
BASE, Manchester Science Park

Environmental Noise Assessment Report

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1 Introduction

BDP Acoustics has been commissioned by Bruntwood SciTech to provide an Environmental Noise Assessment report for the BASE, Manchester Science Park (MSP) Building project “the Project”.

The Project proposals include the erection of a five storey building comprising offices (Use Class B1) and ancillary workshop and maker space, together with associated provision of plant and servicing.

This report includes the following:

- Review of current planning guidance and acoustic standards related to the environmental noise assessment of the new development, including BREEAM 2018 and Local Planning Authority requirements;
- A summary of the environmental noise surveys undertaken;
- Proposed assessment criteria for indoor ambient noise levels and external plant noise break-out based on the relevant guidance and standards;
- Recommended mitigation measures to suitably reduce construction noise and vibration;
- Assessment of the proposed building envelope strategy for the new building within the development;
- Recommended noise limits for fixed plant installations associated with the proposed development;
- Recommended mitigating measures to prevent excessive noise break-out from the external terrace.

A glossary of acoustic terms is presented in Appendix I – Glossary of Acoustic Terms.

2 Relevant Guidance and Standards

2.1 Noise Policy Statement for England

The NPSE provides guidance on the management of noise from sustainable development. The statement sets out three key aims in paragraph 1.7:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impact on health and quality of life;*
- Mitigate and minimise adverse impacts on health and quality of life; and*
- Where possible, contribute to the improvement of health and quality of life.”*

2.2 National Planning Policy Framework

The NPPF sets out the Government’s planning policies for England and how these are expected to be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

It advises that planning decisions should prevent new and existing developments from being put at unacceptable risks from, amongst other things, noise pollution. It goes on to advise that new development should be appropriate to its location and should mitigate and reduce to a minimum potential adverse impacts resulting from noise new development and avoid noise giving rise to significant adverse effects on health and quality of life.

2.3 Manchester City Council (MCC) Core Strategy Policy DM1

Policy DM1 within this document states that all new developments should have regard to, amongst other specific issues, effects of noise, including proposals which would be sensitive to existing environmental conditions.

2.4 MCC Planning and Noise Technical Guidance

The MCC published ‘*Planning & Noise Technical Guidance December 2015*’ document provides planning advice related to noise.

Section 3.6.1.5.1 of this document states the following guidance for noise limits related to fixed plant and equipment, which are sources of noise which will be present as part of the Project proposals:

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

2.5 BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: noise (BS5228-1)

Part 1 of BS 5228 gives recommendations for basic methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels, including Industry specific guidance.

2.6 BS5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS5228-2)

Part 2 of BS 5228 gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including Industry specific guidance.

2.7 BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

BS 4142:2014+A1:2019 (BS 4142) provides a method for rating industrial and commercial sound and a method for assessing resulting impacts upon people. The impact assessment procedure described in BS 4142 is based on the comparison of rating sound level with the background sound level prevailing at the assessment locations.

2.8 BREEAM New Construction 2018

The Project is being targeted to meet certain performance standards from this version of BREEAM.

The acoustic design strategy will address the following requirement elements from this document:

- HEA05 Acoustic Performance;
- Pol 05 Reduction of noise pollution.

2.9 Health Technical Memorandum 08-01: Acoustics (HTM 08-01)

Health Technical Memorandum 08-01 gives comprehensive advice and guidance on the acoustic design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

Some of the acoustic design guidance contained within this document is also applicable to commercial office developments, including guidance on appropriate noise limits for emergency plant equipment.

3 Proposed Assessment Criteria

Based on the guidance documents referenced in Section 2, the following criteria are proposed for the purpose of this assessment.

It should be noted that the proposed internal ambient noise level criteria should only be treated as preliminary and may be subject to change as the design and project brief develops. Compliance with the internal ambient noise criteria for this type of development is not considered to be a Local Authority requirement.

3.1 Intrusive Noise Level Criteria

The intrusive noise criteria includes noise contributions from:

- External sources outside the building premises (including, but not limited to, noise from road, rail and air traffic, industrial and commercial premises).

