level permissible to not exceed the external levels recommended, details of façade / glazing / door performance, details of any lobbied door system and performance / specification.*
- II. In terms of noise from the external terrace the assessment should confirm the distance to the receptors. It will need to confirm and agree the proposed number of patrons / terrace capacity and hours of use for the external areas, especially as the assessment refers to over 600 people using the external roof terrace which would be far too excessive with residential nearby. The assessment can be based on 50% of people talking as included in the scoping report. The use of external speakers or music of any kind in the external terraces would not be supported and the use would not be supported beyond 23:00 (shorter hours may be recommended once the full details are known).*
- III. Any plant to be installed will need to be selected and designed and subsequently be assessed against MCC's Planning Noise Guidance document (including kitchen extraction). The representative background noise has been provided which is accepted (North and East Elevation 54dB day and 51dB Night, and South and West elevations 51dB and 48dB night). However, the proposed limits do not seem to correspond to the background noise levels and the 5dB below criteria as they appear to be higher than the criteria and this needs to be reviewed*
- IV. Construction noise impacts will be assessed and managed through measures in the CEMP and noise and vibration control measures including site noise and vibration levels will need to be agreed by MCC.*

4 Noise survey method

4.1 Attended measurements

Attended sample measurements were taken by Christian Clark at 6 locations around the site. These are indicated in Figure 1 as positions 1 to 6. The measurements were carried out on 6 October 2021, over 15 minute periods during the daytime.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 1 m from any other reflective surface. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

4.2 Unattended measurements

Unattended noise monitoring was undertaken at the site over 10 days (in total) at two positions.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements at position 1 were taken over 15 minute periods between 12:00 on 1 October 2021 and 11:00 on 6 October 2021. The unattended measurements at position 2 were taken over 15 minute periods between 12:00 on 6 October 2021 and 12:00 on 11 October 2021. The equipment was installed by Jose Maria Gonzales and collected by Christian Clark.

The measurement positions used during the survey is indicated in Figure 1, denoted by the position numbers '7' and '8'. A photograph showing the measurement locations are provided in Figure 2. These locations were chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.



Figure 2 Location of measurement positions 7 (left) and 8 (right)

4.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

5 Noise survey results

5.1 Observations

The dominant noise sources observed at the site during the survey were from road traffic, predominantly from Bridge Street, and to a lesser degree from St Mary's Parsonage. Less significant noise sources included faint plant noise, van loading from Alberton House and pedestrian conversation.

5.2 Noise measurement results

5.2.1 Unattended measurement results

A graph showing the results of the unattended measurements is provided in Appendix B. Day and night-time ambient noise levels measured during the unattended survey are presented in Table 1. Measured minimum background sound levels are given in Table 2. These measurements are free-field.

Table 1 Ambient noise levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Position 7		
Friday 1 October 2021	-	54
Saturday 2 October 2021	56	54
Sunday 3 October 2021	55	52
Monday 4 October 2021	56	52
Tuesday 5 October 2021	57	52
Position 8		
Wednesday 6 October 2021	-	55
Thursday 7 October 2021	58	55
Friday 8 October 2021	59	57
Saturday 9 October 2021	60	57
Sunday 10 October 2021	57	53
Average	57	54

Table 2 Minimum background sound levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Position 7		
Friday 1 October 2021	53 ^[1]	51
Saturday 2 October 2021	52	51
Sunday 3 October 2021	52	50
Monday 4 October 2021	52	50
Tuesday 5 October 2021	52	50
Wednesday 6 October 2021	53 ^[1]	
Position 8		
Wednesday 6 October 2021	50 ^[1]	48
Thursday 7 October 2021	50	47
Friday 8 October 2021	52	47
Saturday 9 October 2021	49	45
Sunday 10 October 2021	46	42
Monday 11 October 2021	51 ^[1]	-

^[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 42 dB at night.

Daytime and night time statistical analysis of representative values for the site are given in Figure 3, Figure 4, Figure 5 and Figure 6.

