

DMG-230625-1

14th August 2025



Vernon Properties Ltd

Assessment of noise at the land off Audley
Street, Reading, RG30 1BS for proposed
residential development

Prepared for :-

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1.0 **SUMMARY**

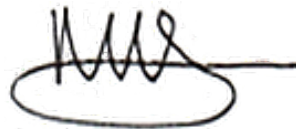
The windows were of poor quality and not well sealed and were a clear weakness in the structure. The room where measurements were made was tiles and very reverberant, significantly contributing to the measured levels.

The surrounding area is predominantly residential, along with some commercial units in the same block as the application site. At all times, the area was dominated by middle distance traffic typical of a residential area. At no time was any impact audible from the commercial units.

The internal levels should be acceptable with natural ventilation. In terms of the facades, basic thermal double glazing and non-acoustic vents should be more than adequate.



A R Raymond



M A Pickering

2.0 INTRODUCTION

Eco Technology Lcz Ltd was asked to carry out an independent assessment of the above site with regards to its suitability for residential development from a noise perspective.

This report begins by summarising assessment standards and, where appropriate, discusses alternative interpretations.

After a brief statement of survey details we discuss basic results and the resulting assessment, along with any mitigation which might be implied. We sum-up and conclude at the end, along with brief recommendations.

3.0 ASSESSMENT STANDARDS

3.1 NPPF, NPSE and NPPG

The National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the National Planning Practice Guidance (NPPG) provide nothing in the way of quantitative criteria but instead provide general policy aims and statements and some guidance on how certain situations can be interpreted.

The NPPF's main statement on noise is to be found in paragraph 198:-

198. 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 life⁷²;
 - 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.

Paragraph 200 is also relevant:-

200. 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.

The NPPF refers to the NPSE which sets out the following aims:-

1. *avoid significant adverse impacts on health and quality of life;*
2. *mitigate and minimise adverse impacts on health and quality of life;*
and
3. *where possible, contribute to the improvement of health and quality of life.*

It also introduces the concepts of:

- *NOEL – No Observed Effect Level. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
- *LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.*
- *SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.*

SOAEL is clearly something the policy seeks to avoid in aim 1. Aim 2 represents situations between SOAEL and LOAEL, and seeks to minimise and mitigate the effects.

The NPPG section on noise adds some further detail, much of it reproducing the NPPF and NPSE, but some useful qualitative guidance is provided Noise Exposure Hierarchy, as follows:-

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and 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 change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
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; where there is no alternative ventilation, having to close 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			
Present 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 the 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
Present 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, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

It also makes the point that the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation, including the level of the noise in absolute terms and how it might compare with the underlying background noise, the impulsiveness or intermittence pattern of the noise, its spectral content, and the time of day. It discusses in very general terms the issues to consider when introducing noise sources to existing noise sensitive area, new residential development in areas affected by existing noise sources (most of which have their own specific guidance, such as BS 4142, BS 8233, etc.) and the potential impact on wildlife.

3.2 BS8233 and WHO

BS 8233 was updated in March 2014. Its guidance is primarily intended for new buildings, but the criteria are routinely referred to for putting general noise climates into context.

The criteria in Table 4 of BS 8233 are based on WHO guidance and give the desirable criteria for indoor ambient noise levels for dwellings as follows:-

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB L_{Aeq} , 16 hour	-
Dining	Dining Room	40 dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} , 16 hour	30 dB L_{Aeq} , 8 hour

The standard does not explicitly state criteria for bedroom noise in terms of dB L_{Amax} but the WHO Guidelines for Community Noise (or similar) are widely used with a recommendation that the noise inside bedrooms should not typically exceed 45 dB L_{Amax} , for instance no more than 10 to 15 times a night.

BS 8233 goes on to state that, where necessary, the criteria can be relaxed by up to 5 dB and still achieve reasonable conditions.

Note that the standard accepts the widely used rule of thumb that, for a partly open window, the levels just outside will be 15dB higher than those just inside. Other more recent research suggests a difference of 13 dB. The latter brings us to an external equivalent of the above table, as follows:-

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	48 dB L_{Aeq} , 16 hour	-
Dining	Dining Room	53 dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	48 dB L_{Aeq} , 16 hour	43 dB L_{Aeq} , 8 hour

Garden area criteria are 50 dB L_{Aeq} and 55 dB L_{Aeq} being considered desirable and reasonable respectively.

3.3 Local Authority

As far as we are aware no planning conditions have been proposed.

4.0 GUIDE TO MODELLING

Full details of calculations are given in Appendix 2. The basic approach is as follows.

1. The external noise break-in is based on the level of external noise just outside the façade(s), the area of the façade(s), the sound insulation properties of the façade(s) and the internal absorption of the room.

2. Measurements were made within two of the worst affected. At face value, the measured levels should be reasonably representative of the proposed internal levels. However, we also need to incorporate changes, such as room sizes and layouts, glazing, vents, carpeting, etc.
3. We begin by analysing the existing room, and then comparing it to the proposed room(s) where different. The first input to the calculation process is the area of the exposed façade. Where more than one façade is exposed, then they can all be entered. The room depth is also entered so as to derive the room volume. Where the room is not a straight forward rectangular shape, an “effective depth” is sometimes entered so as to derive the approximate room volume. Judgement may occasionally be used if the room is not simple, such as a very unusual shape or a multi-use room such as a through-kitchen/dining room/living room, or studio-style area.
4. The reverberation time (RT) is entered. Usually this is a standardised 0.5 seconds for a completed and fitted out room and represents the absorption properties of the room. For an undeveloped site it is usually longer due to the absence of carpets and furnishings.
5. Two corrections result from the above inputs. Firstly, we have the Area Correction. Put simply, the greater the exposed area, the more noise will break in. The correction is $10 \times \log(\text{Effective Area})$ and is usually a positive number. Note that the “Effective Area” takes account of the method of modelling vents – see later. The Room Correction takes account of the room absorption (more absorption reduces the noise) and the room volume (a larger volume disperses, and so reduces, the noise). The correction is $10 \times \log(\text{RT}/0.163/\text{Volume})$ and is usually a negative number.
6. These corrections, together with the sound insulation properties of the façade(s) give us the basic outside-to-inside level difference. The sound insulation properties of the façade(s), known as the Sound Reduction Index (SRI or just R) are effectively the sound insulation of 1m^2 of material (apart from vents – see later). Of course, a façade is usually made up of more than one element – windows and walls for instance. The overall SRI or R is referred to as the Composite SRI or composite R and is related to the SRI or R of the individual elements and their respective areas. SRI or R figures are usually based on laboratory tests and therefore somewhat idealised.
7. An additional complication is that performance data for vents is generally standardised to 10m^2 . The area of a vent is therefore usually entered as 10m^2 , even though its actual area will usually be nowhere near that much.
8. So, the composite SRI or R, combined with the areas and room corrections gives us the basic level difference to be expected under perfect (laboratory) conditions. However, actual site conditions are affected by workmanship, which can never be guaranteed to be