The intrusive noise criteria excludes contributions from:

- Activity noise within the building premises (e.g. noise from building occupants and equipment within the building).
- Building service noise.
- Rain noise.

The proposed intrusive noise project criteria are presented in Table 1.

Table 1: Proposed intrusive noise criteria

Room Type	Reference guidance document	Maximum noise intrusion level
Office units and Maker Space units	BCO Guide to Specification 2014– Speculative office	NR 38 ⁽²⁾ ; L _{Amax} 55 dB ⁽²⁾⁽³⁾
Bookable meeting rooms - less than 20 person	BCO Guide to Specification 2014– Meeting Rooms	NR 35; L _{Amax} 50 dB ⁽²⁾⁽³⁾
Bookable meeting rooms - Greater than 20 person	BCO Guide to Specification 2014– Meeting Rooms / BCO Guide to Fit Out 2011– Conference Room (large)	NR 30; L _{Amax} 50 dB
Lounge event space	CIBSE Guide A – Restaurant / Dining room	NR 40
Atrium	BCO Guide to Specification 2014 – Entrance lobbies	NR 40

Table notes:

1. NR relates to measured L_{eq,09:00 to 18:00 hours}.
2. Criteria to be achieved assuming an enclosed space with a floor area of 20m² and a façade length of 9 metres or less.
3. L_{Amax} criteria applies to typical and regular events only.

3.2 External noise emission criteria

3.2.1 Non-emergency plant and equipment noise limits at nearest existing noise sensitive receptors

External noise limits for fixed plant items should be set in-line with those of the Local Planning Authority.

The cumulative rating noise level (dB $L_{A,T,r}$) resulting from all fixed plant and equipment noise sources forming part of the proposed development should not exceed a level 5dB below the measured pre-development typical background noise level (dB L_{A90}) when assessed in accordance with BS 4142 at the position of the nearest or most exposed noise sensitive receptor(s).

3.2.2 Emergency plant and equipment noise limits at nearest existing noise sensitive premises:

In accordance with HTM 08-01 guidance related to emergency plant noise emissions, external noise from emergency plant forming part of the proposed development should not exceed levels 10 dBA over the existing background level (L_{A90}) at the nearest noise sensitive receptor and regular testing of emergency plant should only take place during the daytime on a weekday.

4 Environmental Noise Surveys

4.1 Introduction

Environmental noise surveys have been undertaken on the 29th and 30th April and the 1st May 2019 at various positions on and in the vicinity of the proposed Project site.

The data obtained has been used in order to assist in the following:

- Establishing the baseline noise climate at the site;
- Assessment of the required sound insulation of the building fabric, including glazing and ventilation; and
- Establishing external noise limit criteria.

4.2 Site Description

The Project site is located within the Manchester Science Park (MSP). To the immediate north and east of the site are commercial buildings associated with MSP with Pencroft Way road also to the east. Further beyond there are 2 main roads, Burlington Street to the north and Lloyd Street North to the east. Adjacent to the south of the site is a mosque and commercial buildings, a primary school and residential accommodation further beyond. To the west, Greenheys Lane is immediately adjacent with residential housing beyond.

The nearest or most exposed noise sensitive receptors to the Project site are identified to be:

- Residential receptors on the opposite side of Greenheys Lane;
- Commercial office building adjacent to the east boundary of the Project site;
- Darul Aman Mosque adjacent to the south boundary of the Project site;
- Greenheys Building adjacent to the north boundary of the Project site.

4.3 Survey Methodology

A series of manned short-term measurements were undertaken by BDP Acoustics at a number of locations on and in the vicinity of the proposed Project site during 'worst-case' daytime, evening and night-time periods.

The approximate measurement positions are presented in Figure 1. Measurement positions were selected in order to:

- Measure worst-case, i.e. noisiest, daytime (0900 – 1120 hours) noise levels at the locations of the proposed building façades in order to establish the noise levels that will impact upon the façades of the proposed building (Positions 1 – 6);
- Provide data representative of the worst-case, i.e. quietest, daytime (1120 – 1300 hours), evening (2200 – 2300 hours) and night-time (0300 – 0400 hours) noise levels at the nearest or most exposed noise sensitive receptors for the purposes of informing environmental plant noise limits to maintain residential amenity (Positions 3 – 5 and 7 – 9).