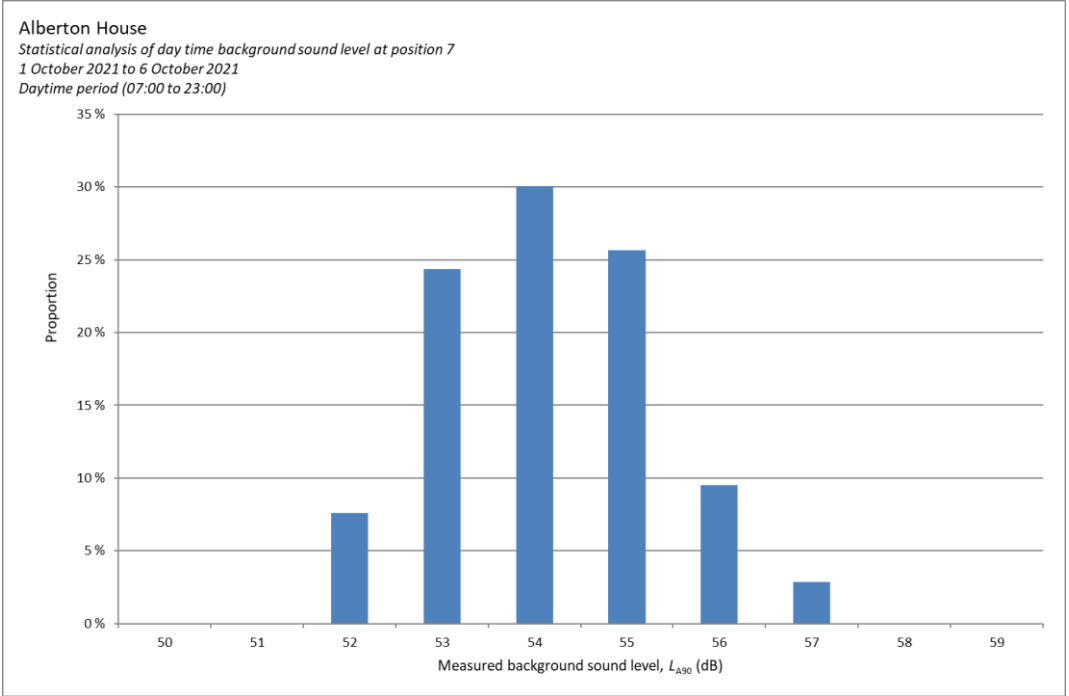


Figure 3 Statistical analysis of day-time background noise levels at location 7

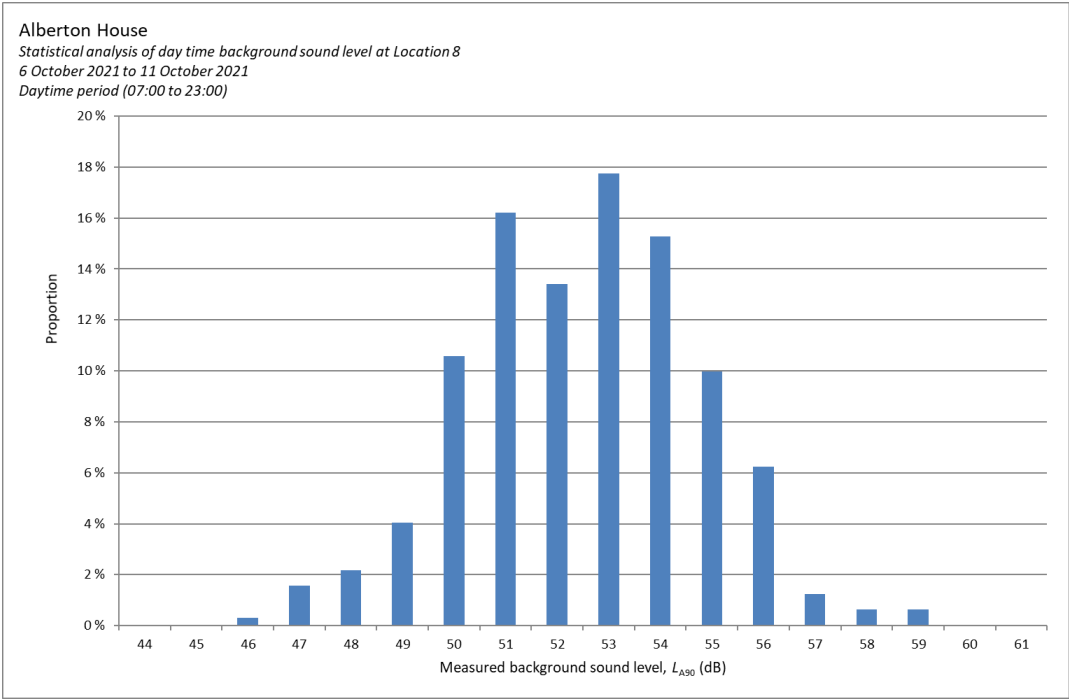


Figure 4 Statistical analysis of day-time background noise levels at location 8

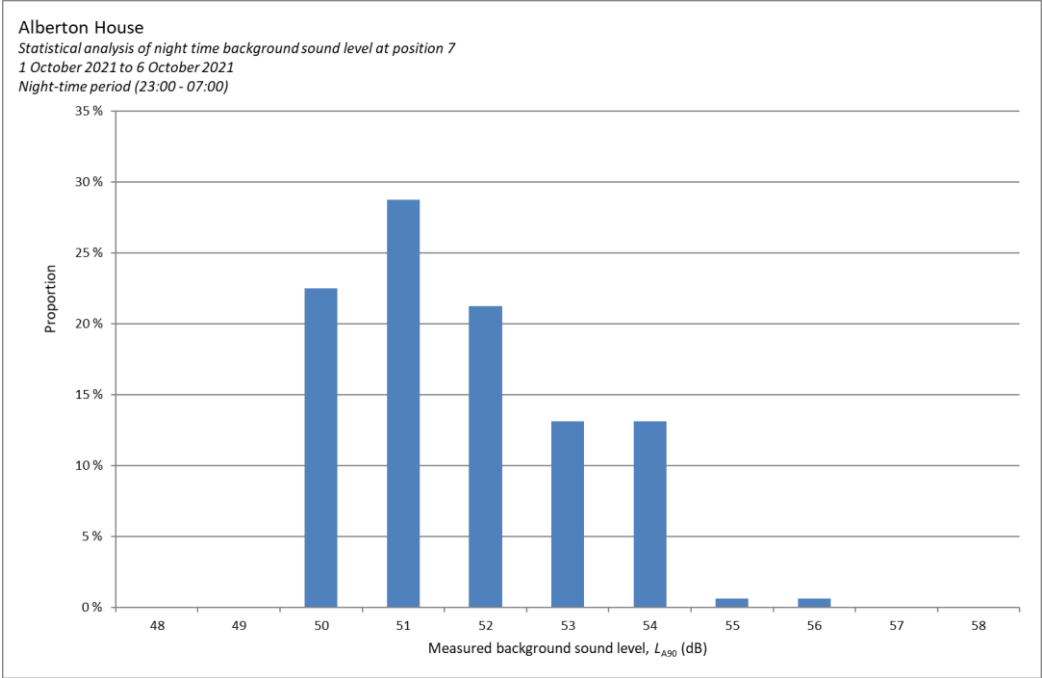


Figure 5 Statistical analysis of night-time background sound levels at position 7

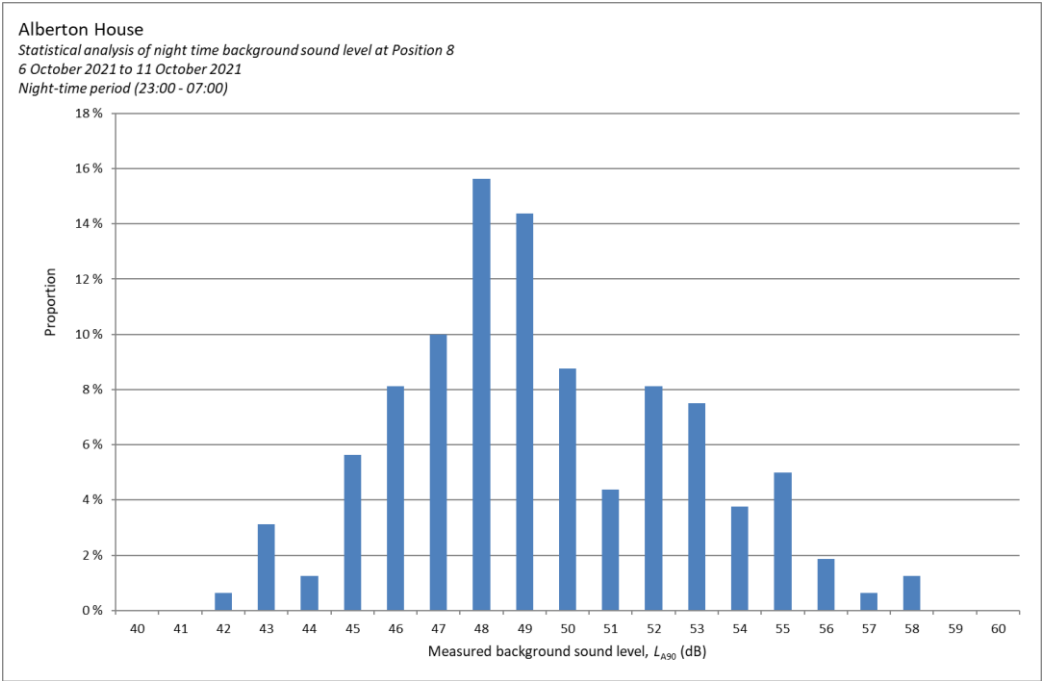


Figure 6 Statistical analysis of night-time background sound levels at position 8

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 54 dB during the daytime and $L_{A90,15min}$ 51 dB at night to premises to the North and East. The representative background sound levels were $L_{A90,15min}$ 51 dB during the daytime and $L_{A90,15min}$ 48 dB to premises to the south and west of the site.

5.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 3. The measurements are free-field.

Table 3 Noise levels and key noise sources from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
1	9:33	63	84	56	Regular traffic from Bridge Street and St Mary's Parsonage.
2	9:49	55	79	51	Road traffic from Bridge Street (from the bridge). Construction and plant noise (origin unknown), regular pedestrian traffic.
3	9:17	65	96	52	Regular traffic on Bridge Street. Occasional traffic from St Mary's Parsonage.
4	9:01	62	80	54	Loading van from Alberton house, traffic from bridge street. Occasional traffic on St Mary's Parsonage.
5	8:45	60	80	53	Loading van from Alberton House. Occasional traffic on St Mary's Parsonage. Moderate pedestrian conversation.
6	10:15	50	68	48	Road traffic from both nearby bridges. Distant construction noise.