perfect, and flanking paths (noise paths other than straight through the façade(s)). Here, however, the measured internal noise includes these and so a correction is not usually required.

9. The calculated inside-to-outside level difference for the existing rooms is set against the actual measured levels when looking at the proposed rooms so that any changes (room sizes and layouts, glazing, vents, absorption (fit-out), etc.) can be taken into account and used to calculate the proposed internal levels.
10. The process is repeated in octave bands across the frequency range to derive the predicted internal levels.

5.0 SURVEY DETAILS

5.1 Site Times and Personnel

The measurements were carried out by Mark Pickering of Eco Technology Lcz Ltd.

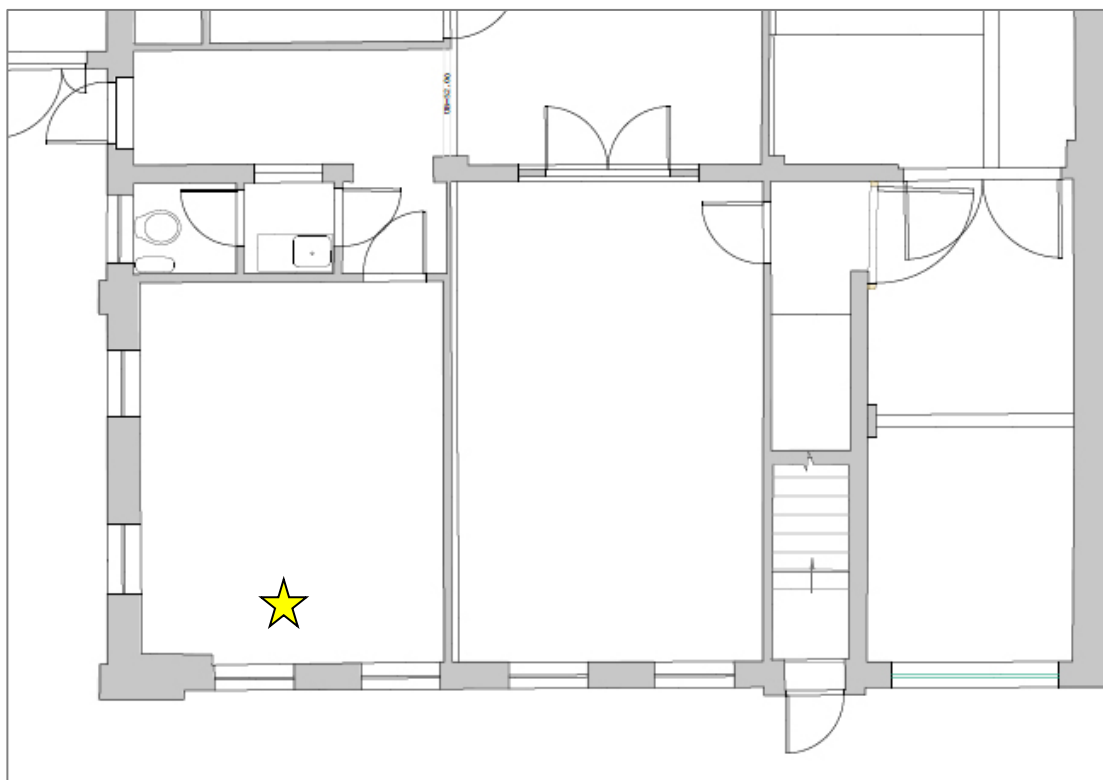
Measurements were carried out on 29th July 2025 from approximately 16:00 hours to 08:15 hours the following day. The measurements were intermittently attended.

5.2 Instrumentation

Instrumentation used was a Rion NL-52 Class I sound level meter which holds a current calibration certificate and which was field-calibrated as necessary with no drift noted. The meter was set up to measure continuous 5 minute samples in terms of dB L_{eq} , dB L_{max} and dB L_{90} in overall A-weighted terms, and in octave bands across the frequency range. See Definition of Acoustic Terms in Appendix 1.

5.3 Measurement Positions

It was not practical to take measurements externally. Access inside was only possible on the ground floor and so it was not possible to leave windows open. Along with brief measurements inside, and out and with windows open and closed, this was dealt with as described in section 4 above. The main measurement position was as shown on the following plan. It was chosen as a worst case, with two exposed sides and a large number of windows.



The microphone was 1.3 m above ground with windows closed. The room at the position had a thin carpeted but was otherwise unfurnished.

5.4 Survey Conditions

We have no reason to believe that the conditions we found on the survey were anything other than representative of normal conditions. We also discussed this with locals and with occupiers of the commercial units.

As the measurements were mainly internal, the weather was not crucial but, for the record, there was no rain or wind and a temperature of 21°C.

