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F55 GOSPEL S.A.R.L

SPECTRUM HOUSE, GOSPEL OAK
LONDON NW5 1LP

RETROSPECTIVE PLANNING APPLICATION FOR RETENTION OF AIR CONDITIONING UNITS

NOISE IMPACT ASSESSMENT

MAY 2020

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NOISE IMPACT ASSESSMENT

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Project Code:	**24348**
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Spectrum House, Gospel Oak, London NW5 1LP
Retrospective Planning Application for
Retention of Air-Conditioning Units
Noise Impact Assessment

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1 Introduction

1.1 Mayer Brown Ltd have been instructed by F55 Gospel S.a.r.l to undertake a Noise Impact Assessment of existing plant installed at Spectrum House, Gospel Oak, London NW5 1LP. A total of thirty-two air-conditioning units have been installed on the east, west elevations and within the courtyard at ground floor and to the east, west and north of the building at roof level.

1.2 It is understood that the plant has been installed without planning permission and that the Client wishes to regularise its installation by means of a retrospective planning application seeking the retention of the plant.

1.3 This report is structured as follows:

- **Section 2** describes the location of the site and its environs;
- **Section 3** discusses national and local planning policy**;**
- **Section 4** outlines noise monitoring and calculations to determine the specific sound level of the installed plant;
- **Section 5** presents the results of automated noise monitoring to determine typical background noise levels characterising the site;
- **Section 6** assesses the "acceptability" of noise emissions;
- **Section 7** discusses planning control implications;
- Conclusions are presented in **Section 8.**

1.4 A glossary of the acoustic terminology used in this report is attached at **Appendix A**.

Suitably Qualified Acoustic Consultant/Engineer

1.5 This report has been prepared by Mayer Brown Limited, a multi-disciplinary practice providing Transport Planning, Infrastructure Design and Environmental Consultancy Services.

1.6 This report has been prepared by David Denham (Senior Acoustic Consultant) who holds Membership of the Institute of Acoustics (MIOA), Chartered Institute of Environmental

Health (MCIEH) and Institute of Environmental Science (MIEnvSc). The preparation of the report has been supervised, reviewed and approved by Paul Gray (Technical Director). Paul has held corporate membership of the Institute of Acoustics (MIOA) since 1994 and has over thirty year's practical experience in acoustic consultancy.

2 Site Location

2.1 The location of the site is shown in **Figure 2.1** below.

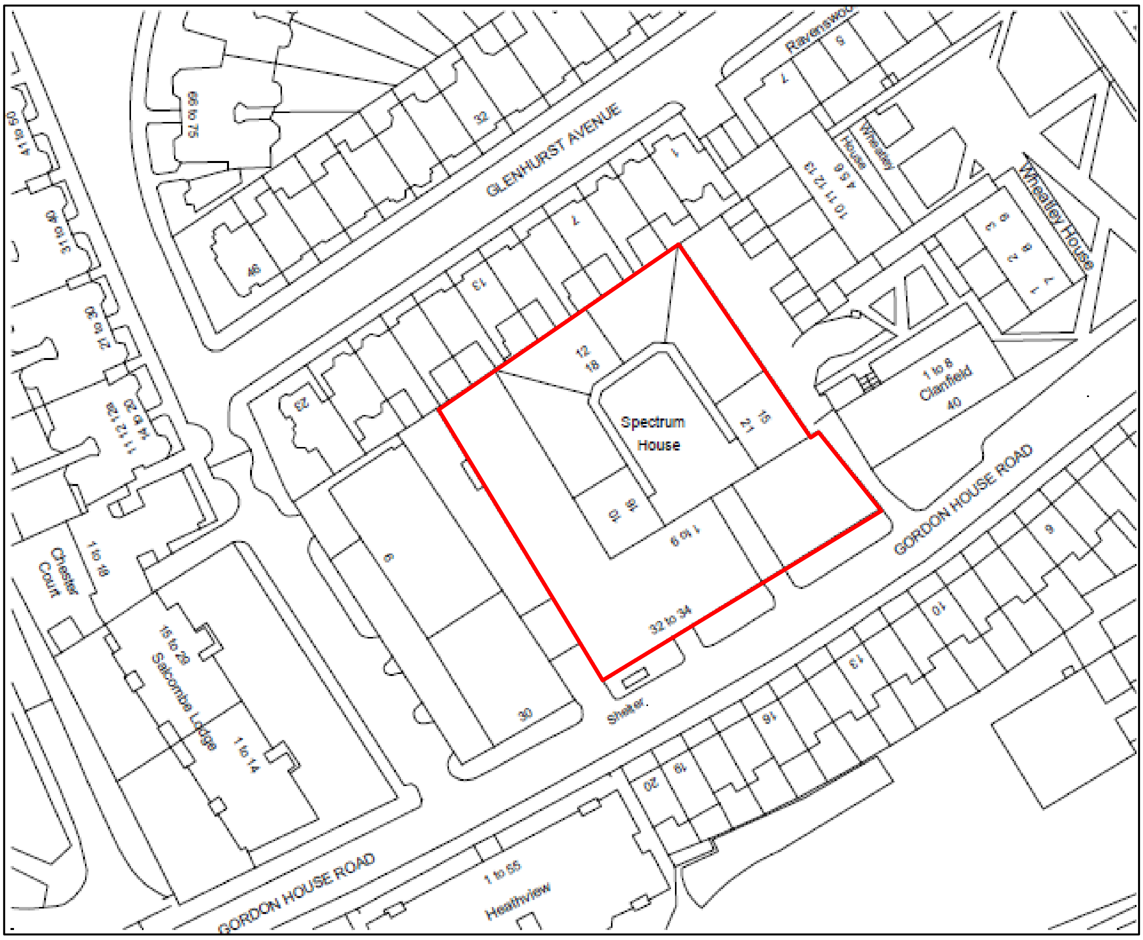


Figure 2.1: Site Location

2.2 The site is located on Gordon House Road and is an occupied two single storey buildings currently providing office space.

2.3 To the south of the site is Gordon House Road with residential dwellings directly opposite.

2.4 To the east of site is residential accommodation comprising Clanfield and Wheatfield House flats and to the north Glenhurst Avenue with existing two-storey dwellings. There are commercial units, currently occupied by a Kwik-Fit garage, to the immediate western boundary located on Lissenden Road.

2.5 Gospel Oak, London Overground station is located approximately 200m to the south-west of the site.

2.6 Thirty-two condenser units are currently located on the site. They are positioned on the eastern and western elevations and within the courtyard at ground floor level and to the north, east and west of the building at roof level, as shown in **Figures 2.1** and **2.2** below:

2.7 Detailed layout plans including photographs of the installed plant are shown in **Appendix B**.

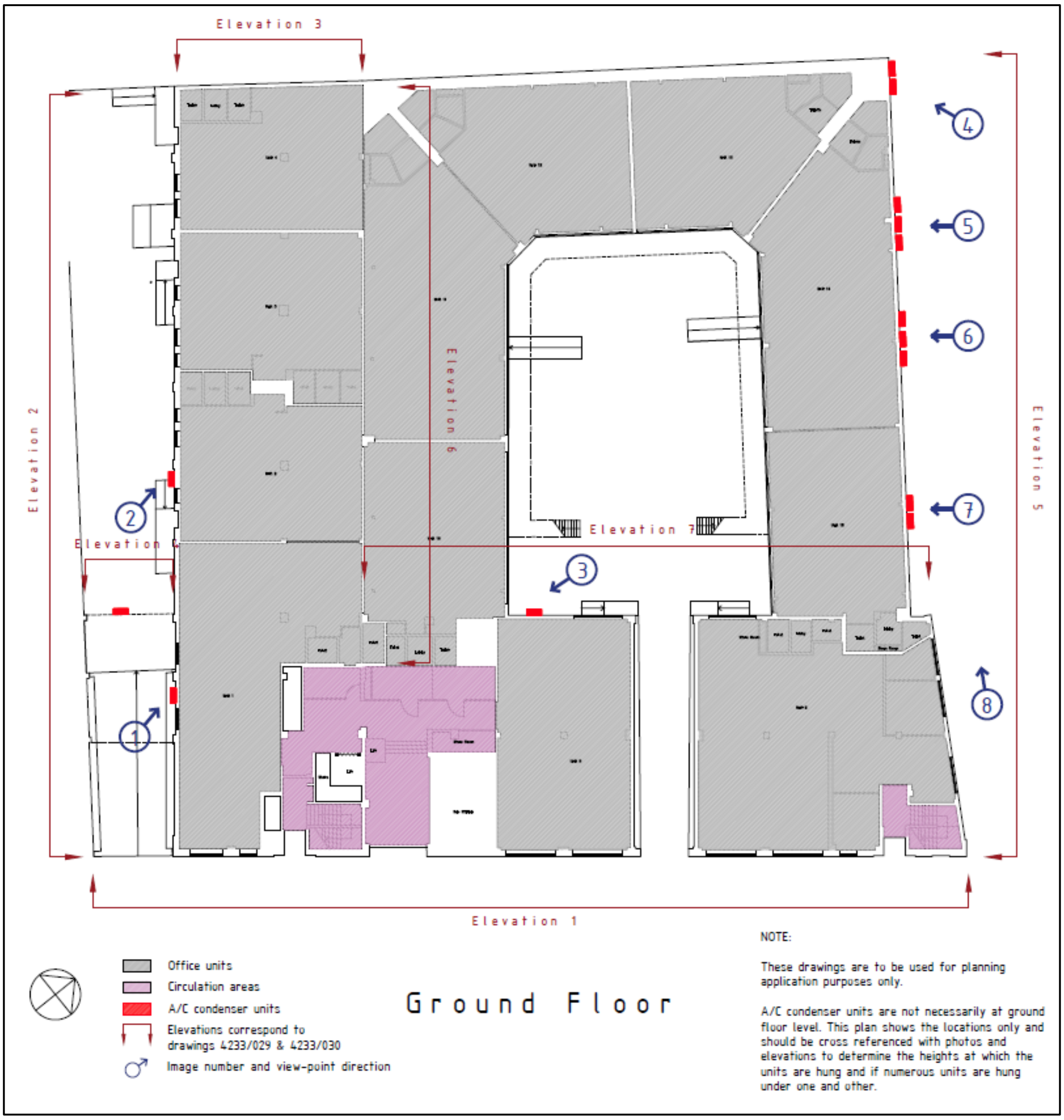


Figure 2.2: Location of Existing AHU – Ground Floor

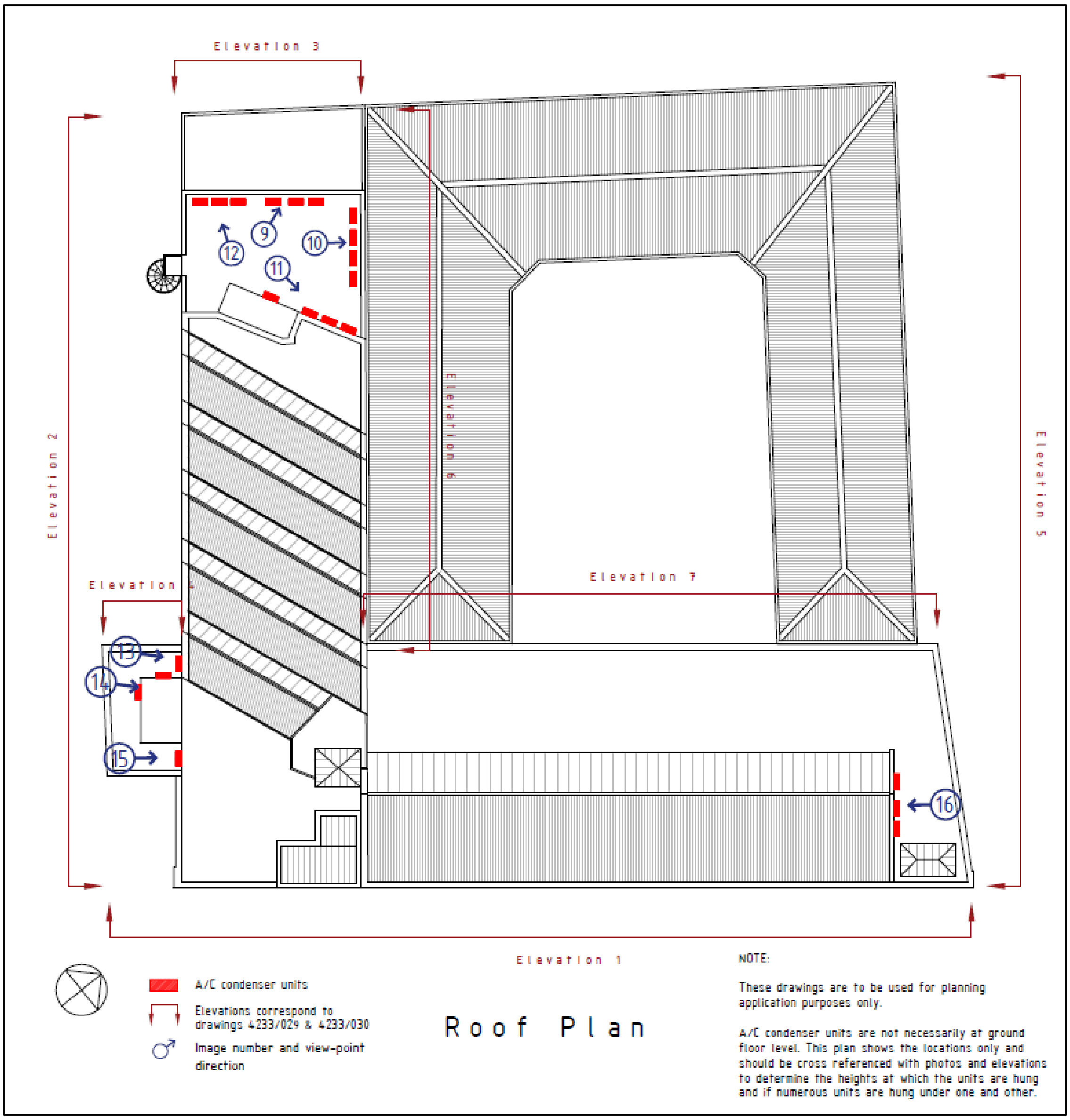


Figure 2.3: Location of Existing AHU – 2nd Floor/Roof

2.8 **Table 2.1** and **2.2** below, provide an inventory for the plant installations at ground and roof level;

No. of Units	Location	Orientation	Make	Model	S/No.
1	Mews	SE	Mitsubushi	Hyper Inverter R410A	FDC71VNX
1	Mews	SE	Daikin	SkyAir Active Series	AZAS100M7VIB
1	Courtyard	NW	Daikin	R32 Inverter	RZAG50A
1	Courtyard	NW	Daikin	Multi Inverter	RZAG50A
2	NE Elevation(N)	NE	Daikin	U/K	RZASG71MV1
1	NE Elevation(N)	NE	Panasonic	R410A	U/K
3	NE Elevation(E)	NE	Fujitsu	DC Inverter	U/K
1	NE Elevation(S)	NE	Daikin	Sky Active	RZASG71MV1
1	NE Elevation(S)	NE	Fujitsu	DC Inverter	U/K
1	Mews	N	Daikin	Sky Active	AZAS71MV1

Table 2.1: Plant Inventory – Ground Floor

No. of Units	Location	Orientation	Make	Model	S/No.
2	North - Above Unit 40-41	W	Daikin	SkyAir Active Series R32	AZAS-MV1 / MY1
2	North - Above Unit 40-41	W	Daikin	SkyAir Alpha Series R32	RZASG-MV1 / MY1
2	North - Above Unit 40-41	SE	Daikin	SkyAir Active Series	RZAG50A
1	North - Above Unit 40-41	SE	Daikin	SkyAir Advance Series R32	RZASG71MV1
3	North - Above Unit 40-41	SE	Panasonic	PACi Standard R32	U-140PZ2E5
2	North - Above Unit 40-41	N	Daikin	SkyAir Alpha Series	RXM50N2V1B9
1	North - Above Unit 40-41	N	Daikin	R32 Inverter	RXM50N9
1	North - Above Unit 40-41	N	Fujitsu	U/K	AOY9ANGC
1	South - Above Unit 34	W	Daikin	R32 Inverter	RXM60N2V1B9
1	South - Above Unit 34	W	Daikin	Seasonal Smart	RZQG71L9V1B
1	South - Above Unit 34	N	Daikin	Seasonal Smart	RXM50N9
1	South - Above Unit 34	N	Fujitsu	DC Inverter	AOYR24LCC
2	West - Above PB AH	E	Daikin	Super Inverter	RZQ125B9V381
1	West - Above PB AH	E	Daikin	Inverter	RKS20D3VMB

Table 2.2: Plant Inventory – Roof Level

Noise Sensitive Receptors

2.9 For noise impact assessment purposes, the nearest noise sensitive receptors have been identified and are as shown in **Figure 2.4** and **Table 2.3** below;

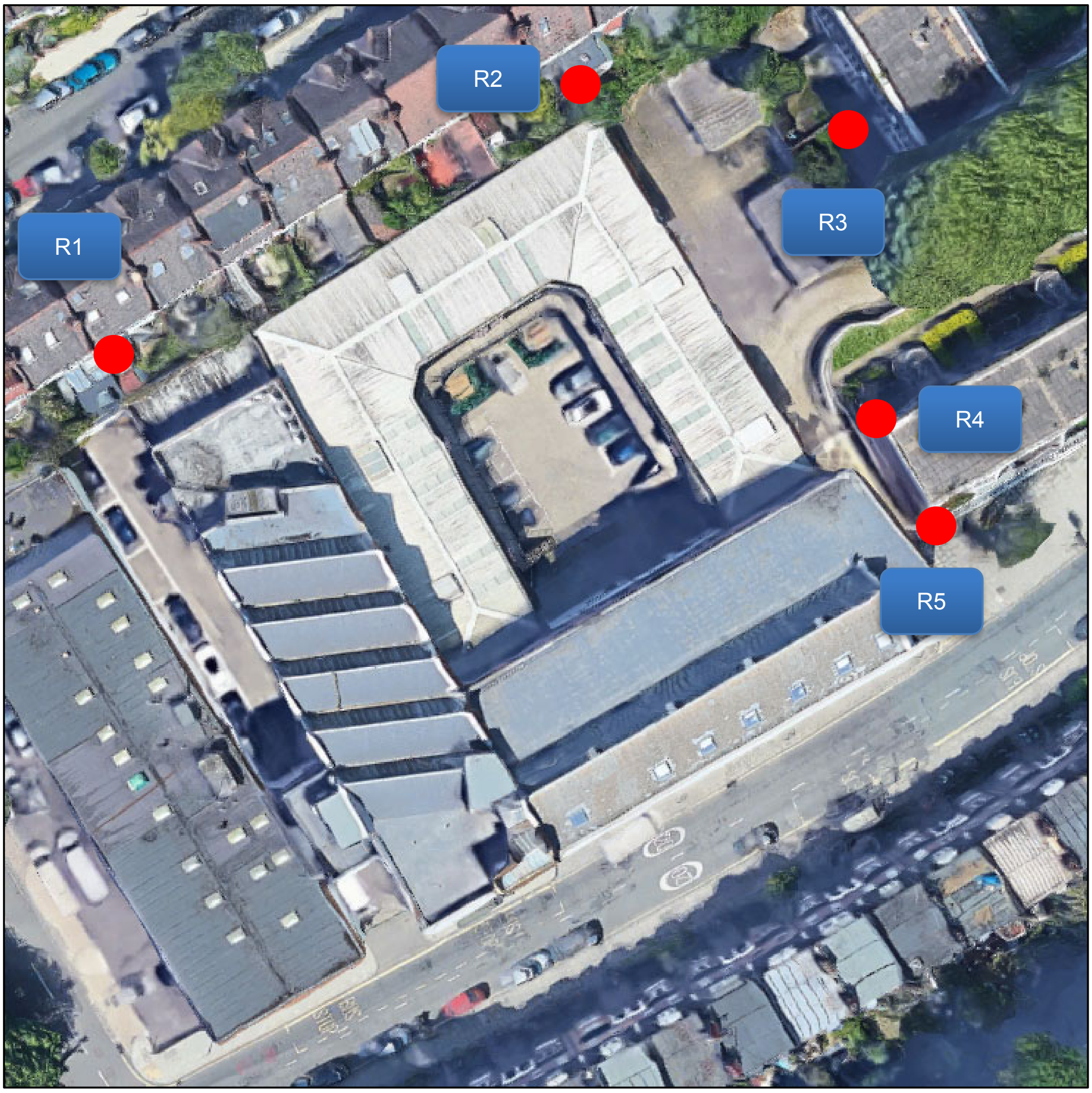


Figure 2.4: Location of Noise Sensitive Receptors

Ref.	Location
R1	House on Glenhurst Avenue – southern elevation
R2	House on Glenhurst Avenue – southern elevation
R3	Flats at Wheatley House, Gordon House Road – western elevation
R4	Flat at Clanfield, Gordon House Road – northern elevation
R5	Flat at Clanfield, Gordon House Road – southern elevation

Table 2.3: Description of Noise Sensitive Receptors

3 Planning Policy Context and Acoustic Design Criteria

National Planning Policy Framework, (NPPF, 2019)

3.1 Current governmental guidance for the determination of planning applications is given in the revised "National Planning Policy Framework" (NPPF), published in February 2019.

Paragraph 170 of the NPPF advises:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *….. e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability."*

3.2 With specific regard to noise, paragraph 180 of the NPPF states:

> *""Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> > *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
> >
> > *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
> >
> > *c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

3.3 Paragraph 182 of the NPPF draw specific attention to the need to ensure that new development is compatible with existing businesses and community facilities and introduces and "agent of change" principle:

> *"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on*

new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

3.4 With regard to 'adverse' impacts and 'significant adverse' impacts, the NPPF directs the reader to the advice contained in DEFRA's "Noise Policy Statement for England" (NPSE). This Policy Statement introduces the concept of a "Significant Observed Adverse Effect Level" (SOAEL), "Lowest Observed Adverse Effect Level" (LOAEL) and "No Observed Adverse Effect Level" (NOAEL). These are concepts aligned with toxicology outcomes derived from guidance given by the World Health Organisation.

Noise Policy Statement for England

3.5 Whilst the intent of the NPSE in relation to the NPPF is clear, the NPSE does not, at this time, provide any quantitative threshold values for each identified level of "effect". Indeed, the NPSE carefully highlights that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

National Planning Practice Guidance

3.6 The application of national planning is amplified in the governments *"National Planning Practice Guidance"* (NPPG) (July 2019). This seeks to help clarify understanding the perception of noise effects, outcomes and actions that should be taken to align decision making with the NPPF. In line with the NPPF concept of basing decision making on the identification of *"adverse"* or *"significant adverse"* impacts on health and quality of life, the NPPG aligns its guidance with the NPSE.

The table below summarises this guidance:

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	**No specific measures required**
No Observed Adverse Effect Level (NOAEL)			
Present not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	**No specific measures required**
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	**Mitigate and reduce to a minimum**
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	**Avoid**
Noticeable and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress or physiological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	**Prevent**

Table 3.1: NPSE Guidance

3.7 Whilst the NPPF and associated planning practice guidance sets out stringent imperatives to ensure the satisfactory development of land in relation to possible noise impacts, this policy and guidance does not provide any specific technical guidance defining what may be considered to constitute an "adverse" or "significant adverse" impact. The guidance does, however, make reference to a number of 'industry standard' guidance documents. Where available, technical noise standards supporting local planning policies can also be used to inform the assessment of potential noise effects.