6 Plant noise egress assessment

6.1 BS 4142

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

6.2 Local authority requirements

Manchester City Council (MCC) provides guidance in relation to plant noise emissions in their *Noise and Planning Guidance* document dated May 2022. The following is stipulated:

'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.'

6.1 Plant noise limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 4.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. These have been corrected relative to the measured free-field background noise levels by the addition of 3 dB.

In this case these limits would apply at Albert Bridge House, Cardinal House and No 2 St Mary's Parsonage during the daytime, and at Century Buildings during the day and night-time.

Noise sensitive receptor	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB) ^[2]	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Cardinal House	52	-
Century Buildings	52	49
Albert Bridge House	49	-
No 2 St Mary's Parsonage	49	-
Reedham House	49	-

The limits set out in Table 4 do not include any attention catching features. The penalty corrections for attention catching features may be significant, and will need to be considered as the building services design progresses. This is discussed in Appendix C.

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features.

[illegible]

Page 15 of 32

The mitigation strategy for the external plant proposed is currently under development, but this will be designed to ensure that the limits outlined in Table 4 are met.

7 Operational noise

7.1 External terraces

An external terrace is proposed at the roof level of the building, and an external retail terrace is proposed at the ground floor. The exact occupancy rates on the rooftop terrace have not been confirmed, but an assumed worst-case of 1 person per 2 m² has been assumed, however this is subject to confirmation and may be limited by fire regulations.

The ground floor terrace has an assumed occupancy of 44 based on the furniture layout.

7.1.1 Proposals

The proposed terrace spaces at roof level are shown in Figure 8 and Figure 9. The proposed terrace space at ground level is shown in Figure 10.



Figure 8 Location of the proposed rooftop terrace

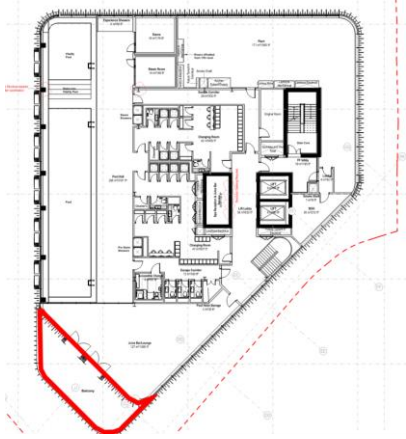


Figure 9 Location of proposed balcony at roof level

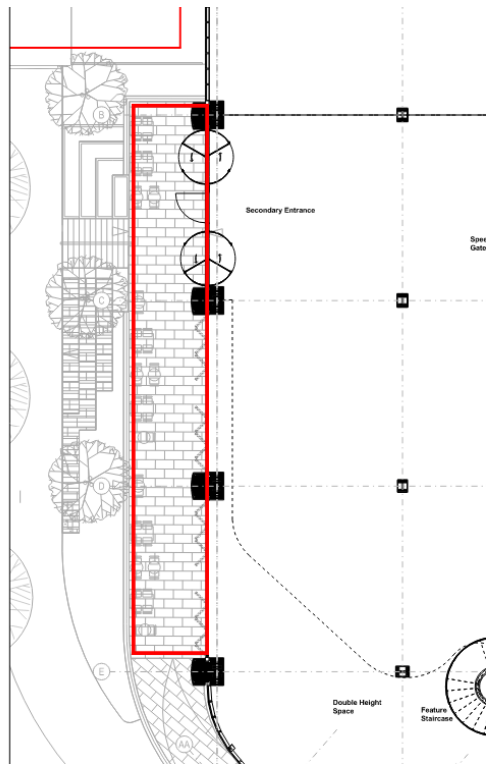


Figure 10 Location of the proposed terrace at the ground floor

7.1.2 Guidelines on noise egress

MCC do not stipulate any specific criteria in relation to noise egress associated with operational noise from the occupants of external amenity spaces. However the *Noise and*

Planning Guidance document dated May 2022 refers to the WHO *Guidelines for Community Noise* 1999.

The guideline values provided in the WHO guidelines for the impact of community noise on residential premises is given in Table 5.

Table 5 WHO guidelines for impact from community noise

Specific environment	Health effect	Noise level
Outdoor living areas	Serious annoyance, daytime and evening	$L_{Aeq,16hr}$ 55 dB
	Moderate annoyance, daytime and evening	$L_{Aeq,16hr}$ 50 dB
Outside bedrooms	Sleep disturbance, window open	$L_{Aeq,8hr}$ 45 dB

The worst affected nearby residential premises to the proposed terraces are the proposed apartments located at Century buildings.

Given that speech noise associated with the rooftop terraces is only likely to occur during peak periods and not for the whole 16 hour time base given during the daytime (07:00 to 23:00), and that the existing ambient noise levels exceed those provided in the WHO guidelines, the health effects are likely to be less severe than those stated. On the basis of the above, it is considered that an external noise level of $L_{Aeq,1hr}$ 55 dB between 07:00 – 20:00 hrs would be appropriate.

Manchester City Council do not typically permit the use of external terraces after 23:00, therefore use after 23:00 may not be possible.