6.0 RESULTS AND DISCUSSIONS

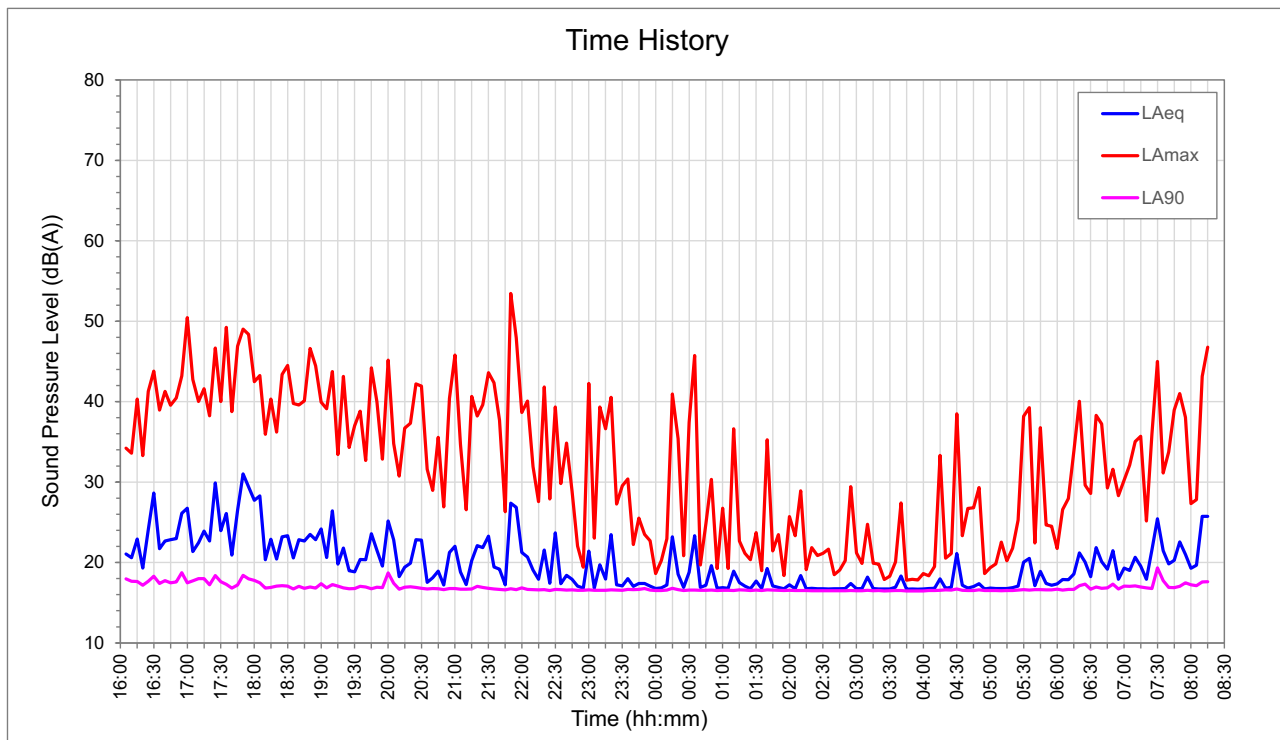
The windows were of poor quality and not well sealed and were a clear weakness in the structure. The room where measurements were made was tiles and very reverberant, significantly contributing to the measured levels.

The surrounding area is predominantly residential, along with some commercial units in the same block as the application site.

At all times, the area was dominated by middle distance traffic typical of a residential area. At no time was any impact audible from the commercial units. We spoke to the operator of the welders and he advised that the unit was primarily for storage. He also advised that the ladies' gym had been closed for some time, but was never a noticeable noise source. A dog grooming business appeared to be operating normally, but there was no audible noise from it.

6.1 Basic Results

Results are best presented graphically as follows:-



A summary of overall levels is as follows:-

Internal Levels	Index	dB(A)
Overall Rush Hour	Leq	24
	Lmax	43
	L90	17
Overall Evening	Leq	21
	Lmax	41
	L90	17
Overall Nighttime	Leq	18
	Lmax	33
	Lmax*	37
	Lmax**	33
	L90	17

* and ** are the levels exceeded 10 and 15 times respectively (8 hour night equivalent). Otherwise logarithmic means

6.2 Assessments

The above results give the following assessments.

In terms of BS 8233, we are mainly concerned with the dB(A) L_{eq} values, or the dB L_{Aeq} levels. See definition of Acoustic terms in Appendix 1. The current version of BS 8233 no longer has night time criteria in terms of dB(A) L_{max} values, or dB L_{Amax} values, but some local authorities still like to see them presented and assessed to WHO guidelines or similar.

So, ignoring for now changes to windows, ventilation, room layouts and fit out, rooms to the front facades are well within BS 8233 and WHO-type criteria. This is with windows closed. Appendix 2 shows the

calculation effective external levels which were also confirmed by brief measurements on site. A summary is as follows:-

<i>Effective External</i>	<i>Index</i>	<i>dB(A)</i>
Overall Rush Hour	Leq	48
Overall Evening	Leq	46
Overall Nighttime	Leq	45
	Lmax*	58

6.3 Modelled Levels and Mitigation

BS8233 suggests that a partly open window will provide around 15 dB reduction from outside to inside. In our experience this is a conservative value, but some standards suggest a reduction of 13 dB. Either way the internal levels can be expected to be well within all criteria for daytime. For bedrooms at night, levels should be around the BS 8233 criterion for *desirable* conditions and obviously well within the criterion for *reasonable* conditions. The WHO criterion of 45 dB L_{Amax} should be met.

A summary of mitigation (or building elements assumed in our calculations) is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Make-Up on Which Calculations are Based</i>
Front and Side	Living Rooms and Bedrooms	Walls: Traditional Masonry
		Glazing: Basic thermal eg. 4+20+4
		Vents: Non-acoustic eg. Simon Airstrip 300

NB. R_w should come with a negative C_{tr} term, usually around -5 dB, eg. 35 dB R_w and -5 dB C_{tr} is 30 dB $R_w + C_{tr}$

The room used in the calculations is a worst case example, for instance exposed on more than one façade and/or have large window areas and/or short room depths, etc. Other rooms on the same façade with the same glazing and vent specification can be expected to perform better

Note that the table provides the acoustic specifications (such as R_w for windows) to meet appropriate criteria. The glazing build-ups and vent models which are also shown are examples and many other options achieving the same acoustic performance are available. For instance the existing glazing can be fitted with secondary panes internally, or replaced with a double glazed unit with the same performance.