Weather conditions during the daytime survey were dry with low wind speeds (<2m/s), temperatures varying around 10°C and cloud cover of approximately 10%. Weather conditions during the evening survey were dry with no wind, temperatures of 12°C and 100% cloud cover. Weather conditions during the night-time survey were dry with no wind, temperatures of 8°C and no cloud cover.

The instrumentation used for measurements consisted of 2no. Rion NA-28 sound level meters and 1no. Bruel & Kjaer 2260 sound level meter, which were all calibrated before and after the surveys, with no significant drift in sensitivity observed.

At each position octave band and A-weighted fast response levels were recorded for a comprehensive suite of noise level metrics.

All readings were taken at a height of 1.5m above local ground level in free-field conditions, with the exception of façade measurements taken at Position 1.

Measurements were carried out by Gavin Stevenson MIOA, Dan Forbes AMIOA and Martha Sadler SMIOA.

4.4 Results

A summary of the measured results are presented in Table 2 below.

Table 2: Summary of noise measurement results

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	L_{Aeq,5mins} Range (dB)	L_{AFmax,5mins} Range (dB)	L_{A90,5mins} Range (dB)
1	29/04/2019 09:08	58	64 - 75	56
1	29/04/2019 10:07	52 - 53	62 - 70	43 - 45
2	29/04/2019 09:28	65 - 67	76 - 84	49 - 57
2	29/04/2019 10:31	63 - 64	74 - 77	49 - 50
3	29/04/2019 09:48	52 - 54	65 - 72	45 - 46
3	29/04/2019 10:55	51 - 53	61 - 63	45 - 48
3	29/04/2019 12:00	53 - 54	66 - 72	46 - 47
4	29/04/2019 09:03	48 - 50	56 - 75	46 - 47
4	29/04/2019 10:06	46 - 47	60 - 61	42 - 43
4	29/04/2019 11:21	47 - 49	61 - 65	43 - 44
5	29/04/2019 09:21	46 - 49	52 - 60	44 - 45
5	29/04/2019 10:24	48 - 51	60 - 66	45 - 46
5	29/04/2019 11:38	46 - 47	57 - 67	43 - 44
6	29/04/2019 09:38	46 - 47	54 - 63	42
6	29/04/2019 10:41	48 - 50	60 - 65	41 - 45
7	29/04/2019 11:45	64 - 65	76 - 78	48 - 50
7	30/04/2019 22:03	60 - 63	73 - 77	44 - 46
7	02/05/2019 03:00	47 - 50	66 - 70	38 - 39
8	29/04/2019 12:22	48 - 51	61 - 71	44 - 45
9	30/04/2019 22:27	45 - 46	55 - 61	38 - 39
9	02/05/2019 03:24	40	46 - 53	38

Figure 1: Approximate survey measurement positions



Figure 2: Noise monitoring positions (1 to 9 from top left to bottom right)



5 Site suitability assessment

5.1 Construction phase

5.1.1 Construction noise and vibration

Construction programme, process and plant information are not finalised at this stage of the Project, however noise and vibration resulting from the construction of the proposed development can be suitably mitigated at nearest noise sensitive receptors by including a construction management plan as part of the final construction proposals which adopts the relevant noise and vibration reduction measures recommended in BS5228-1 and BS5228-2.

5.2 Operational phase

5.2.1 Noise break-in assessment

Using environmental noise survey data from on-site measurements, the proposed building envelope strategy for the new buildings associated with the proposed development has been assessed against the internal noise criteria detailed in Section 3.1.

Based on the measured noise levels for worst-case, i.e. noisiest, daytime break-in noise at the locations of the proposed building façades, conventional external window, wall and roof build-ups and ventilation strategies will enable compliance with the criteria detailed in Section 3.1.

5.2.2 External roof terrace

The external roof terrace will be used as a break out area for the internal event space which will be used to host events associated with commercial office use. Noise break-out from the terrace can be suitably controlled to not disturb surrounding noise sensitive premises

though building management procedures that are typical for a commercial office development.