Manchester City Council do not typically permit any external amplified sound on the external terraces.

7.1.3 Assessment

Noise modelling has been carried out to determine the potential impact of occupants of the roof terraces speaking upon the worst affected dwellings. 3D modelling has been carried out to assess the impact of the noise egress.

Noise calculations have been carried out with a total of 293 people on the roof terrace, 44 people on the ground floor terrace and 26 people on the balcony. The model assumes half of the people are talking simultaneously, of which 20% are talking with raised voices. Normal levels for speech of L_{Aeq} 60 dB at 1 m and raised voices of L_{Aeq} 66 dB at 1 m have been used in the assessment, as defined in ISO 9921.

The predicted operational noise levels to both Alberton House and nearby noise sensitive receptors are shown in Figure 11 and Figure 12. The receptors assessed are the following:

- Cardinal House, 43 m north-east of the rooftop terrace
- Century Buildings, 66 m north-east of the rooftop terrace
- Albert Bridge House, 55 m west of the rooftop terrace
- No 2 St Mary's Parsonage, 53 m east of the rooftop terrace
- Reedham House, 53 m east of the rooftop terrace.

All noise sensitive premises are screened from the rooftop terrace by a perimeter balustrade of height 1.4 m

Predicted noise levels with all terraces in use at the nearest residential premises are well within the suggested criteria, with a worst-case level of L_{Aeq} 42 dB. This is also below the existing daytime background noise levels measured during the survey.

Although there are no specific guidelines on operational noise to commercial/office spaces, the predicted from the ground level terrace to the Alberton House Building will be considered to inform the facade sound insulation strategy. The predicted levels outside the other nearby commercial receptors are L_{Aeq} 55 dB or lower. This is equivalent to the existing daytime ambient noise levels measured during survey, which indicates a low risk of noise disturbance.