Full calculation details are shown in Appendix 2 and a summary of predicted internal noise levels is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Time</i>	<i>Index</i>	<i>dB(A)</i>
Front and Side	Living Rooms and Bedrooms	Rush	Leq	23
		Night	Leq	18
			Lmax	36

Of course, these assessments are very robust as they use what should be the worst affected room. Rooms at higher levels should be a little quieter.

7.0 CONCLUSIONS/RECOMMENDATIONS

The internal levels should be acceptable with natural ventilation. In terms of the facades, basic thermal double glazing and non-acoustic vents should be more than adequate.

Our only recommendation, therefore, is that you issue this report to Planners and we would encourage Officers to contact us directly with any queries.

Appendix 1

Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but it really should be stated. The threshold of human hearing is a sound pressure of $20\mu\text{Pa}$ or a sound power of 1pW .

A sound pressure level or SPL should be expressed in dB(re. $20\mu\text{Pa}$). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to give an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted level are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

Equivalent Continuous Sound Level, L_{eq}

This is a kind of mean noise level.

The unit is dB L_{eq} . For A-weighted levels the unit is dB(A) L_{eq} or, in more modern units, dB L_{Aeq} . The Noise at Work Regulations use $L_{\text{eq(s)}}$ which refers to a sample level.

Maximum Level, L_{max}

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB L_{max} . For A-weighted levels the unit is dB(A) L_{max} or, in more modern units, dB L_{Amax} .

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceeded for a percentage of the time. L_n is the index representing the level exceeded for $n\%$ of the measurement period.

The unit is dB L_n . For A-weighted levels, the unit is dB(A) L_n or, in more modern units, dB L_{An} .

Common examples are as follows :-

dB L_{A90} is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB L_{A50} is the A-weighted level exceeded for 50% of the time. Mathematically, it is the median, another kind of average.

dB L_{A10} is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band from low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of L_{eq} , L_{max} , L_n , etc. as defined above.