City-Wide Planning Policy

3.8 Policy 7.15 of the current London Plan (*'Reducing and managing noise, improving and enhancing the acoustic environment and promoting appropriate soundscapes'*) states:

> ***"Strategic***
>
> A. *The transport, spatial and design policies of this plan will be implemented in order to reduce noise and support the objectives of the Mayor's Ambient Noise Strategy.*
>
> ***Planning Decisions***
>
> B. *Development proposals should seek to reduce noise by:*
>
> a. *Avoiding significant adverse noise impacts on health and quality of life as a result of new development;*
>
> b. *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 development or adding unduly to the costs and administrative burdens on existing businesses;*
>
> c. *Improving and enhancing the acoustic environment and promotion appropriate soundscapes (including Quiet Areas of spaces of relative tranquillity);*
>
> d. *Separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation;*
>
> e. *Where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse*

effects should be controlled and mitigated through the application of good acoustic design principles;

f. *Having particular regard to the impact of aviation noise on noise sensitive development;*

g. *Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

LDF preparation

C. *Boroughs and others will relevant responsibilities should have policies to:*

a. *manage the impact of noise through the spatial distribution of noise making and noise sensitive uses;*

b. *identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise action Plan for Agglomerations"*

3.9 The Mayor of London has published a draft replacement London Plan. Draft Policy D13 deals with noise:

"Policy D13 Noise

A. *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:*

1) *Avoiding significant adverse noise impacts on health and quality of life*

2) *Reflecting the Agent of Change principle as set out in Policy D12. To ensure measures do not add unduly to the costs and administrative burdens on existing noise-generating uses*

3) *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 restriction on existing noise-generating uses development*

4) *Improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)*

5) Separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, or internal layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) Where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

B. Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations."

3.10 Given that Policy D13 of the draft London Plan closely reflects governmental planning policy objectives, the emerging policies are considered to carry significant weight in relation to their relevance to the determination of this application.

Local Planning Policy

3.11 The London Borough of Camden's Local Plan was adopted on 3rd of July 2017.

3.12 Technical guidance accompanying the Local Plan states that in relation to commercial plant that:

> *'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).*

Existing Noise sensitive receptor	*Assessment location*	*Design period*	*LOAEL (Green)*	*LOAEL to SOAEL (Amber)*	*SOAEL (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}

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room' (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.'

BS 4142: 2014:+A1:2019 "Methods for Rating and Assessing Industrial and Commercial Sound"

3.13 Camden's noise guidance makes specific reference to the assessment methodology of BS 4142: 2014, which has been superseded by a subsequent revision of the standard. The current standard is BS 4142: 2014:+A1:2019.

3.14 As noted earlier, this standard provides a rating and assessment methodology for assessing the potential adverse impact of industrial and commercial noise sources on neighbouring dwellings.

3.15 The assessment procedure initially compares the ***'Rating Level'*** of the source with the '***Background*** Noise ***Level'*** when the source is not present.

3.16 The ***'Rating*** Level' (L_{Ar}) referred to is the specific noise level of the noise source under investigation (in terms of the L_{Aeq} noise index), to which corrections are applied if the noise has certain audible characteristics. The following corrections (based on a subjective assessment of noise source characteristics is given:

Character Correction				
Feature / Perception	**Tonality**	**Impulsivity**	**Intermittency**	**Other acoustic characteristics**
Just Perceptible	+2dB	+3dB	When the specific sound has identifiable On/Off conditions that are readily distinctive. +3dB	+3dB
Clearly Perceptible	+4dB	+6dB		
Highly Perceptible	+6dB	+9dB		

Table 3.2: BS4142 Character Correction for Rating Level Calculation

3.17 The 'Background Noise Level' (L_{A90}) represents the noise level that is exceeded for 90% of the stated measurement period. For assessment purposes, the background noise level needs to be determined without the noise source under investigation operating.

3.18 The time of operation needs to be taken into account. During the day (normally taken to be 07.00 to 23.00 hours) a one-hour measurement period is considered appropriate. During the night (normally taken to be 23.00 – 07.00 hours) a 15-minute time period is normally used.

3.19 The following guidance is then offered based on the outcome of this initial assessment:

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

- A difference of around +5 dB 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.

3.20 As noted in section 4, national planning policy directs that adverse noise impacts should be mitigated and reduced to a minimum and that *"significant"* noise impacts should be avoided. If the guidance of BS 4142:2014 + A1: 2019 is aligned with these objective, it can be concluded that:

- A *"significant"* noise impact (i.e. sound above a SOAEL) is likely where the rating level ($L_{Ar,T}$) of noise is 10dB or more above the background noise level ($L_{A90,T}$); and
- A *"low"* noise impact (i.e. sound above a LOAEL) is likely where the rating level does not exceed the background level.

3.21 A note accompanying the guidance of BS 4142: 2014 + A1: 2019 states:

> *"Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

3.22 The initial estimate of the impact should then be modified to account for its context. Such considerations include:

- The absolute level of the sound - the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

- Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- The character and level of the residual sound compared to the character and level of the specific sound.

- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

4 Plant Noise Levels

4.1 In order to assess the acceptability of noise emissions from the existing plant and given that the plant is existing and operational, the potential noise emissions from plant could (theoretically) be assessed by direct measurement. Even where it is not possible to take measurements directly a property, measurements can be extrapolated to determine the resultant noise emissions at the noise sensitive receptor locations.

4.2 During the site attendance on 10 March 2020, it was, however, apparent that it would not be possible to reliably measure plant noise due to the dominance of other ambient noise sources (including road traffic noise and construction work in the immediate locality), which was masking plant noise emissions. In addition, many of the units were observed not to be operating at the time of the visit and access to controls to switch them on/off was not available.

4.3 In accordance with paragraph 7.3.6 of BS 4142, the specific noise levels of the installed plant have therefore been calculated, based on manufacturer's noise data. For the limited number of units where manufacturer noise data is not available, comparative noise data has been used, based on the type of unit installed.

4.4 Manufacturer's noise data for all the units is summarised in **Table 4.1** below.

Plant Ref.	Octave Band Centre Frequency (Hz)								Sound Pressure Level (L_{PA}) @1m
	63	125	250	500	1000	2000	4000	8000	
Daikin AZAS100M7VI	58	57	53	51	47	42	37	32	53
Daikin RZAG50A	36	39	41	47	45	42	38	33	49
Daikin RZASG71MV1	34	37	39	44	42	39	35	31	46
Daikin AZAS-MV1/MY1	58	57	53	51	47	42	37	32	53
Daikin RZASGMV1/ MY1	58	57	53	51	47	42	37	32	53
Daikin RXM50N2V1B9	49	50	47	44	43	37	31	23	47
Daikin RXM50N9	35	38	40	46	44	41	37	32	48

Plant Ref.	Octave Band Centre Frequency (Hz)								Sound Pressure Level (L_{PA}) @1m
	63	125	250	500	1000	2000	4000	8000	
Daikin RXM60N2V1B9	52	53	51	47	46	40	35	26	50
Daikin RZQG71L9V1B	48	51	48	46	43	37	33	27	48
Daikin RZQ125B9V381	51	49	51	48	45	42	34	25	50
Daikin RKS20D3VMB	46	45	43	39	38	30	23	18	42
Daikin AZAS71MV1	34	37	40	44	42	40	36	33	47
Mitsubushi FDC71VNX	35	38	41	47	46	43	39	33	48
Panasonic R410A	52	54	51	50	50	48	39	31	54
Panasonic U-140PZ2E5	45	46	48	54	52	49	45	40	56
Fujitsu DC Inverter	47	54	52	44	45	37	34	23	49
Fujitsu AOY9ANGC	47	54	52	44	45	37	34	23	49
Fujitsu AOYR24LCC	56	52	54	50	49	44	40	32	53

Table 4.1: Plant Noise Emission Data

5 Background Noise Levels

5.1 In order to establish existing ambient noise levels in the vicinity of the site, unattended noise surveys have been undertaken.

5.2 The measurement locations are shown in **Figure 5.1** below and the monitoring positions described in **Table 5.1.**

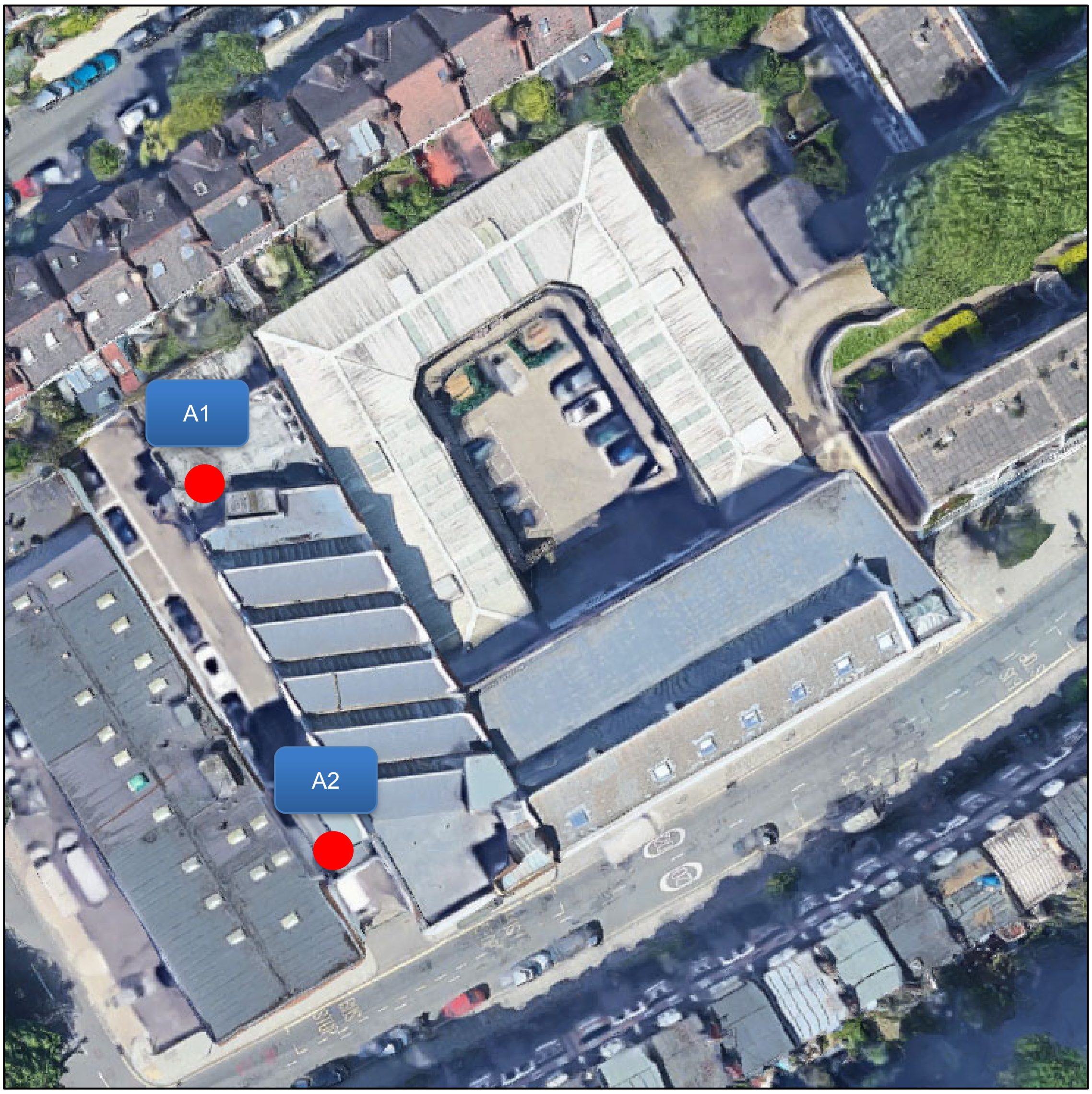


Figure 5.1: Noise Measurement Locations

Monitoring Location	Description
A1	Located at roof level, overlooking the mews to the west and with a line of site view of the first-floor windows of the nearest dwellings on Glenhusrt Avenue,. The measurement microphone was attached to railings and positioned approximately 1.5m from the top of the roof in free-field conditions.
A2	Located at roof level on the western boundary of Spectrum House overlooking Gordon House Road to the west and with a line of sight view to the third floor of flats along Gordon House Road and Lissenden Road. The measurement microphone was attached to railings and positioned approximately 1.5m from the top of the roof in free-field conditions.