5.2.3 External plant noise emissions

Plant selections are not finalised at this stage of the Project, however building service plant, such as roof top located AHUs and air conditioning units, form part of the proposals.

Based on the noise levels measured at the nearest/most exposed noise sensitive receptors, Table 3 presents the recommended external noise limits that fixed plant and equipment installations associated with the new development be designed to, in order to comply with the proposed design criteria in Section 3.2 of this report.

Noise limits only apply to a noise sensitive premises during periods when the noise sensitive premises is typically occupied.

Based on the proposed new building proximity to the nearest noise sensitive receptors, these limits can be achieved with suitable equipment selections and conventional plant and equipment attenuation measures.

When determining attenuation requirements in relation to external noise limits for fixed plant, it should be noted that plant must also be selected and/or designed to ensure that the external noise emissions generated at the façades of the proposed new building will not cause the required new building internal noise criteria to be exceeded.

Table 3: Proposed nearest or most exposed noise sensitive receptor (NSR) noise limits for fixed plant and equipment installations associated with the new development

Nearest or most exposed noise sensitive receptor (NSR) location	Time Period	Lowest measured existing background noise level at NSR (dB $L_{A90,5min}$)	Non-emergency external noise limits at the NSR façade location for plant items associated with the Project (dB $L_{A,Tf}$)	Emergency external noise limits at the NSR façade location for plant items associated with the Project (dB $L_{A,Tf}$)
Residential properties on Greenheys Lane	Daytime (07:00 - 23:00 hours)	48	43	58
	Evening (19:00 to 23:00 hours)	44	39	54
	Night-time (23:00 - 07:00 hours)	38	33	48
Greenheys Building	Daytime (07:00 - 23:00 hours)	42	37	52
Commercial office building to east of the Project site	Daytime (07:00 - 23:00 hours)	43	38	53
Darul Aman Mosque	Daytime (07:00 - 23:00 hours)	45	40	55

6 Summary

- BDP Acoustics has been commissioned by Bruntwood SciTech to provide an Environmental Noise Assessment report for the BASE, MSP Building project “the Project”.
- The Project proposals include the erection of a five storey building comprising offices (Use Class B1) and ancillary workshop and maker space, together with associated provision of plant and servicing.
- Suitable assessment acoustic criteria have been provided relating to internal ambient noise levels and external plant and equipment noise emissions resulting from the operation of the proposed development, based on relevant guidance documents such as BREEAM 2018, BS4142 and Manchester City Council planning guidance.
- An environmental noise survey has been carried out to determine the existing noise climate at the site and at the nearest or most exposed noise sensitive receptor locations.
- Based on the assessment criteria, relevant guidance documents referenced and obtained environmental noise survey data, a site suitability assessment has been undertaken and indicates that:
 - Construction noise and vibration resulting from the Project construction phase can be suitably mitigated at nearest noise sensitive receptors by including a construction management plan as part of the final construction proposals which adopts the relevant noise and vibration reduction measures recommended in BS5228-1 and BS5228-2.
 - Noise break-out from the terrace can be suitably controlled to not disturb surrounding noise sensitive premises through building management procedures that are typical for a commercial office development.
 - Conventional external window, wall and roof build-ups and ventilation strategies will enable compliance with the proposed indoor ambient noise level criteria.
 - Fixed plant and equipment external noise emissions can be suitably mitigated through imposing noise limits in accordance with the assessment criteria at the nearest or most exposed noise sensitive receptors. Based on the proposed new building proximity to the nearest noise sensitive receptors, these limits can be achieved with suitable equipment selections and conventional plant and equipment attenuation measures.

Appendix I – Glossary of Acoustic Terms

A-Weighting

Normal hearing covers the frequency range from approximately 20Hz to 20kHz but sensitivity is greatest between about 500Hz and 8kHz. The "A-Weighting" is an electronic filters network incorporated in sound level meters which approximately corresponds to the frequency response of the ear. The unit of measurement of A-weighted sound level is dBA or dB(A).

Break-in

Noise transmission into a structure from the outside.