Appendix 2

Measurement and Calculation Details

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
16:00	Leq	0	0	0	0	0	0	0	0	0
	Lmax	0	0	0	0	0	0	0	0	0
	L90	0	0	0	0	0	0	0	0	0
16:05	Leq	21	32	29	25	14	9	9	11	12
	Lmax	34	53	41	39	30	23	19	17	19
	L90	18	25	26	17	9	7	9	10	12
16:10	Leq	21	27	29	25	11	8	9	11	12
	Lmax	34	42	41	38	22	17	22	26	22
	L90	18	23	25	17	8	7	9	10	12
16:15	Leq	23	32	29	29	15	10	9	11	12
	Lmax	40	50	46	42	38	34	31	28	17
	L90	18	24	20	19	9	7	9	10	12
16:20	Leq	19	28	27	22	11	8	9	11	12
	Lmax	33	41	40	40	25	18	15	16	17
	L90	17	24	19	16	8	7	9	10	12
16:25	Leq	24	37	30	30	16	11	10	11	12
	Lmax	41	59	49	47	33	28	28	26	14
	L90	18	25	21	18	9	7	9	11	12
16:30	Leq	29	41	35	34	25	17	13	11	12
	Lmax	44	60	50	48	42	34	25	18	21
	L90	18	27	23	20	11	8	9	11	12
16:35	Leq	22	31	30	26	16	9	9	11	12
	Lmax	39	45	45	46	33	23	12	11	13
	L90	17	25	21	16	9	7	9	10	12
16:40	Leq	23	33	30	28	16	11	10	11	12
	Lmax	41	52	44	49	32	24	19	15	13
	L90	18	26	22	18	10	8	9	10	12
16:45	Leq	23	35	29	28	17	10	9	11	12
	Lmax	40	52	47	46	37	25	15	13	13
	L90	17	25	21	17	9	8	9	10	12
16:50	Leq	23	35	30	28	17	10	9	11	12
	Lmax	40	56	46	47	35	22	17	15	16
	L90	18	25	21	17	9	8	9	10	12
16:55	Leq	26	37	33	32	21	13	11	11	12
	Lmax	43	54	46	48	41	33	29	28	21
	L90	19	28	24	21	11	8	9	11	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
17:00	Leq	27	33	35	33	20	13	10	11	12
	Lmax	50	49	57	58	44	36	25	16	13
	L90	17	25	21	17	9	8	9	10	12
17:05	Leq	21	32	29	26	15	9	9	11	12
	Lmax	43	49	53	49	37	26	19	15	13
	L90	18	24	21	18	10	7	9	10	12
17:10	Leq	22	32	31	28	15	8	9	11	12
	Lmax	40	54	49	46	36	23	25	15	13
	L90	18	26	22	20	10	7	9	10	12
17:15	Leq	24	36	31	30	17	11	10	11	12
	Lmax	42	57	48	49	34	27	25	20	13
	L90	18	25	21	20	10	8	9	10	12
17:20	Leq	23	35	30	27	17	11	10	11	12
	Lmax	38	56	48	42	34	25	22	16	18
	L90	17	24	20	16	8	7	9	10	12
17:25	Leq	30	37	36	36	26	20	14	13	12
	Lmax	47	56	51	52	43	38	31	28	17
	L90	18	27	24	20	10	8	9	11	12
17:30	Leq	24	35	32	29	21	11	9	11	12
	Lmax	40	54	47	45	39	28	22	17	14
	L90	18	28	23	17	8	7	9	10	12
17:35	Leq	26	36	33	32	21	14	11	11	12
	Lmax	49	52	52	56	45	36	27	24	13
	L90	17	25	21	16	8	7	9	11	12
17:40	Leq	21	34	26	25	15	10	9	11	12
	Lmax	39	57	47	45	31	23	18	14	13
	L90	17	23	16	12	8	7	9	11	12
17:45	Leq	26	37	32	29	25	19	15	12	12
	Lmax	47	61	56	48	44	41	31	27	20
	L90	17	23	20	15	8	8	9	11	12
17:50	Leq	31	28	32	32	31	24	21	13	12
	Lmax	49	40	45	47	49	44	40	28	21
	L90	18	24	23	20	11	8	9	11	12
17:55	Leq	29	35	32	32	27	24	19	12	12
	Lmax	48	56	55	51	43	44	36	23	21
	L90	18	22	20	17	12	8	9	11	12
18:00	Leq	28	30	31	30	26	21	16	12	12
	Lmax	42	47	43	44	42	36	32	21	22
	L90	18	22	21	16	11	8	9	11	12
18:05	Leq	28	34	32	32	27	20	16	12	12
	Lmax	43	48	45	46	42	36	34	24	20
	L90	17	27	21	16	9	8	9	11	12
18:10	Leq	20	34	26	25	12	9	9	11	12
	Lmax	36	54	43	42	25	21	16	18	23
	L90	17	22	15	13	8	7	9	10	12
18:15	Leq	23	32	30	29	15	10	9	11	12
	Lmax	40	51	45	48	33	26	19	13	13
	L90	17	23	18	14	8	7	9	10	12
18:20	Leq	20	31	25	25	12	9	9	11	12
	Lmax	36	53	42	43	28	23	22	16	13
	L90	17	23	19	15	8	7	9	10	12
18:25	Leq	23	30	28	30	15	9	9	11	12
	Lmax	43	49	47	51	36	26	17	17	13
	L90	17	23	20	15	8	7	9	10	12
18:30	Leq	23	35	29	29	16	11	9	11	12
	Lmax	45	60	51	52	35	30	20	16	13
	L90	17	23	18	16	8	7	9	10	12
18:35	Leq	21	33	26	24	14	11	9	11	12
	Lmax	40	52	45	42	36	35	24	23	13
	L90	17	22	15	12	7	7	9	10	12
18:40	Leq	23	34	31	28	14	9	9	11	12
	Lmax	40	48	50	46	29	25	16	12	13
	L90	17	23	18	15	8	7	9	10	12
18:45	Leq	23	30	28	28	18	10	10	11	12
	Lmax	40	51	49	46	36	23	21	16	13
	L90	17	21	14	13	8	7	9	11	12
18:50	Leq	24	33	25	30	16	11	9	11	12
	Lmax	47	57	44	55	33	24	17	13	13
	L90	17	22	19	13	8	8	9	11	12
18:55	Leq	23	33	27	26	22	10	9	11	12
	Lmax	44	56	46	46	46	26	21	26	13
	L90	17	22	18	12	8	7	9	11	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
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	Lmax	40	57	44	46	36	25	22	18	13
	L90	17	24	20	17	8	7	9	11	12
19:05	Leq	21	36	24	25	13	9	10	11	12
	Lmax	39	57	39	45	27	22	26	30	13
	L90	17	23	17	13	8	7	9	11	12
19:10	Leq	26	34	31	33	19	13	10	11	12
	Lmax	44	57	55	48	40	28	24	20	13
	L90	17	21	19	17	8	7	9	11	12
19:15	Leq	20	25	24	24	12	9	9	11	12
	Lmax	33	39	38	40	25	26	21	12	13
	L90	17	22	18	15	8	7	9	10	12
19:20	Leq	22	32	27	27	15	9	9	11	12
	Lmax	43	55	52	50	33	25	22	19	17
	L90	17	22	16	13	8	7	9	10	12
19:25	Leq	19	25	21	22	13	9	9	11	12
	Lmax	34	38	43	39	32	24	20	16	13
	L90	17	20	14	12	8	7	9	10	12
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	Lmax	37	49	36	36	39	23	16	14	13
	L90	17	20	13	13	8	7	9	10	12
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	Lmax	39	54	46	46	30	22	16	14	13
	L90	17	23	18	15	8	7	9	11	12
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	Lmax	33	36	38	40	26	20	12	14	13
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	Lmax	44	55	52	51	36	29	23	18	13
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	Lmax	33	41	41	40	26	17	16	13	13
	L90	17	24	17	14	8	7	9	10	12
20:00	Leq	25	37	32	30	19	17	13	11	12
	Lmax	45	52	51	49	35	41	35	15	13
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20:20	Leq	20	26	24	24	12	10	9	11	12
	Lmax	37	43	44	43	31	29	24	16	13
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	L90	17	19	14	13	7	7	9	10	12
20:40	Leq	18	26	21	19	11	8	9	11	12
	Lmax	29	48	31	33	27	17	14	12	13
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	Lmax	36	38	45	38	34	27	19	15	13
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20:55	Leq	21	29	23	26	16	10	9	11	12
	Lmax	40	51	43	46	39	27	21	18	13
	L90	17	20	16	13	8	7	9	10	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
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	L90	17	20	16	13	8	7	9	10	12
21:05	Leq	19	28	21	22	10	8	9	11	12
	Lmax	35	46	39	42	27	21	16	12	13
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21:10	Leq	17	23	17	16	9	8	9	11	12
	Lmax	27	34	29	32	25	13	13	12	13
	L90	17	18	13	12	7	7	9	10	12
21:15	Leq	20	31	24	25	11	8	9	11	12
	Lmax	41	54	45	48	30	23	17	13	13
	L90	17	19	15	13	7	7	9	10	12
21:20	Leq	22	36	28	27	15	11	10	11	12
	Lmax	38	57	49	42	31	24	23	17	13
	L90	17	21	18	15	8	7	9	11	12
21:25	Leq	22	34	26	27	16	11	10	11	12
	Lmax	40	56	44	46	33	26	27	20	15
	L90	17	21	15	14	8	7	9	11	12
21:30	Leq	23	35	28	29	19	12	10	11	12
	Lmax	44	55	48	50	40	30	23	20	15
	L90	17	21	14	13	8	7	9	11	12
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	Lmax	42	55	49	50	28	19	14	14	13