Table 5.1: Measurement Instrumentation

5.3 The following measurement instrumentation was used for the survey:

Position	Description	Make	Model	S/No.	Calibration
A1	Sound Level Analyser	Svantek	SVAN971	72535	23/04/2018
	Microphone	ACO Pacific	7052E	68260	
	Preamplifier	Svantek	SV18	72235	
	Outdoor Microphone Kit	Svantek	SA271U	--	n/a
	Calibrator	Rion	NC-74	34651766	12/07/2019

Table 5.2: Measurement Instrumentation

Survey Procedure

5.4 An automated survey at position A1 was carried out over a 7-day period between 20 September 2019 to Thursday the 26 September 2019 and was related to a previous project at Spectrum House. These data are deemed representative of the typical background noise levels at the rear of properties on Glenhust Avenue and Wheatland House due to their position, screened from road traffic noise

5.5 An additional automated survey was carried out at position A2 was undertaken over a notional 5 day period between 13 March to 17 March 2020 and is deemed representative of background noise levels at Clanfield flats due to the measurement position being a similar distance to Gordon House Road to the south.

5.6 The automated sound level analyser at Positions A1 and A2 were configured to measure the L_{A90}, L_{Aeq}, L_{A10} and $L_{Amax,fast}$ noise indices over consecutive 15 minute time periods. The equipment was also configured to log at a higher (1 second) resolution to assist with the discrimination of noise events, in addition to audio recordings to assist with source identification.

5.7 The sound level analyser was calibrated prior to the survey and the calibration checked on completion. No drift in calibration was observed.

Measurement Results

5.8 The following noise levels were measured:

Date	$L_{A90,15mins}$	$L_{Aeq,15mins}$	$L_{Amax,fast}$
20/09/2019	43	55	76
21/09/2019	42	50	74
22/09/2019	38	51	71
23/09/2019	42	58	82
24/09/2019	43	57	78
25/09/2019	41	51	76
26/09/2019	45	53	82

Table 5.3: A1 - Measured Noise Levels

Date	$L_{A90,15mins}$	$L_{Aeq,15mins}$	$L_{Amax,fast}$
13/03/2020	49	55	76
14/03/2020	48	50	74
15/03/2020	45	51	71
16/03/2020	46	58	82
17/03/2020	52	57	78

Table 5.4: A2 - Measured Noise Levels

5.9 **Figures 5.2** and **5.3** below, show the time history profile of positions A1 and A2. A more detailed time history profile showing the variation of noise levels throughout the survey period is also presented in **Appendix B.**

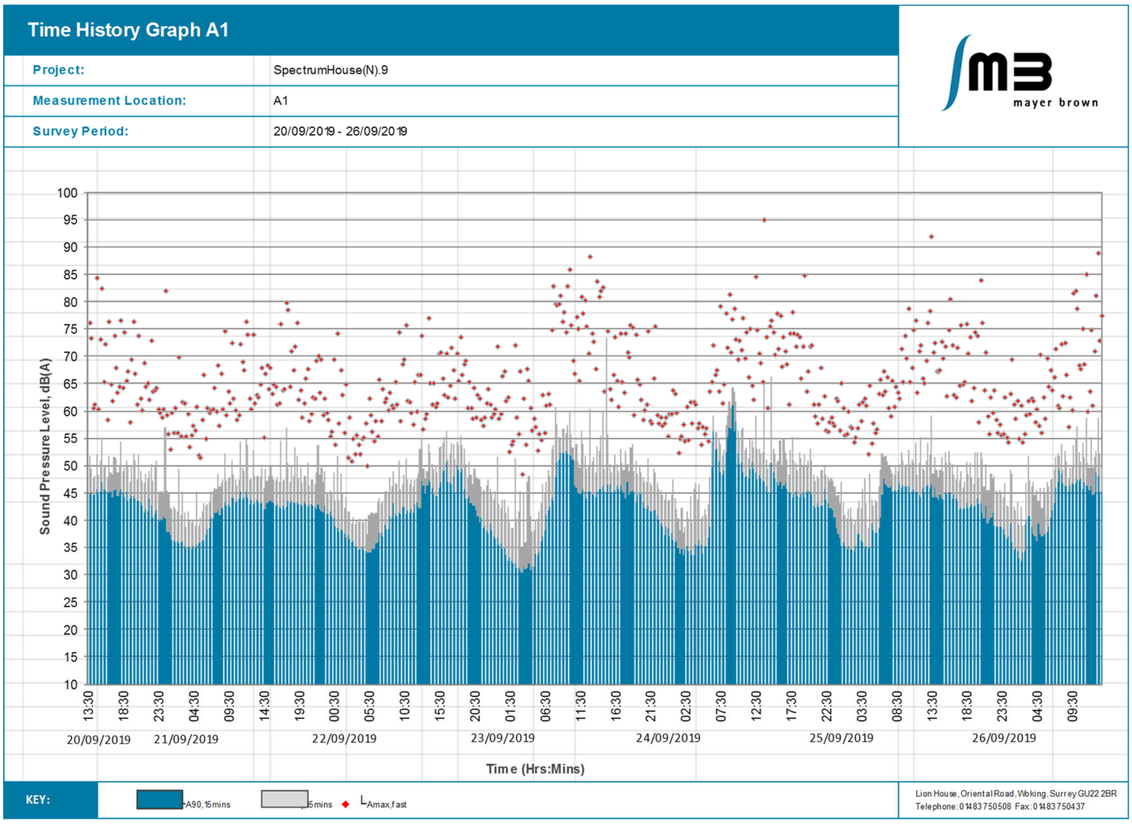


Figure 5.2: Time History Profile - A1

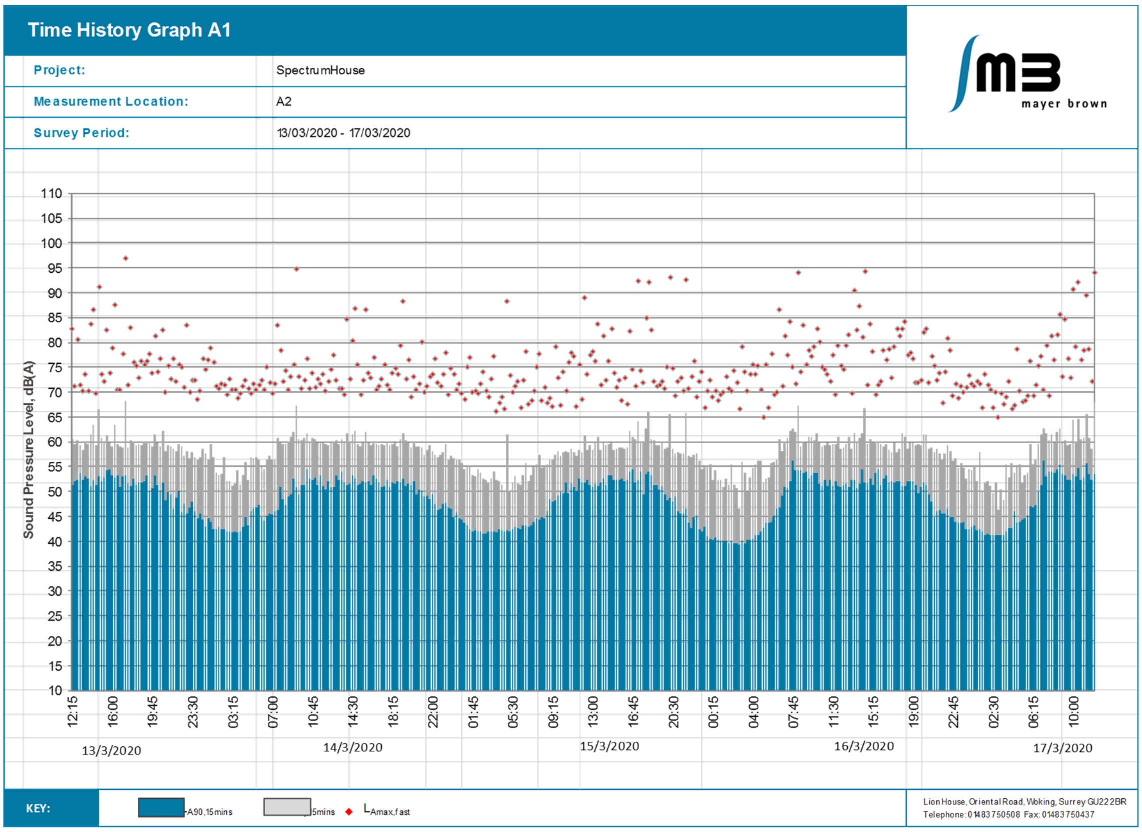


Figure 5.3: Time History Profile – A2

Weather

5.10 Whilst weather conditions during the automated survey were not actively measured, observations at the time of site attendances and publicly available historic online data indicates that weather conditions were typically characterised as set out in **Table 5.4** below:

September 2019 Survey

2019	Temp. (°C)	Humidity (%)	Wind Speed (km/h)	Wind Direction	Pressure (hPa)		Rainfall (mm)
September	Avg.	Avg.	Avg.		Max	Min	total
20	14	96	12	SW	1031	1020	0.0
21	17	82	12	E	1020	1007	0.0
22	17	89	10	SSE	1008	1003	1.6
23	16	92	17	SSW	1013	1008	0.8
24	17	95	15	SSW	1008	1000	0.4
25	17	94	16	SW	1005	998	0.2
26	17	94	18	SW	1006	1002	0.2

Table 5.5: Weather – September 2019 Survey

March 2020 Survey

2020	Temp. (°C)	Humidity (%)	Wind Speed (km/h)	Wind Direction	Pressure (hPa)		Rainfall (mm)
March	Avg.	Avg.	Avg.		Max	Min	total
13	8	72	18	WSW	1020	1013	0.0
14	10	82	18	SSW	1019	1012	3.1
15	10	83	22	SSW	1015	1007	1.1
16	8	74	10	W	1027	1014	0.0
17	10	81	21	SW	1029	1026	0.0

Table 5.6: Weather – March 2020 Survey

Data Analysis

5.11 The measurement data has been statistically analysed to determine "typical" daytime background (L_{A90}) noise levels, as presented in **Figure 6.2** and **Figure 6.3** below.