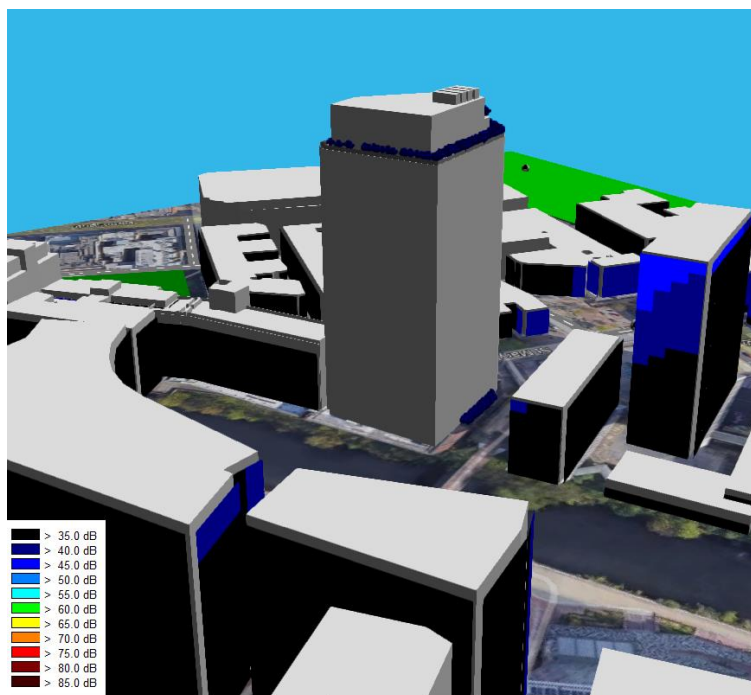


Figure 11 Predicted noise egress levels during the daytime

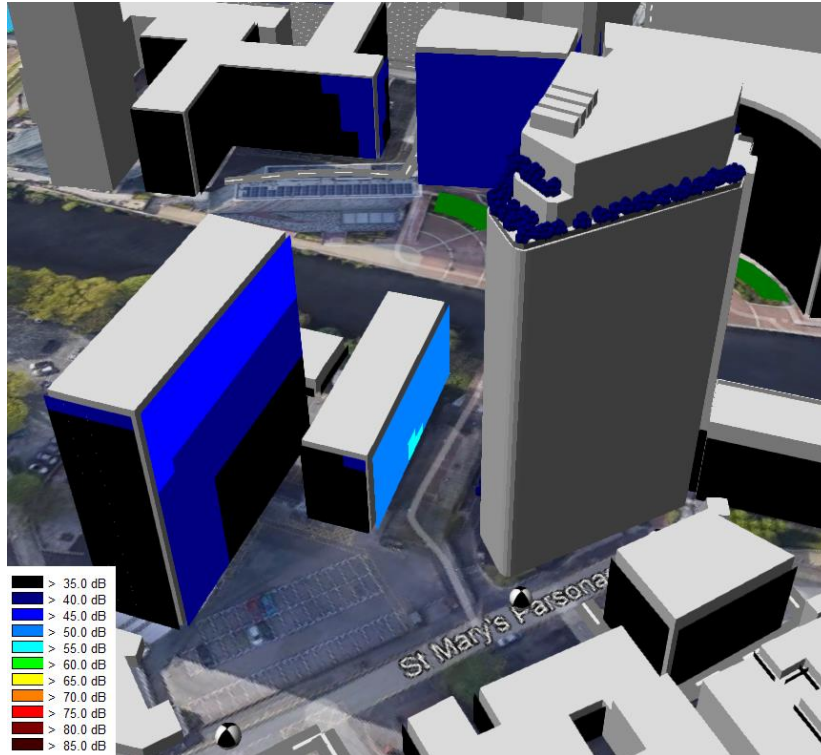


Figure 12 Predicted noise egress levels during the daytime

If any external amplified is proposed to the terrace areas, an assessment would need to be provided to Manchester City Council to demonstrate that the proposals would meet with their requirements, which are discussed below.

7.2 Amplified sound egress

7.2.1 Limits

The cumulative noise level resulting from amplified sound egress associated with the scheme should not exceed 5 dB below the existing background (L_{A90}) in each octave band at 1 m from the most affected windows of the nearest noise sensitive premises. These limits are set out in Table 6. This is in line with the MCC *Noise and Planning Guidance* document dated May 2022.

Table 6 Amplified sound limits at 1 m from the nearest noise sensitive premises

	Maximum sound pressure level at 1m from noise sensitive premises, $L_{eq,5min}$ (dB) ^[3]							
	Octave-band centre frequency (Hz)							L_{Aeq}
	63	125	250	500	1k	2k	4k	
Nearest noise sensitive premises to the west and south of the site								
Daytime (07:00 – 23:00)	55	53	52	49	48	42	34	52
Nearest noise sensitive premises to the east of the site								
Daytime (07:00 – 23:00)	53	52	49	46	44	39	32	49
Night (23:00 – 07:00)	50	49	46	43	41	36	29	46

^[3] Limits have been corrected relative to the measured free-field background noise levels by the addition of 3 dB. This correction has been applied to both the background noise level and the amplified sound limit.

7.2.2 Assessment

If any amplified sound is proposed for the retail unit, the basement gym, the events space or the amenity areas or on any of the external terraces, the cumulative egress level to the nearby noise sensitive receptors will need to be controlled to meet with the limits set above. This will need to be assessed as the design progresses.

If loud amplified sound is proposed within the retail unit, lobbied entrance door arrangements would typically be stipulated by Manchester City Council to help mitigate noise breakout. If this is not possible, the doors to the terrace would likely need to be locked off during periods where loud amplified sound is proposed to control noise breakout.

Amplified sound transfer and operational noise will need to be considered as part of the design to ensure that noise breakout and transfer within the building are suitably controlled.

7.2.3 Facade sound insulation – breakout from Events space

It is understood that the main function of the events space will be for hosting networking type events and presentations for users of the building. There is a possibility that it may be used to occasionally host parties/functions with live music/DJs.

In order to assess the impact of amplified music, it is useful to consider the following categories:

- Background music – this is relatively quiet, and would be lost in the hubbub of a busy space/event (music levels typically around L_{Aeq} 60 dB or less)
- Function music – this would be a feature of an event (eg small amplified band, singer with acoustic guitar, piano or light jazz band), but would not be so loud that conversation would completely cease, albeit with raised voices, similar to a busy city bar (music levels typically in region of L_{Aeq} 70-80 dB)
- Live amplified music – this would be the focus of an event, and simultaneous conversation would be difficult. This is the loudest category, and would be similar to attending a gig/concert or night-club dancefloor (music levels typically in region of L_{Aeq} 90-100 dB).

The breakout assessment is based on the assumption that music within the events space would be consistent with 'function music' as a worst-case.

The design includes doors between the event space and the outdoor terrace on level 17, in line with Manchester City Council requirements, lobbied doors to typically required for any space that hosts loud amplified music i.e. anything louder than background music. An alternative to this which would be subject to agreement with Manchester City Council could be that the doors between the events space and the terraces remain closed during such events (i.e. locked off). This is subject to further development.

A typical amplified sound spectrum for a lounge/function band operating at L_{Aeq} 80 dB is provided below. This is used as the basis of the noise breakout assessment.

Table 7 Typical function music level

	Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
L_{eq} (dB) typical for function music	80	75	75	76	76	70	68	70

The 3D model has been used to assess noise breakout from the events space. It is assumed that such events would occur during the daytime only, hence finish by 2300 hours at the latest.

Images of our events noise breakout model is provided in Figure 13.