	L90	17	21	15	12	7	7	9	10	12
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	Lmax	38	39	37	46	26	21	14	18	17
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21:45	Leq	17	23	16	16	8	8	9	11	12
	Lmax	26	40	28	33	22	12	11	11	13
	L90	17	17	13	11	7	7	9	10	12
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	Lmax	48	58	53	56	40	31	23	19	15
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	Lmax	39	39	44	47	26	17	14	12	13
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22:20	Leq	22	28	26	27	15	10	9	11	12
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	Lmax	35	44	37	43	24	15	11	12	13
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22:55	Leq	17	20	17	11	7	7	9	11	12
	Lmax	19	32	24	21	11	9	10	11	13
	L90	17	16	14	9	7	7	9	11	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
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	L90	17	18	15	11	7	7	9	11	12
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	Lmax	23	44	29	26	14	10	12	11	13
	L90	17	15	14	9	7	7	9	11	12
23:10	Leq	20	28	23	24	12	9	9	11	12
	Lmax	39	52	49	46	33	27	17	13	13
	L90	17	16	13	10	7	7	9	11	12
23:15	Leq	18	31	23	18	9	8	9	11	12
	Lmax	37	57	48	40	27	16	13	12	13
	L90	17	17	14	10	7	7	9	11	12
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	Lmax	41	57	52	46	31	20	15	13	13
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	L90	17	16	14	9	7	7	9	11	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
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	L90	17	15	15	9	7	7	9	11	12
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	Lmax	37	41	52	38	23	15	13	12	13
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02:55	Leq	17	19	18	17	8	8	9	11	12
	Lmax	29	34	37	35	22	14	15	20	16
	L90	17	15	14	9	7	7	9	10	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
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03:05	Leq	17	20	17	10	7	7	9	11	12
	Lmax	20	29	29	16	14	12	10	11	13
	L90	16	15	14	9	7	7	9	10	12
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	Lmax	25	29	28	31	19	15	13	12	13
	L90	17	17	14	9	7	7	9	10	12
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	Lmax	20	28	19	16	13	12	14	11	13
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	L90	16	16	13	9	7	7	9	10	12
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	Lmax	20	32	30	21	11	10	10	12	13
	L90	17	16	14	9	7	7	9	10	12
03:40	Leq	18	25	29	12	7	7	9	11	12
	Lmax	27	35	43	20	14	9	10	11	13
	L90	17	16	15	9	7	7	9	10	12
03:45	Leq	17	16	15	9	7	7	9	11	12
	Lmax	18	23	19	12	9	9	10	11	13
	L90	16	13	13	9	7	7	9	10	12
03:50	Leq	17	15	15	10	7	7	9	11	12
	Lmax	18	24	20	15	9	9	10	11	13
	L90	16	13	13	9	7	7	9	10	12
03:55	Leq	17	16	15	10	7	7	9	11	12
	Lmax	18	23	18	14	9	9	10	11	13
	L90	16	13	13	9	7	7	9	10	12
04:00	Leq	17	17	14	11	7	7	9	11	12
	Lmax	19	25	22	20	9	9	10	11	13
	L90	16	14	13	9	7	7	9	10	12
04:05	Leq	17	17	15	11	7	7	9	11	12
	Lmax	18	23	20	17	12	9	10	11	13
	L90	17	13	14	10	7	7	9	10	12
04:10	Leq	17	17	15	11	7	7	9	11	12
	Lmax	20	29	25	21	13	9	10	11	13
	L90	17	14	13	10	7	7	9	10	12
04:15	Leq	18	25	20	20	9	8	9	11	12
	Lmax	33	46	41	40	28	20	14	12	13
	L90	17	13	13	9	7	7	9	10	12
04:20	Leq	17	16	15	11	7	8	9	11	12
	Lmax	21	23	28	21	18	9	10	11	13
	L90	17	13	13	10	7	7	9	11	12
04:25	Leq	17	20	17	13	7	8	9	11	12
	Lmax	21	38	24	25	11	11	10	11	13
	L90	17	15	14	10	7	7	9	11	12
04:30	Leq	21	36	28	25	14	10	10	11	12
	Lmax	38	58	47	44	28	19	18	19	15
	L90	17	17	15	11	7	7	9	11	12
04:35	Leq	17	18	18	16	8	7	9	11	12
	Lmax	23	30	29	30	16	9	10	11	13
	L90	17	15	12	10	7	7	9	10	12
04:40	Leq	17	17	14	12	8	8	9	11	12
	Lmax	27	26	22	28	27	17	13	11	13
	L90	17	14	12	9	7	7	9	10	12
04:45	Leq	17	17	18	14	8	7	9	11	12
	Lmax	27	29	31	34	20	13	10	11	13
	L90	17	14	12	9	7	7	9	10	12
04:50	Leq	17	23	22	14	8	8	9	11	12
	Lmax	29	35	33	22	26	25	19	21	17
	L90	17	17	14	10	7	7	9	11	12
04:55	Leq	17	19	13	10	7	7	9	11	12
	Lmax	19	26	19	16	12	10	11	11	13
	L90	17	14	12	9	7	7	9	11	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
05:00	Leq	17	18	16	12	7	7	9	11	12
	Lmax	19	29	27	19	10	10	11	12	13
	L90	17	14	12	10	7	7	9	10	12
05:05	Leq	17	16	14	12	7	7	9	11	12
	Lmax	20	24	25	24	10	9	10	11	13
	L90	17	13	11	9	7	7	9	11	12
05:10	Leq	17	18	14	10	7	8	9	11	12
	Lmax	23	27	30	22	21	13	11	11	13
	L90	16	15	11	9	7	7	9	10	12
05:15	Leq	17	18	15	11	7	7	9	11	12
	Lmax	20	25	26	21	15	13	10	11	13
	L90	17	15	12	9	7	7	9	10	12
05:20	Leq	17	20	16	12	8	7	9	11	12
	Lmax	22	33	31	25	15	9	11	11	13
	L90	17	15	12	9	7	7	9	10	12
05:25	Leq	17	21	21	12	8	8	9	11	12
	Lmax	25	31	33	27	19	21	14	12	13
	L90	17	16	13	10	7	7	9	11	12
05:30	Leq	20	33	25	25	11	8	9	11	12
	Lmax	38	41	47	45	27	23	17	13	13
	L90	17	17	13	10	7	7	9	11	12
05:35	Leq	21	39	22	24	13	10	9	11	12
	Lmax	39	60	41	45	32	26	21	18	13
	L90	17	18	13	11	7	7	9	10	12
05:40	Leq	17	23	20	14	8	8	9	11	12
	Lmax	22	36	32	24	16	14	11	12	13
	L90	17	17	14	11	7	7	9	11	12
05:45	Leq	19	27	21	22	12	8	9	11	12
	Lmax	37	45	41	44	32	24	18	13	13
	L90	17	18	14	11	7	7	9	11	12
05:50	Leq	17	22	23	14	9	8	9	11	12
	Lmax	25	34	36	26	23	10	10	11	13
	L90	17	17	13	11	7	7	9	10	12
05:55	Leq	17	20	21	14	8	8	9	11	12
	Lmax	25	31	37	26	18	11	10	13	13
	L90	17	16	14	11	7	7	9	10	12
06:00	Leq	17	21	22	15	8	8	9	11	12
	Lmax	22	30	33	22	15	11	10	11	13
	L90	17	17	15	12	7	7	9	10	12
06:05	Leq	18	23	24	19	8	8	9	11	12
	Lmax	27	32	37	32	15	10	13	15	17
	L90	17	17	14	11	7	7	9	10	12
06:10	Leq	18	27	22	19	8	7	9	11	12
	Lmax	28	47	39	33	14	9	10	11	13
	L90	17	18	16	12	7	7	9	10	12
06:15	Leq	19	27	22	21	12	8	9	11	12
	Lmax	34	43	38	42	26	17	11	12	13
	L90	17	20	15	12	7	7	9	10	12
06:20	Leq	21	32	28	26	15	9	9	11	12
	Lmax	40	47	51	46	29	20	14	14	13
	L90	17	23	18	16	7	7	9	11	12
06:25	Leq	20	26	27	25	11	8	9	11	12
	Lmax	30	35	39	36	22	13	10	11	13
	L90	17	23	20	17	8	7	9	10	12
06:30	Leq	18	25	22	21	8	8	9	11	12
	Lmax	29	36	31	36	22	12	10	11	13
	L90	17	21	15	12	7	7	9	10	12
06:35	Leq	22	29	29	27	13	9	9	11	12
	Lmax	38	45	46	46	31	19	15	14	13
	L90	17	23	19	14	8	7	9	11	12
06:40	Leq	20	32	24	24	12	9	9	11	12
	Lmax	37	56	40	43	31	26	20	14	13
	L90	17	20	16	14	7	7	9	10	12
06:45	Leq	19	26	24	23	9	8	9	11	12
	Lmax	29	40	38	36	20	11	10	11	13
	L90	17	21	17	14	7	7	9	10	12
06:50	Leq	21	28	30	27	10	7	9	11	12
	Lmax	32	40	39	39	18	10	10	11	13
	L90	17	24	21	17	8	7	9	11	12
06:55	Leq	18	24	20	20	9	7	9	11	12
	Lmax	28	44	32	35	22	13	17	12	13
	L90	17	20	15	13	7	7	9	10	12