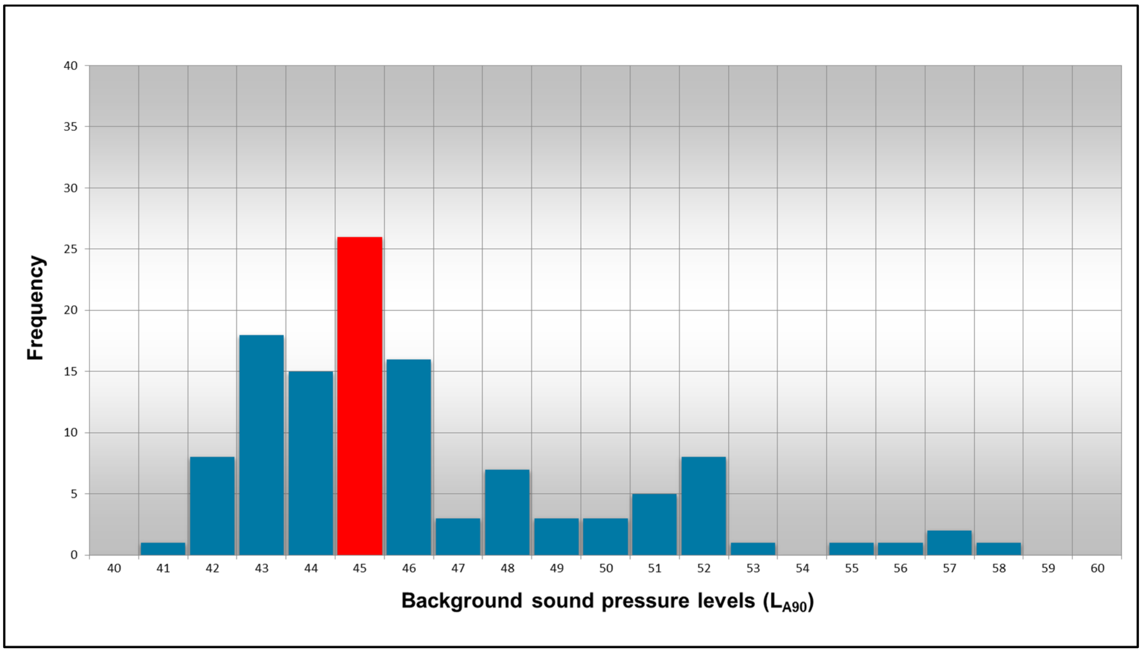


Figure 5.4: A1 - L_{A90} Statistical Analysis – Daytime

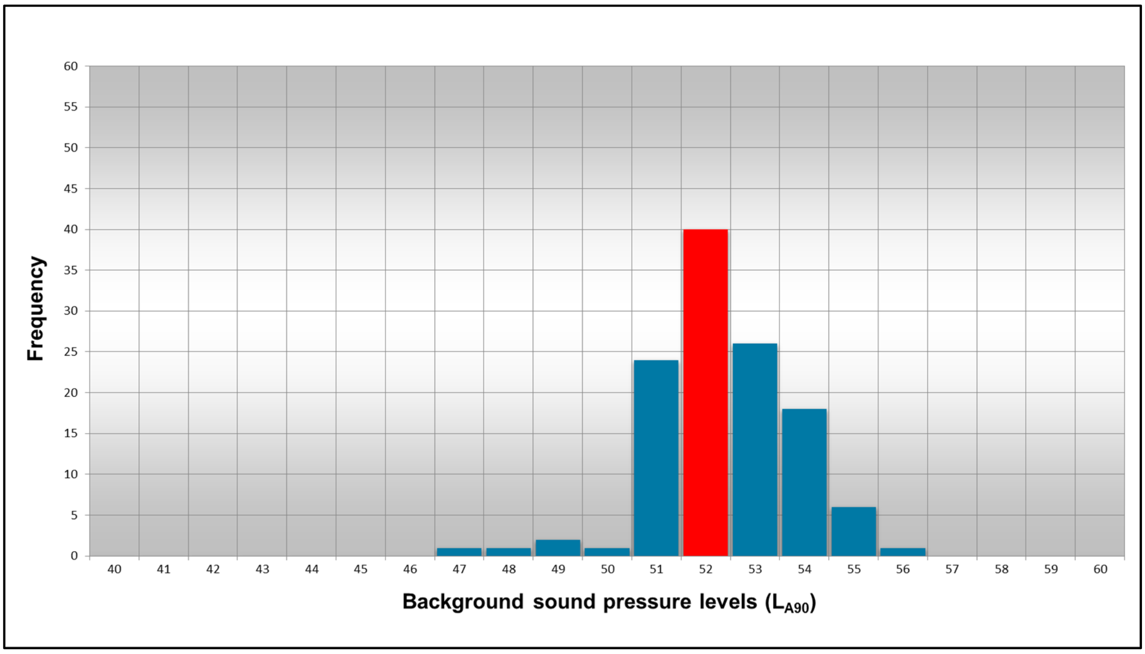


Figure 5.5: A2 - L_{A90} Statistical Analysis – Daytime

5.12 From the analysis shown, it can be seen that the typical L_{A90} is taken to be **45dB** at position A1 and **52dB** at position A2, within the vicinity of the nearest noise sensitive receptors to the north and east respectively.

Proposed Noise Limits

5.13 As noted earlier, Camden Council requires that the rating level of plant noise is controlled to a level at least 10dB below the typical background noise level. Based on the results of the noise monitoring, Camden Council require that the following plant noise emission limits should be achieved.

Ref.	Location	$L_{Ar,\ T,1hour}$ dB
R1	House on Glenhurst Avenue – southern elevation	35
R2	House on Glenhurst Avenue – southern elevation	
R3	Flats at Wheatley House, Gordon House Road – eastern elevation	
R4	Flat at Clanfield, Gordon House Road – northern elevation	
R5	Flat at Clanfield, Gordon House Road – southern elevation	42

Table 5.7: Recommended Plant Noise Emission Limits

5.14 The above values are to be met at 1m from the window or any adjoining property and should represent the total cumulative value (i.e. noise emission from all plant operating at the same time).

6 Noise Impact Assessment

Noise Predictions

6.1 In lieu of in-situ noise measurements and in accordance with paragraph 7.3.6 of BS 4142 noise level predictions of the operational plant have been carried out to determine receptor noise levels.

6.2 The predictions have been undertaken in general accordance with "*ISO:9613- 2:1996 – The attenuation of sound during propagation outdoors: Part 2 General Method of Calculation"* and are based on manufacturers technical datasheets, aerial photography and general site observations regarding building heights and other features that may influence noise propagation e.g. boundary screening.

6.3 Corrections have been applied for to account for directivity of the noise source relative to the receiver, where these are off axis. It is assumed that all plant is operating continuously during the hours 8.00am – 6.00pm only and predictions present the total cumulative value.

6.4 The noise level predictions are shown in **Table 6.1** below;

Ref.	Location	Predicted Noise Level, $L_{Aeq,1hour}$ dB
R1	House on Glenhurst Avenue – southern elevation	40
R2	House on Glenhurst Avenue – southern elevation	33
R3	Flats at Wheatley House, Gordon House Road – western elevation	33
R4	Flat at Clanfield, Gordon House Road – northern elevation	35
R5	Flat at Clanfield, Gordon House Road – southern elevation	33

Table 6.1: Noise Level Predictions

Assessment

6.5 **Table 6.2** below compares the above predicted noise levels with the design targets As noted earlier, the LB Camden's assessment criterion for plant of this nature is that rating levels should be 10dB below the typical background noise level. **Table 6.4** presents a comparison of the rated noise levels against the LB Camden's assessment criterion:

Location	Rated Noise Level, $L_{Ar, T}$	LB Camden Assessment Criterion, dB	Difference between Rated Level and Assessment Criterion	Compliant Yes/No
R1	40	35	+5	**No**
R2	33	35	-2	**Yes**
R3	33	35	-2	**Yes**
R4	35	35	0	**Yes**
R5	33	42	-9	**Yes**

Table 6.4: Comparison with LB Camden Plant Noise Criteria

6.6 The above Table shows that noise levels at all receptor locations are fully compliant with the London Borough of Camden's technical requirements, other than Position R1 which indicates that a resultant sound level that would be 5dB below background, rather than 10dB below background.

Discussion

6.7 Whilst the above assessment indicates that installed plant exceeds the numeric design targets inferred from technical guidance set out in the London Borough of Camden's Local Plan, this should not be taken to infer that the existing plant has an "adverse" or "significant adverse" noise impact of the adjoining dwelling.

6.8 To amplify on this and as noted earlier, BS 4142: 2014+A1: 2019: *"Method for Rating and Assessing Industrial and Commercial Sound"* provides detailed guidance which assists in assessing the likely significance of noise commercial noise. If this guidance is aligned with that of the NPPF, NPPG and NPSE leads, the potential effect of plant noise emissions can be assessed in line with the following significance categorisation:

Difference Between Rating Level ($L_{Ar,T}$) and Typical Background Level ($L_{A90,15mins}$)	Effect
Less than -10	No observed effect
Between -10 and zero	No observed adverse effect
Between zero and +10	Observed adverse effect
More than +10	Significant observed adverse effect

Table 6.2: Likely Significance of Noise Effect

6.9 A summary of the BS4142 assessments for the use of the existing plant installations are presented in **Tables 6.3** below;

Location	Predicted Noise Level, L_{Aeq}	Character correction, dB	Rated Noise Level, $L_{Ar,1hour}$	Background Noise Level, L_{A90}	Difference between Rated and Background Noise Level, dB	Assessment Outcome
R1	40	0	40	45	**-5**	*"No observed adverse effect"*
R2	33	0	33	45	**-12**	*"No observed effect"*
R3	33	0	33	45	**-12**	*"No observed effect"*
R4	35	0	35	45	**-10**	*"No observed effect"*
R5	33	0	33	52	**-19**	*"No observed effect"*

Table 6.3: BS 4142 Noise Assessment

6.10 The assessments presented above adopt a time period of 1-hour (assuming plant will operate during daytime hours only). No acoustic character corrections have been applied to the predictions as noise from plant of this nature is typically broadband i.e. it contains no dominant tones. It is assumed that the plant will be in continuous in operation therefore no on-time correction has been applied. It is also assumed that all plant will be operating simultaneously at full capacity (and thus represents an absolute worst case scenario).

6.11 The above table shows that receptors, R2, R3, R4 and R5 would be considered to have *"no observed effect".*

6.12 It can also be seen that whilst Receptor R1 was concluded not to be compliant with the LB Camden's standard noise control requirement, the resultant level of noise would still be concluded to have *"no observed adverse effect*", when assessed in accordance with the methodology of BS 4142.

6.13 In light of the above, it is concluded that whilst noise emissions may not (on the basis of an absolute worst case assessment) comply with the London Borough of Camden's standard noise control requirements, on the basis of the guidance of BS 4142: 2014 +

A1: 2019, the resultant sound level would remain below a *"Lowest Observed Adverse Effect Level"* and would therefore be accordance with national planning policy objectives.

6.14 In addition to the above conclusion, the following additional matters are considered relevant.

6.15 Section 11 of BS4142 advises that the assessment of commercial noise should also take into account "context",

> *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context".*

6.16 Matters of context include:

- <u>*Absolute level of sound;*</u>
  Camden's Local Plan also suggests that it may also be material to consider the absolute level of noise in situations where background noise levels are "low", suggesting that plant noise levels should not exceed a noise rating level of NR 35. For typical building services installations, this noise rating level would approximately equate to a sound level of around 41dB(A)[1]. Therefore, whilst the site is not considered to be in a low noise area, it can be seen that, based on Camden's local plan guidance, the absolute level of the installed plant is not at a level that would be considered to have a material adverse impact on neighbouring dwellings.
  This is also entirely consistent and reinforced by the fact that the BS4142 assessment undertaken concludes that noise should have *"no observed adverse effect"*.
- <u>*The character and level of the residual sound;*</u>
  As noted above the existing plant is low level and generally emit broadband noise and analysis of the frequency spectra from the manufacturers data sheets does not indicate the presence of tones.
  When compared with the prevailing ambient noise level, comprised of road traffic noise and other nearby commercial noise sources i.e.
  Kwik-Fit garage immediately adjacent, the plant installations do not emit any noise that is distinguishable or incongruous above the existing noise climate.
- <u>*The sensitivity of the receptor;*</u>

1 Guidance in Annex B of BS 4142: 2014: "Guidance on Sound Insulation and Noise Reduction for Buildings" indicates that the dB(A) sound level can be determined by the approximate dB(A) = NR + 6.

The context here is that the co-location of residential and commercial uses is well established, with the plant already installed and having been operational for some time. This has not resulted in complaints from nearby dwellings, to Mayer Brown's knowledge and therefore there is no reason to consider nearby receptors as particularly sensitive, given this context. Again the absence of any known complaints, is again considered to be entirely consistent with the conclusion drawn from an assessment following the principles of BS 4142 and which concludes there would be no observed adverse effect.

6.17 In light of the above noise emissions at all receptor locations are not considered to cause any material harm to the closest dwellings and are considered to be compliant with national, city-wide and local planning policy objectives.

7 Conclusions

7.1 An environmental noise survey has been undertaken to determine existing background noise levels characterising the site.

7.2 Based on these measurement data, acoustic design targets for proposed plant installation have been determined, in accordance with the requirements of the LB Camden's assessment criterion.