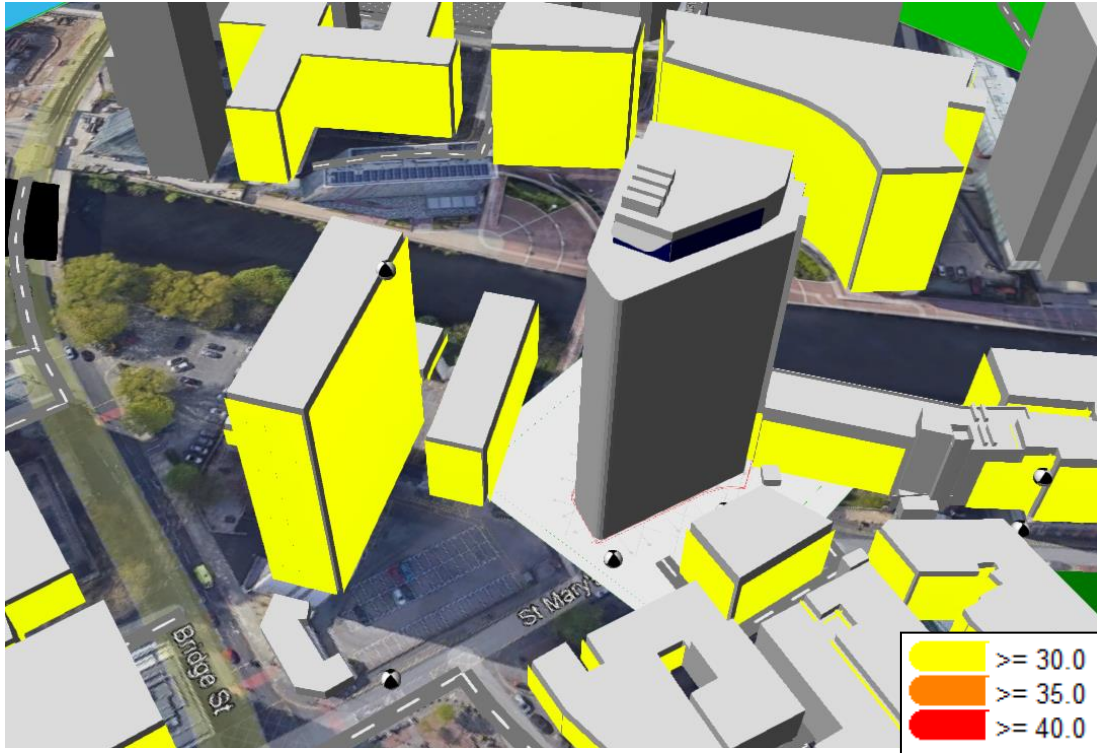


Figure 13 Noise breakout modelling from events space

The assessment indicates that a minimum facade sound insulation performance of $R'_w + C_{tr}$ 28 dB is capable of controlling noise breakout based on the typical 'function music' spectrum above to meet with the daytime MCC noise criteria. This assumes that any opening windows and doors to the space would be closed.

As the predicted levels are below the criteria, there is some flexibility to allow for higher amplified noise levels up to 5 dB. However, if higher levels at 63Hz octave band centre frequency are proposed, or night-time events are likely to be proposed, an enhanced facade sound insulation performance will need to be considered to control noise breakout.

Noise transfer within the development during such events will be assessed separately but it may be possible to manage excessive operational noise transfer (to be out of normal office hours etc).

7.2.4 Basement gym

A gym is currently proposed at basement level. Given the location is below street level, amplified sound breakout is expected to be well-controlled. This however will be addressed as part of the design, including amplified sound breakout via building services connections to the atmosphere, to ensure that the criteria set out in Table 6 are met.

7.3 Deliveries

It is recommended that deliveries/collections to the site be limited to be during the daytime only, 0700-2300 hrs, to reduce the risk of noise disturbance to nearby noise sensitive receptors.

8 Construction noise and vibration assessment

An initial construction noise and vibration assessment is provided in Sandy Brown report 21443-R02-A *Construction noise and vibration assessment* dated 10 December 2021.

This will need to be assessed and managed through measures in the CEMP. Noise and vibration control measures including site noise and vibration criteria will need to be agreed by MCC.

9 Conclusion

An environmental noise survey has been carried out at the site.

Key noise sources at the site were noted as traffic on Bridge Street and St Mary's Parsonage.

Measured ambient noise levels were in the range $L_{Aeq,15min}$ 55 to 60 dB during the day, and $L_{Aeq,15min}$ 52 to 57 during the night. The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 42 dB at night.

The noise data collected has been used to determine the following plant noise limits:

- L_{Aeq} 52 dB during the daytime at 1 m from the facade of Century Buildings and Cardinal House
- L_{Aeq} 49 dB during the night at 1 m from the facade of Century Buildings
- L_{Aeq} 49 dB during the daytime at 1 m from the facade of Albert Bridge House and No 2 St Mary's Parsonage.

Criteria for operational noise associated with use of the terrace spaces have been suggested. It is considered that an external noise limit of $L_{Aeq,1hr}$ 55 dB between 07:00 – 23:00 hrs would be appropriate outside nearby noise sensitive receptors due to people speaking on the terraces. The predicted worst-case levels meet this outside the nearest commercial receptors and are significantly below this outside the nearest residential premises. Manchester City Council does not normally support use of external terraces after 11pm or amplified sound on external terraces. If this is proposed, further assessment will be required.

Limits to amplified noise egress has been advised in octave bands based on the requirements of Manchester City Council. This will need to be considered further as the design progresses, particularly if the retail unit proposed includes any loud amplified sound.