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
07:00	Leq	19	26	26	23	11	8	9	11	12
	Lmax	30	37	37	35	26	24	13	11	13
	L90	17	22	18	16	7	7	9	10	12
07:05	Leq	19	25	23	23	11	8	9	11	12
	Lmax	32	41	38	39	27	20	17	14	13
	L90	17	20	18	16	8	7	9	10	12
07:10	Leq	21	31	26	26	11	8	9	11	12
	Lmax	35	53	39	42	27	22	18	13	13
	L90	17	22	19	16	7	7	9	10	12
07:15	Leq	20	27	25	23	11	9	9	11	12
	Lmax	36	47	40	43	29	23	18	13	13
	L90	17	21	19	15	7	7	9	10	12
07:20	Leq	18	24	22	19	8	8	9	11	12
	Lmax	25	36	34	31	13	11	11	11	13
	L90	17	20	18	13	7	7	9	11	12
07:25	Leq	22	25	24	27	16	9	9	11	12
	Lmax	36	38	36	44	29	17	13	13	13
	L90	17	21	16	12	7	7	9	11	12
07:30	Leq	25	38	32	32	18	11	9	11	12
	Lmax	45	64	52	51	35	30	22	21	14
	L90	19	24	24	24	11	8	9	11	12
07:35	Leq	21	28	28	27	11	8	9	11	12
	Lmax	31	38	36	39	23	12	11	12	13
	L90	18	24	22	19	8	7	9	10	12
07:40	Leq	20	31	26	24	11	9	9	11	12
	Lmax	34	50	44	39	27	21	15	13	13
	L90	17	22	17	14	8	7	9	10	12
07:45	Leq	20	28	26	25	12	8	9	11	12
	Lmax	39	53	48	45	32	24	19	16	13
	L90	17	22	17	14	7	7	9	10	12
07:50	Leq	23	34	32	28	14	10	9	11	12
	Lmax	41	51	55	43	33	23	18	15	13
	L90	17	22	17	15	8	7	9	11	12
07:55	Leq	21	28	29	26	13	8	9	11	12
	Lmax	38	48	43	45	35	18	13	12	13
	L90	17	23	23	17	8	7	9	11	12
08:00	Leq	19	25	27	22	9	8	9	11	12
	Lmax	27	39	37	33	17	14	13	13	13
	L90	17	21	22	15	8	7	9	10	12
08:05	Leq	20	28	28	23	11	8	9	11	12
	Lmax	28	41	38	33	22	12	11	11	13
	L90	17	22	21	14	8	7	9	10	12
08:10	Leq	26	37	32	32	19	12	10	11	12
	Lmax	43	53	49	51	34	29	21	19	13
	L90	18	25	22	17	8	8	9	11	12
08:15	Leq	26	32	34	32	16	11	10	11	12
	Lmax	47	50	56	54	35	27	22	17	13
	L90	18	24	23	18	8	7	9	11	12