7.3 Full information regarding proposed plant selections (including manufacturer's noise data) and details are provided, and detailed acoustic design calculations are presented.

7.4 A BS4142 assessment confirms that resultant precited noise levels are, as a worse case, at a *"No observed adverse effect"* level.

7.5 In light of the above, it is concluded that noise emissions from the installed plant do not cause any material harm to the closest dwellings and are therefore considered to be compliant with national, city-wide and local planning policy objectives.

APPENDIX A: Glossary of Acoustic Terminology

GLOSSARY OF ACOUSTIC TERMINOLOGY

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as "sound".

Measurement Units

The human ear can detect sound pressures as low as about 20 µPa, and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in "acoustic shorthand" as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20µPa, thus a sound pressure of 20µPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with "normal" hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. "Low" pitched sounds fluctuate less times per second than "high" pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an "A-weighting" network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in "acoustic shorthand" as L_A.

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a "Fast" time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it's nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from "clanking" types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as "noticeable"
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.

$L_{Amax,fast}$ This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.

$L_{A90,T}$ This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w The **"Weighted Sound Reduction Index"** (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.

R'_w The **"Weighted Apparent Sound Reduction Index"** (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission.

D_w The **"Weighted Sound Level Difference"** (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements. Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$ The "**Weighted Normalised Flanking Level Difference**" ($D_{nf,w}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.

Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$ The "**Standardised Impact Sound Pressure Level**" is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.

$L_{nf,w}$ The "**Normalised Flanking Impact Sound Pressure Level**" is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

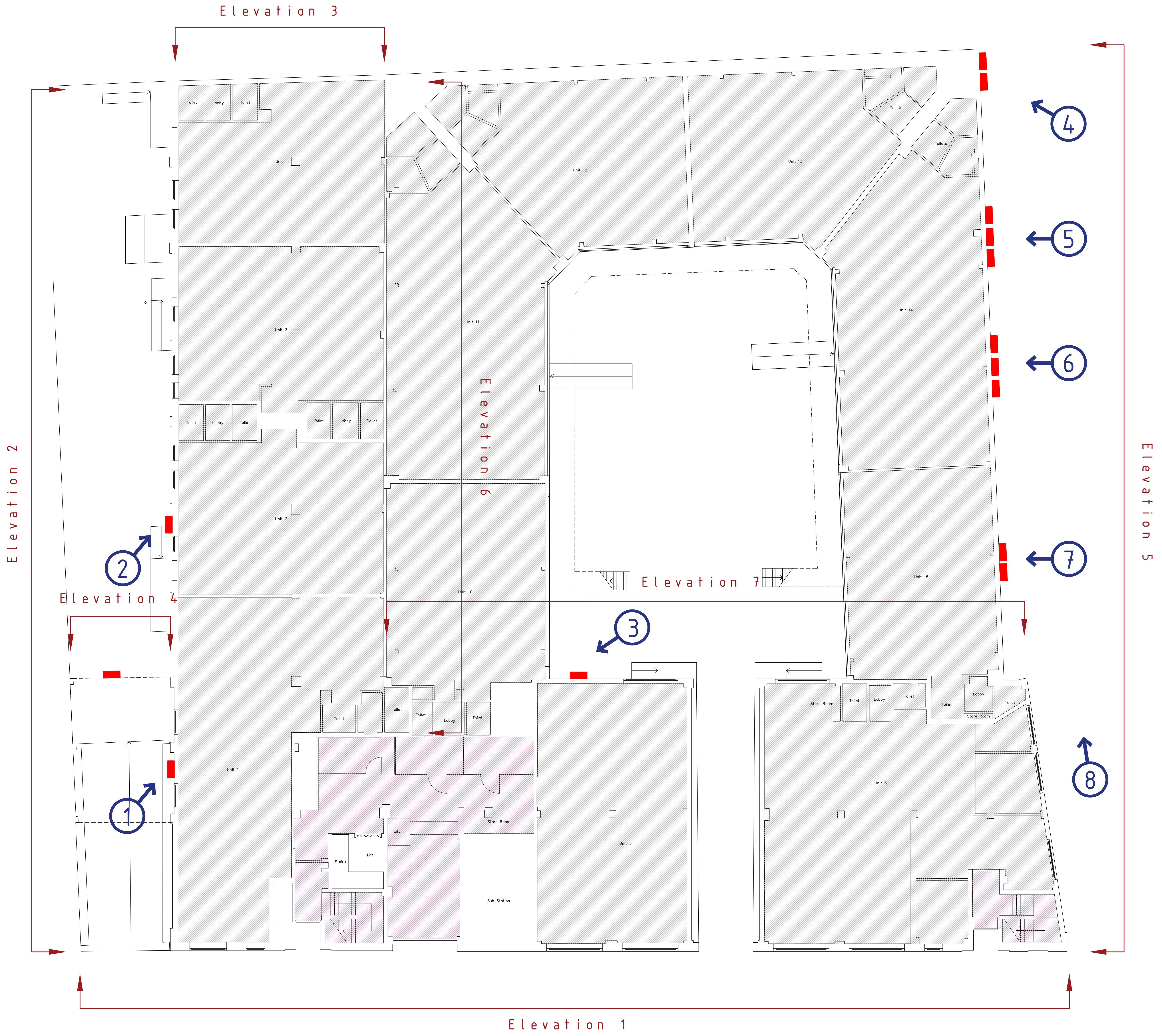
Room Acoustic Measurements

T The "**Reverberation Time**" (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT) to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.

α_p The "**Practical Acoustic Absorption Coefficient**" (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.

α_w The "**Weighted Absorption Coefficient**" (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

APPENDIX B: Plant Layout and Elevation Drawings



Ground Floor

- Office units
- Circulation areas
- A/C condenser units
- Elevations correspond to drawings 4233/029 & 4233/030
- Image number and view-point direction

NOTE:

These drawings are to be used for planning application purposes only.

A/C condenser units are not necessarily at ground floor level. This plan shows the locations only and should be cross referenced with photos and elevations to determine the heights at which the units are hung and if numerous units are hung under one and other.


Image 1


Image 2


Image 3


Image 4


Image 5

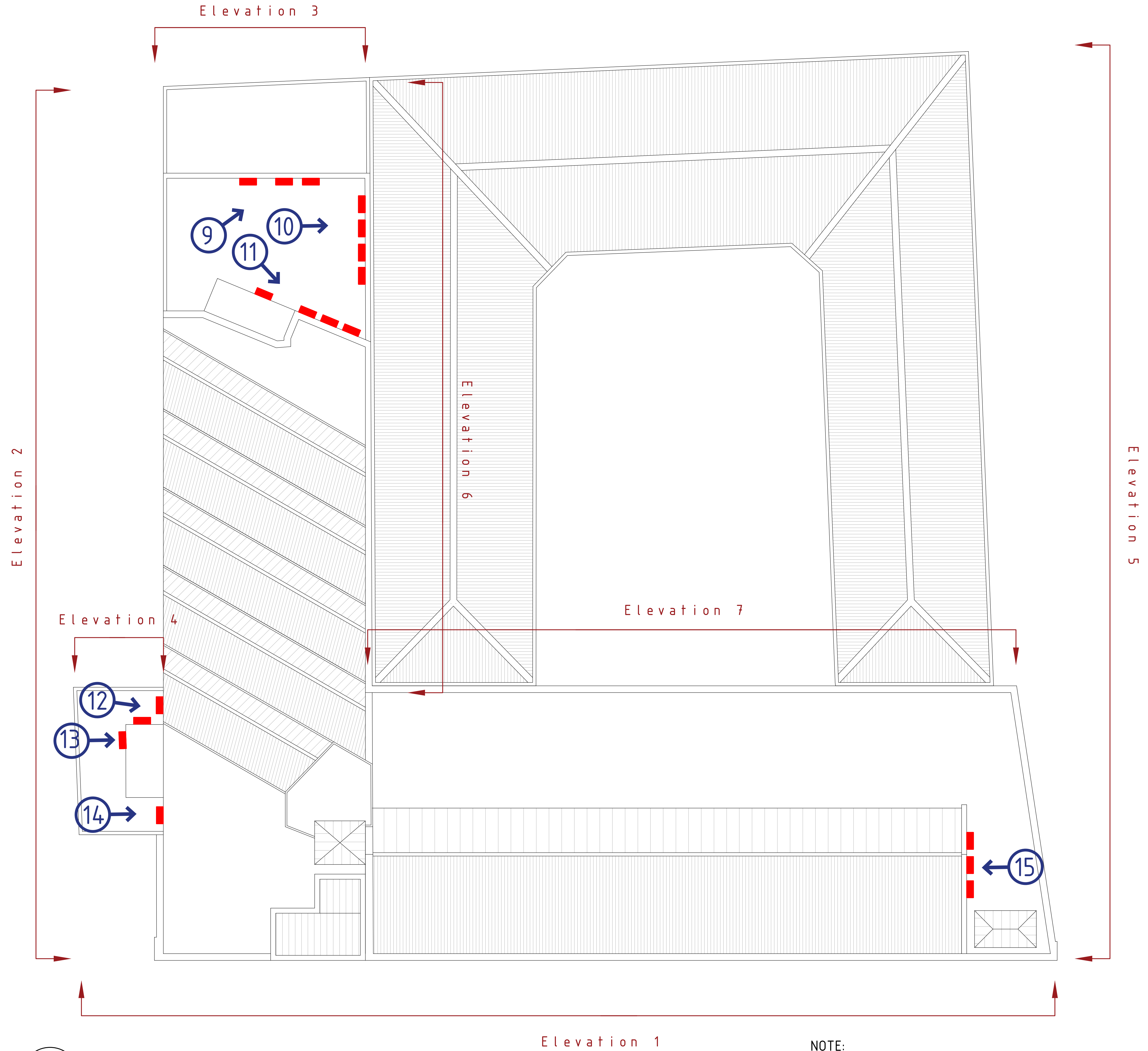

Image 6


Image 7


Image 8

Date	Scale bars	Client	Project title	Drawing title	Rev		Drawing No.	
06/03/20	9 metres @ 1:100	F55 Gospel S.a.r.l	Spectrum House	Existing External A/C Units - Location Plan	A	21/05/20 Condenser unit to Elevation 4	4233/027	A2
Drawn JCW	5 metres @ 1:50						Scale 1:200	Rev A
Checked HB	2 metres @ 1:20; 1 metre @ 1:10						Project Spectrum	

WESTON ALLISON WRIGHT



A/C condenser units

Elevations correspond to drawings 4233/029 & 4233/030

Image number and view-point direction

Roof Plan

NOTE:

These drawings are to be used for planning application purposes only.

This plan shows the locations only and should be cross referenced with photos and elevations to determine the heights at which the units are hung.

Image 9

Image 10

Image 11

Image 12

Image 13

Image 14

Image 15

Date	Client	Project title	Drawing title	Drawing No.	
06/03/20	F55 Gospel S.a.r.l	Spectrum House	Existing External A/C Units - Location Plan	4233/028	A2
Drawn JCW				Scale 1:200	Rev -/-
Checked HB				Project Spectrum	

9 metres @ 1:100 · 5 metres @ 1:50 · 2 metres @ 1:20 · 1 metre @ 1:10

Rev

WESTON ALLISON WRIGHT

NOTE:

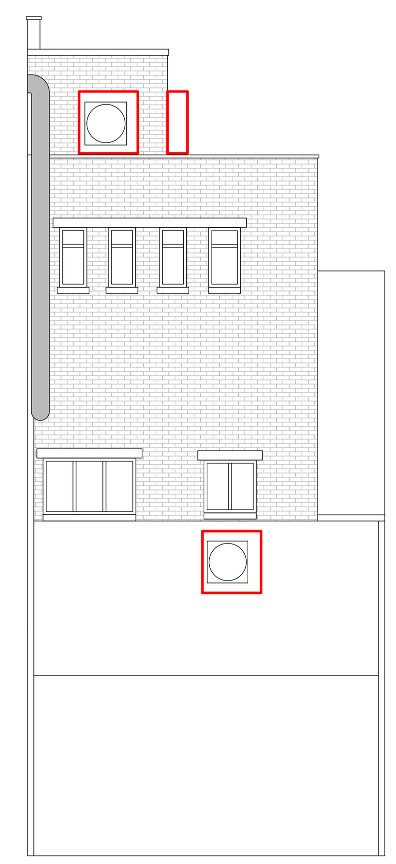
These drawings are to be used for planning application purposes only.