Appendix A

Survey details

Equipment

The unattended and attended noise measurements were taken using a Rion NL-52 sound level meter and a Bruel & Kier 2250 sound level meter, respectively.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
2250 (F)				
Sound level meter	2250/3011964	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Microphone	4189/3100176	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Pre-amp	ZC0032/26376	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Calibrator	4231/3019123	Brüel & Kjær	8 Sep 23	UCRT21/2086
NL-52 C				
Sound level meter	NL-52/00932326	Rion	16 Mar 23	TCRT21/1182
Microphone	UC-59/05549	Rion	16 Mar 23	TCRT21/1182
Pre-amp	NH-25/32354	Rion	16 Mar 23	TCRT21/1182
Calibrator	NC-74/34125432	Rion	16 Mar 23	TCRT21/1181

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

Weather conditions

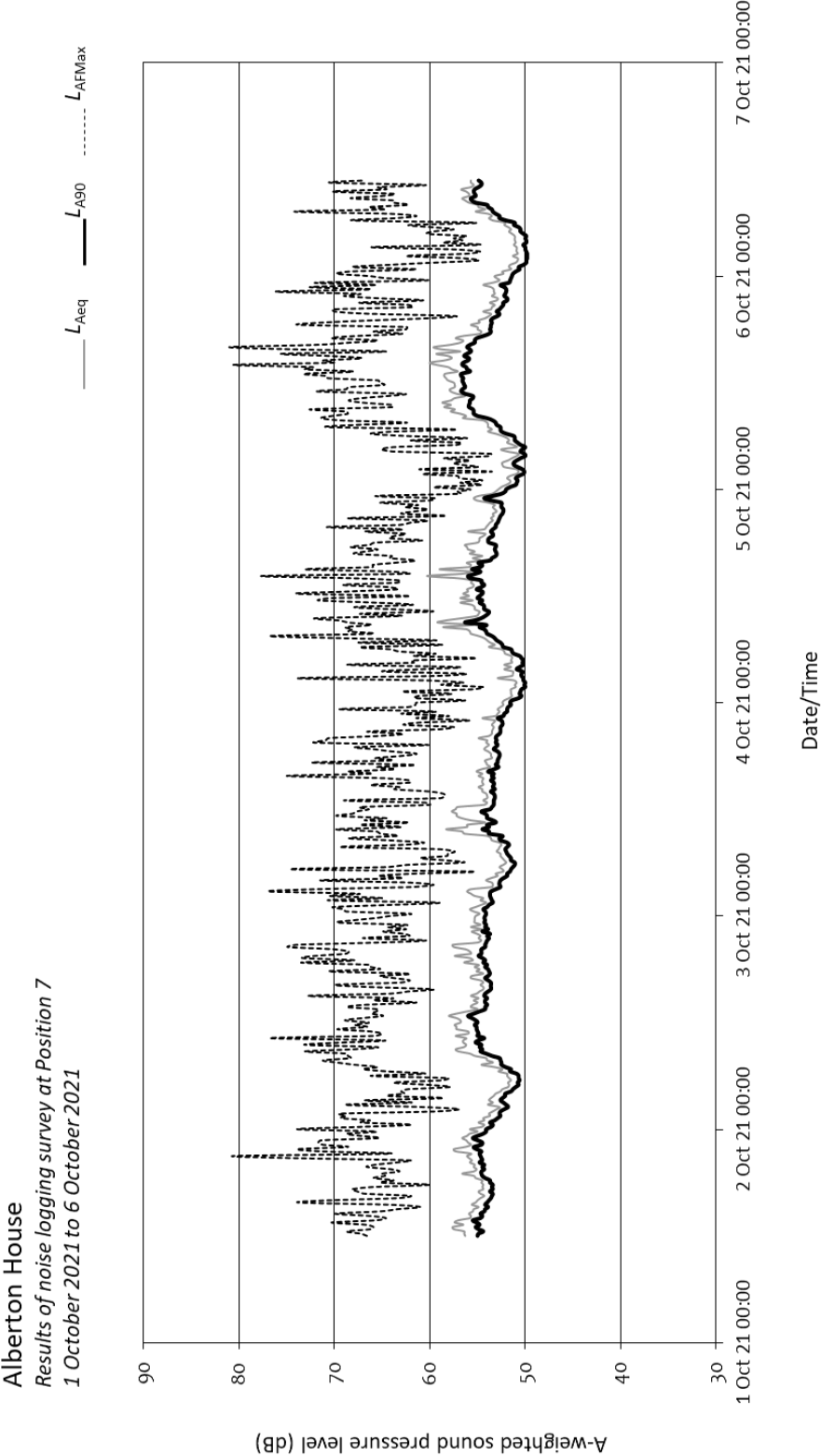
During the attended noise measurements, the weather was generally clear and dry with occasional rain.

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 6°C at night and 20°C during the day, and the wind speed was less than 9 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location 7



Appendix C

Results of unattended measurements at Location 8