<i>Internal Levels</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
Overall Rush Hour	Leq	24	34	30	29	20	14	12	11	12
	Lmax	43	54	49	49	39	33	27	21	16
	L90	17	24	21	17	9	7	9	10	12
Overall Evening	Leq	21	31	27	27	14	10	9	11	12
	Lmax	41	53	49	48	34	27	22	18	13
	L90	17	21	16	14	8	7	9	10	12
Overall Nighttime	Leq	18	26	23	19	10	8	9	11	12
	Lmax	33	47	41	39	26	20	17	15	14
	Lmax*	37	47	46	43	31	24	18	14	13
	Lmax**	33	45	42	40	27	20	15	13	13
	L90	17	17	15	10	7	7	9	10	12

* and ** are the levels exceeded 10 and 15 times respectively (8 hour night equivalent). Otherwise logarithmic means

<i>Effective External</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
Overall Rush Hour	Leq	48	43	47	49	44	41	38	40	41
Overall Evening	Leq	46	41	44	47	37	37	35	40	41
Overall Nighttime	Leq	45	35	40	39	33	35	35	40	41
	Lmax*	58	57	64	63	54	51	43	44	42

Measurement Summary

Position	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Main	Overall Rush Hour	Leq	24	34	30	29	20	14	12	11	12
		Lmax	43	54	49	49	39	33	27	21	16
		L90	17	24	21	17	9	7	9	10	12
	Overall Evening	Leq	21	31	27	27	14	10	9	11	12
		Lmax	41	53	49	48	34	27	22	18	13
		L90	17	21	16	14	8	7	9	10	12
	Overall Nighttime	Leq	18	26	23	19	10	8	9	11	12
		Lmax	37	47	46	43	31	24	18	14	13
		L90	17	17	15	10	7	7	9	10	12

Required Reductions for BS 8233 Guidelines

Position	Environment	Reductions for BS8233 desirable* criteria	Reductions for WHO-Type Criteria
Main	Living Rooms	0 dB L_{Aeq}	-
	Bedrooms	0 dB L_{Aeq}	0 dB L_{Amax}

* BS 8233 considers a 5 dB relaxation would still provide *reasonable* conditions

Mitigation Summary

Façade	Room Type	Make-Up on Which Calculations are Based
Front and Side	Living Rooms and Bedrooms	Walls: Traditional Masonry
		Glazing: Basic thermal eg. 4+20+4
		Vents: Non-acoustic eg. Simon Airstrip 300

NB. R_w should come with a negative C_{tr} term, usually around -5 dB, eg. 35 dB R_w and -5 dB C_{tr} is 30 dB R_w+C_{tr}

Predicted Summary

Façade	Room Type	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Front and Side	Living Rooms and Bedrooms	Rush	Leq	23	26	25	29	20	14	10	13	8
			Lmax	18	19	18	19	9	7	7	13	8
		Night	Leq	18	19	18	19	9	7	7	13	8
			Lmax	36	40	41	43	30	23	16	16	10

Break-In

Main Position		dB(A)	63	125	250	500	1k	2k	4k	8k
Ground Floor (Existing)										
Width of Exposed Façade 1	4.10 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	5.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	9.10 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	5.00 m	-	-	-	-	-	-	-	-	-
Element Area	22.75 m2	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	22.75 m2	-	-	-	-	-	-	-	-	-
Room Volume	51.25 m3	-	-	-	-	-	-	-	-	-
Measured RT		-	2.11	1.19	1.41	1.23	1.04	0.90	0.78	0.58
Element Area Correction		-	14	14	14	14	14	14	14	14
Room Correction 10 x Log (RT/0.163/V)		-	-6	-8	-8	-8	-9	-10	-10	-12
Walls: Traditional Masonry	16.75 m2	-	23	32	41	47	49	53	58	55
Glazing: Poor quality glazing	6.00 m2	-	12	17	20	23	26	24	27	25
Vents: None	0.00 m2	-	0	0	0	0	0	0	0	0
Composite SRI	22.75 m2	-	17	22	26	29	32	30	33	31
Level Difference (Reverberant only)		-	-9	-17	-20	-23	-27	-26	-30	-29
Façade relative to Measurement Position		-	9	17	20	23	27	26	30	29
Allowance for flanking/workmanship (as measured so n/a)		-	0	0	0	0	0	0	0	0
Existing Levels Modelled	Rush	Leq	24	34	30	29	20	14	12	11
	Eve	Leq	21	31	27	27	14	10	9	11
	Night	Leq	18	26	23	19	10	8	9	11
		Lmax	37	47	46	43	31	24	18	14
Existing Levels Modelled	Rush	Leq	48	43	47	49	44	41	38	40
	Eve	Leq	46	41	44	47	37	37	35	40
	Night	Leq	45	35	40	39	33	35	35	40
		Lmax	58	57	64	63	54	51	43	44

Predicted Break-in

Front and Side		dB(A)	63	125	250	500	1k	2k	4k	8k
Living Rooms and Bedrooms										
Width of Exposed Façade 1	4.50 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	8.80 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	13.30 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	8.80 m	-	-	-	-	-	-	-	-	-
Element Area	33.25 m2	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	73.25 m2	-	-	-	-	-	-	-	-	-
Room Volume	99.00 m3	-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s	-	-	-	-	-	-	-	-	-
Element Area Correction		-	19	19	19	19	19	19	19	19
Room Correction 10 x Log (RT/0.163/V)		-	-15	-15	-15	-15	-15	-15	-15	-15
Walls: Traditional Masonry	22.55 m2	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	8.70 m2	-	15	21	17	25	35	37	31	31
Door: Typical front door, eg. 40 mm timber	2.00 m2	-	12	17	21	26	29	31	34	34
Vents: Non-acoustic eg. Simon Airstrip 300	40.00 m2	-	23	28	26	26	29	29	29	36
Composite SRI	73.25 m2	-	20	26	24	27	31	31	31	36
Level Difference (Reverberant only)		-	-17	-22	-20	-24	-28	-28	-27	-33
Façade relative to Measurement Position		-	9	17	20	23	27	26	30	29
Allowance for flanking/workmanship (based on as measured, so n/a)		-	0	0	0	0	0	0	0	0
Predicted Internal Levels	Rush	Leq	23	26	25	29	20	14	10	13
	Eve	Leq	21	24	22	26	14	9	7	13
	Night	Leq	18	19	18	19	9	7	7	13
		Lmax	36	40	41	43	30	23	16	16