This drawing should be cross referenced with the associated plans 4233/027 and 4233/028 and photographs.

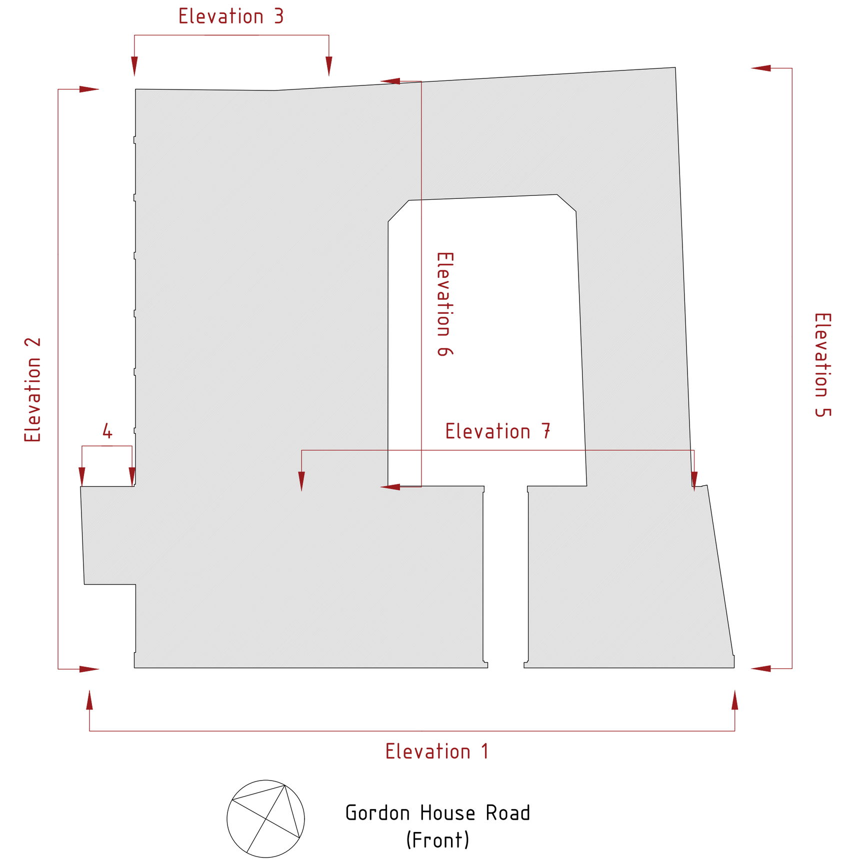
Elevation 1

Elevation 2

Elevation 3



Elevation 4



A/C condenser units

Date	Drawn	Project title	Drawing title	Client	Rev		
13/03/20	HB	Spectrum House	Existing External A/C Units - Elevations	F55 Gospel S.a.r.l	A	21/05/20	Condenser unit to Elevation 4
	Checked JCW						

RICS

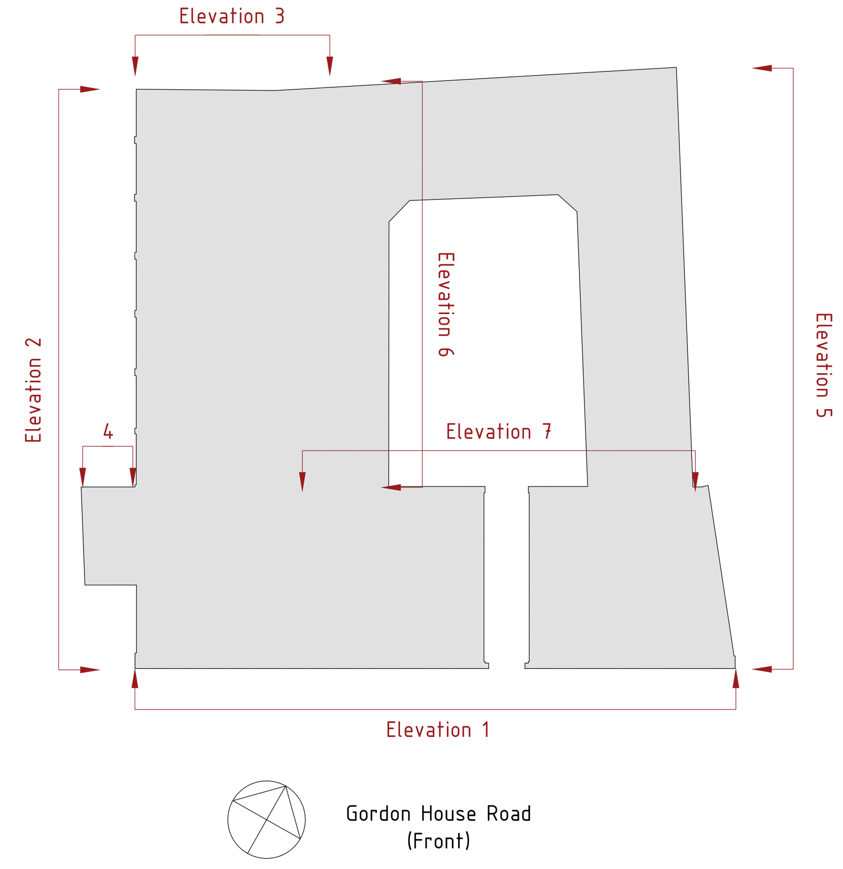
WESTON ALLISON WRIGHT

Drawing No. 4233/029 A1

Scale 1:100

Rev A

Project Spectrum



Elevation 5

Elevation 6

Elevation 7

A/C condenser units

NOTE:

These drawings are to be used for planning application purposes only.

This plan should be cross referenced with the associated plans 4233/027 and 4233/028 and photographs.

Date	Drawn	Project title	Drawing title	Client	Rev
13/03/20	HB	Spectrum House	Existing External A/C Units - Elevations	F55 Gospel S.a.r.l	
	Checked JCW				

RICS

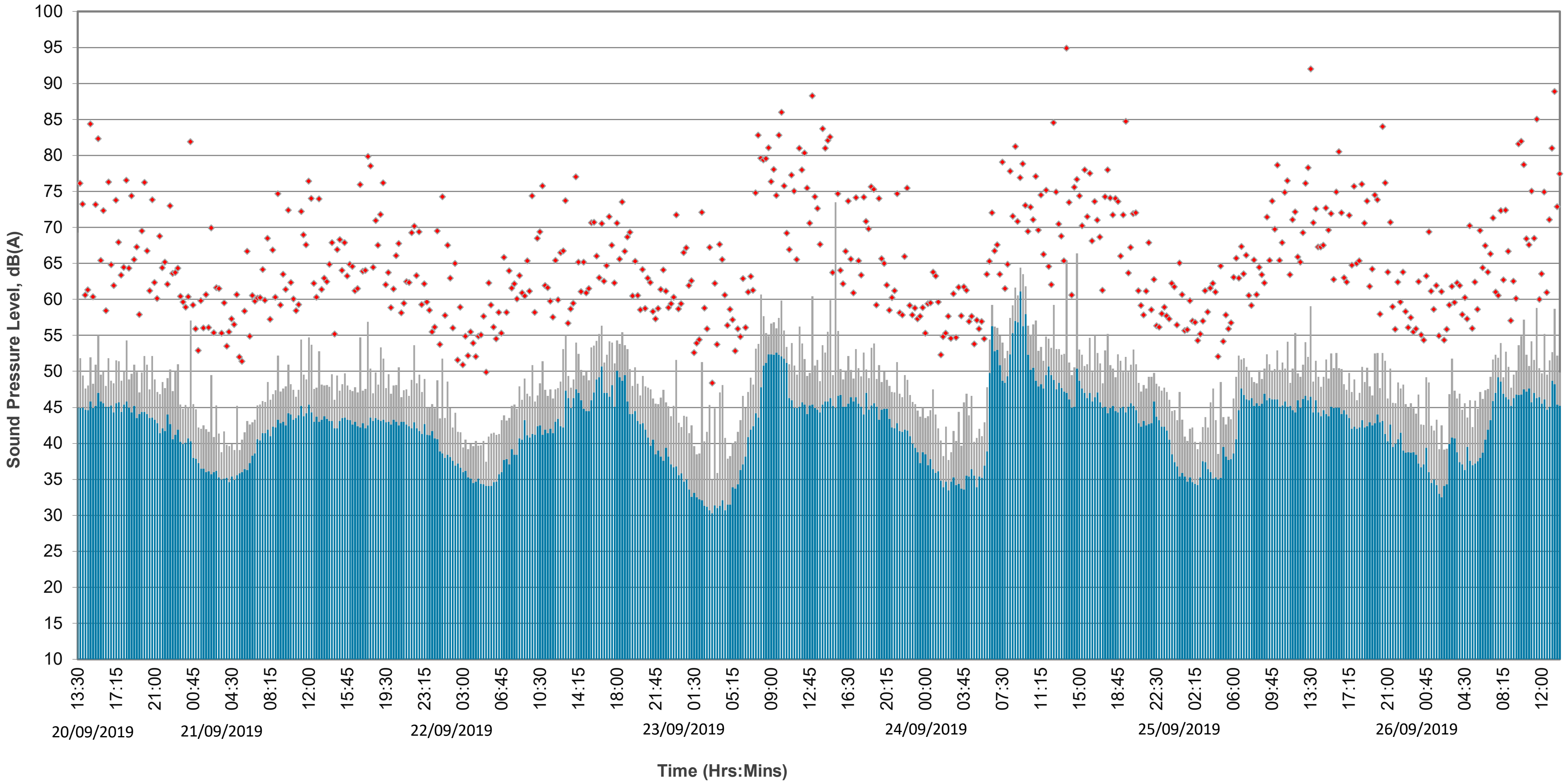
WESTON ALLISON WRIGHT

Drawing No. 4233/030	A1
Scale 1:100	Rev -/-
Project Spectrum	

APPENDIX C: Time History Profile

Time History Graph A1

Project:	Spectrum House, Gospel Oak, London
Measurement Location:	A1
Survey Period:	20/09/2019 - 26/09/2019

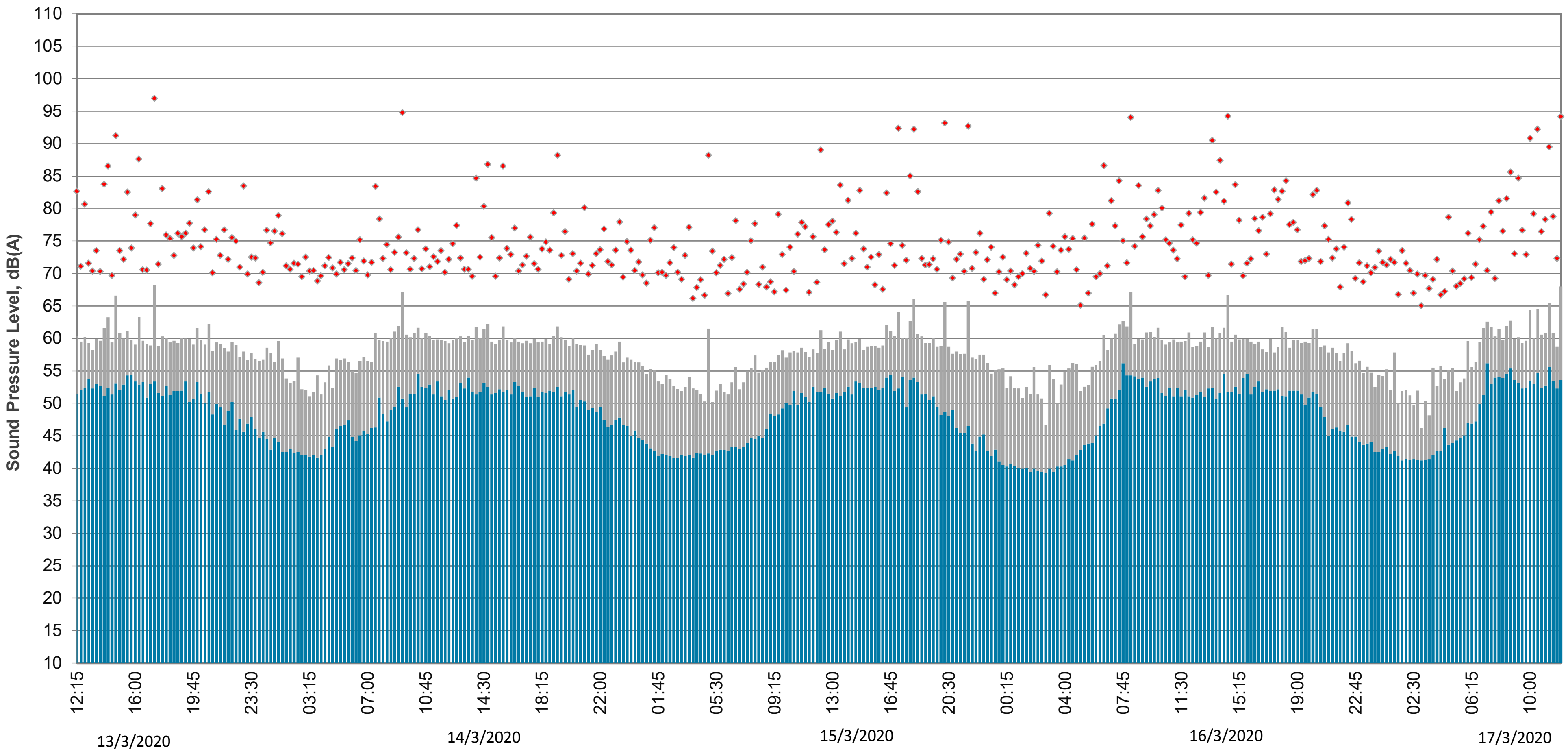


KEY: $L_{A90,15mins}$ $L_{Aeq,15mins}$ $L_{Amax,fast}$

Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph A2

Project:	Spectrum House, Gospel Oak, London
Measurement Location:	A2
Survey Period:	13/03/2020 - 17/03/2020



KEY: $L_{A90,15mins}$ $L_{Aeq,15mins}$ $L_{Amax,fast}$

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APPENDIX D: Calculation Sheets CS1 – CS5

CALCULATION SHEET	CS1	RECEPTOR	R1
PROJECT	Spectrum House		

System 1 - Daikin AZAS-MV71/MY1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	58	57	53	51	47	42	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	20	20	20	20	20	20	20	20
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	33	32	28	26	22	17	12	7
Component Noise Level	**28 dB(A)**							

System 2 - Daikin AZAS-MV71/MY1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	58	57	53	51	47	42	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 14m)	23	23	23	23	23	23	23	23
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit 2	30	29	25	23	19	14	9	4
Component Noise Level	**25 dB(A)**							

System 3 - Daikin RZAG-MV1/MY1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	58	57	53	51	47	42	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 11m)	21	21	21	21	21	21	21	21
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	32	31	27	25	21	16	11	6
Component Noise Level	**27 dB(A)**							

System 4 - Daikin RZAG-MV1/MY1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	58	57	53	51	47	42	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 13m)	22	22	22	22	22	22	22	22
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	31	30	26	24	20	15	10	5
Component Noise Level	**25 dB(A)**							

System 5 - Daikin RZAG50A	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	36	39	41	47	45	42	38	33
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	12	15	17	23	21	18	14	9
Component Noise Level	**25 dB(A)**							

System 6 - Daikin RZAG50A	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	36	39	41	47	45	42	38	33
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P2	12	15	17	23	21	18	14	9
Component Noise Level	**25 dB(A)**							

System 7 - Daikin RZASG71MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	10	13	15	20	18	15	11	7
Component Noise Level	**22 dB(A)**							

System 8 - Daikin RXM50N2V1B9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	49	50	47	44	43	37	31	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	3	3	3	3	3	3	3	3
Lp Condenser Unit P4	26	27	24	21	20	14	8	0
Component Noise Level	24 dB(A)							

System 9 - Daikin RXM50N2V1B9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	49	50	47	44	43	37	31	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	3	3	3	3	3	3	3	3
Lp Condenser Unit P1	26	27	24	21	20	14	8	0
Component Noise Level	24 dB(A)							

System 10 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	35	38	40	46	44	41	37	32
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	3	3	3	3	3	3	3	3
Lp Condenser Unit P2	12	15	17	23	21	18	14	9
Component Noise Level	26 dB(A)							

System 11 - Fujitsu AOY9ANGC	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	3	3	3	3	3	3	3	3
Lp Condenser Unit P3	24	31	29	21	22	14	11	0
Component Noise Level	26 dB(A)							

System 12 - Panasonic U-140PZ2E5	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	45	46	48	54	52	49	45	40
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	21	22	24	30	28	25	21	16
Component Noise Level	32 dB(A)							

System 13 - Panasonic U-140PZ2E5	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	45	46	48	54	52	49	45	40
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	21	22	24	30	28	25	21	16
Component Noise Level	32 dB(A)							

System 14 - Panasonic U-140PZ2E5	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	45	46	48	54	52	49	45	40
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 9m)	19	19	19	19	19	19	19	19
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	21	22	24	30	28	25	21	16
Component Noise Level	32 dB(A)							

System 15 - Daikin AZAS71MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	40	44	42	40	36	33
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 40m)	32	32	32	32	32	32	32	32
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	2	5	8	12	10	8	4	1
Component Noise Level	15 dB(A)							

	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	39	39	36	37	35	31	27	22
TOTAL NOISE LEVEL	40 dB(A)							

CALCULATION SHEET	CS2	RECEPTOR	R2
PROJECT	Spectrum House		

System 1 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 5m)	14	14	14	14	14	14	14	14
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	10	13	15	20	18	15	11	7
Component Noise Level	23 dB(A)							

System 2 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 5m)	14	14	14	14	14	14	14	14
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit 2	10	13	15	20	18	15	11	7
Component Noise Level	23 dB(A)							

System 3 - Panasonic R410A	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	52	54	51	50	50	48	39	31
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 5m)	14	14	14	14	14	14	14	14
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	28	30	27	26	26	24	15	7
Component Noise Level	30 dB(A)							

System 4 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	35	38	40	46	44	41	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 11m)	21	21	21	21	21	21	21	21
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	9	12	14	20	18	15	11	6
Component Noise Level	23 dB(A)							

System 5 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	35	38	40	46	44	41	37	32
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 12m)	22	22	22	22	22	22	22	22
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	8	11	13	19	17	14	10	5
Component Noise Level	22 dB(A)							

System 6 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 13m)	22	22	22	22	22	22	22	22
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P2	20	27	25	17	18	10	7	-4
Component Noise Level	22 dB(A)							

System 7 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	16	23	21	13	14	6	3	-8
Component Noise Level	18 dB(A)							

System 8 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 20m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	11	18	16	8	9	1	-2	-13
Component Noise Level	13 dB(A)							

System 9 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 21m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	11	18	16	8	9	1	-2	-13
Component Noise Level	13 dB(A)							

System 10 - Daikin RZASG71MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	34	37	39	44	42	39	35	31
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 32m)	30	30	30	30	30	30	30	30
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	-1	2	4	9	7	4	0	-4
Component Noise Level	11 dB(A)							

System 11 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	5	5	5	5	5	5	5	5
Geometric Divergence, A_{div} (Distance = 32m)	30	30	30	30	30	30	30	30
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	12	19	17	9	10	2	-1	-12
Component Noise Level	14 dB(A)							

	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	29	33	31	29	29	26	20	14
TOTAL NOISE LEVEL	33 dB(A)							

CALCULATION SHEET	CS3	RECEPTOR	R3
PROJECT	Spectrum House		

System 1 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	8	11	13	18	16	13	9	5
Component Noise Level	21 dB(A)							

System 2 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit 2	8	11	13	18	16	13	9	5
Component Noise Level	21 dB(A)							

System 3 - Panasonic R410A	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	52	54	51	50	50	48	39	31
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 19m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	26	28	25	24	24	22	13	5
Component Noise Level	29 dB(A)							

System 4 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	35	38	40	46	44	41	37	32
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 21m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	9	12	14	20	18	15	11	6
Component Noise Level	22 dB(A)							

System 5 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	35	38	40	46	44	41	37	32
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 21m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	9	12	14	20	18	15	11	6
Component Noise Level	22 dB(A)							

System 6 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 21m)	26	26	26	26	26	26	26	26
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P2	21	28	26	18	19	11	8	-3
Component Noise Level	23 dB(A)							

System 7 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 25m)	28	28	28	28	28	28	28	28
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	19	26	24	16	17	9	6	-5
Component Noise Level	21 dB(A)							

System 8 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 25m)	28	28	28	28	28	28	28	28
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	19	26	24	16	17	9	6	-5
Component Noise Level	21 dB(A)							

System 9 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 25m)	28	28	28	28	28	28	28	28
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	19	26	24	16	17	9	6	-5
Component Noise Level	21 dB(A)							

System 10 - Daikin RZASG71MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	34	37	39	44	42	39	35	31
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 33m)	30	30	30	30	30	30	30	30
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	4	7	9	14	12	9	5	1
Component Noise Level	16 dB(A)							

System 11 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	0	0	0	0	0	0	0	0
Geometric Divergence, A_{div} (Distance = 33m)	30	30	30	30	30	30	30	30
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	17	24	22	14	15	7	4	-7
Component Noise Level	19 dB(A)							

	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	29	34	32	29	29	25	19	13
TOTAL NOISE LEVEL	33 dB(A)							

CALCULATION SHEET	CS4	RECEPTOR	R4
PROJECT	Spectrum House		

System 1 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 35m)	31	31	31	31	31	31	31	31
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	1	4	6	11	9	6	2	-2
Component Noise Level	14 dB(A)							

System 2 - Daikin RZASG1MV1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	34	37	39	44	42	39	35	31
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 34m)	31	31	31	31	31	31	31	31
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit 2	1	4	6	11	9	6	2	-2
Component Noise Level	14 dB(A)							

System 3 - Panasonic R410A	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	52	54	51	50	50	48	39	31
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 33m)	30	30	30	30	30	30	30	30
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	20	22	19	18	18	16	7	-1
Component Noise Level	22 dB(A)							

System 4 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	35	38	40	46	44	41	37	32
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 27m)	29	29	29	29	29	29	29	29
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P4	4	7	9	15	13	10	6	1
Component Noise Level	18 dB(A)							

System 5 - Daikin RXM50N9	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level	35	38	40	46	44	41	37	32
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 26m)	28	28	28	28	28	28	28	28
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P1	5	8	10	16	14	11	7	2
Component Noise Level	18 dB(A)							

System 6 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 25m)	28	28	28	28	28	28	28	28
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P2	17	24	22	14	15	7	4	-7
Component Noise Level	19 dB(A)							

System 7 - Fujitsu DC Inverter	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	47	54	52	44	45	37	34	23
Directivity Correction, D_c	2	2	2	2	2	2	2	2
Geometric Divergence, A_{div} (Distance = 18m)	25	25	25	25	25	25	25	25
Atmospheric Absorption, A_{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A_{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A_{bar}	0	0	0	0	0	0	0	0
Miscellaneous Attenuation, A_{misc}	0	0	0	0	0	0	0	0
Reflections	0	0	0	0	0	0	0	0
Lp Condenser Unit P3	20	27	25	17	18	10	7	-4
Component Noise Level	22 dB(A)							