CadnaA Noise Modelling Software

CadnaA is an internationally recognised software package for calculation and assessment of environmental noise resulting from industrial and traffic sources. From input of calibrated noise sources, topographical data and building locations, a 3D model of an area can be produced. The propagation of noise from user defined sources can then be evaluated, taking into account height data and building locations. Noise levels at specific locations (such as a particular building façade) can then be calculated.

The standard outdoor noise propagation model used in the CadnaA program is in accordance with ISO 9613 Parts 1 & 2: 1996 '*Attenuation of sound during propagation outdoors*'.

Decibel, dB

This is a relative unit of measurement which in acoustics is the unit to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). The dB is a logarithmic unit used to describe a ratio between the measured level and a reference or threshold level of 0dB (re. 20 micro-Pascals). We therefore use a logarithmic scale to describe sound pressure level, intensities and sound power levels. Subjectively, an increase of 10dB corresponds to a doubling in the perceived loudness of sound.

Equivalent Continuous Sound Level, L_{eq} or L_{Aeq}

The equivalent continuous sound level, L_{eq} is a notional sound level. It is the sound level, which, if maintained for a given length of time, would produce the same acoustic energy as a fluctuating noise over the same time period. (The formula for the above is implemented electronically in all good sound level meters and it is customary to measure rather than calculate the equivalent continuous sound level.) L_{Aeq} (A-weighted L_{eq}) is widely used to measure any environmental noise which varies considerably with time.

Free Field

A sound field region with no adjacent reflecting surfaces.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of approximately 20Hz to 20kHz, and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands (continuous range of frequencies between two limiting frequencies), and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it. (For instance the octave bands above and below the 500Hz octave band are 1kHz and 250Hz respectively). For finer analysis, each octave band may be split into three one-third octave bands or in some cases, fine frequency bands.

Rating Level, $L_{Ar,Tf}$

The specific sound level plus any adjustment for the characteristic features of the sound, as described in BS 4142:2014.

Sound Insulation

Airborne sound insulation refers to the process of separating, by a physical barrier, a space to be protected from a noise source or space containing a noise source.

Statistical Level: L_{90} or L_{A90}

Sound pressure level that is exceeded for 90% of the measurement time. Consequently it is indicative of the general background noise level in the absence of any higher level short duration events that occur during the period.

Statistical Level: $L_{max,T}$

A noise level index defined as the maximum RMS sound pressure level measured during the measurement period, T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

Time Weighting

One of the standard averaging times (Fast (F), Slow (S)) used for the measurement of RMS sound pressure level in sound level meters, specified in BS 5969.

Appendix II – Noise Survey Measurement Data

Further noise survey measurement data for measurements undertaken at Positions 1 to 9

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	Duration (mm:ss)	Metric	$L_{Aeq,5min}$ (dB) / $L_{AFmax,5min}$ (dB) / $L_{A90,5min}$ (dB)	$L_{Zeq,5min}$ and $L_{Zmax,5min}$ and $L_{Z90,5min}$ (dB) at octave band centre frequency							
					63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
1	29/04/2019 09:08	05:00	Leq	58.0	67.2	59.2	60.2	55.0	51.5	48.4	45.7	39.6
1	29/04/2019 09:13	05:00	Leq	57.8	69.1	60.2	59.5	54.5	51.8	48.8	45.6	34.9
1	29/04/2019 09:18	05:00	Leq	58.3	68.3	60.7	59.4	55.1	52.7	49.3	46.0	35.2
1	29/04/2019 10:07	05:00	Leq	53.2	69.9	55.6	51.0	47.3	49.6	45.1	37.9	29.3
1	29/04/2019 10:12	05:00	Leq	53.1	68.3	55.3	54.8	48.8	48.9	43.6	35.4	27.4
1	29/04/2019 10:17	05:00	Leq	52.0	67.6	55.6	50.7	47.2	48.4	43.1	35.5	28.3
2	29/04/2019 09:28	05:00	Leq	65.3	71.7	63.9	61.4	59.6	62.1	57.4	50.6	52.6
2	29/04/2019 09:33	05:00	Leq	66.1	71.2	64.8	62.0	60.8	63.1	58.4	52.2	46.1
2	29/04/2019 09:39	05:00	Leq	67.1	73.4	63.0	62.5	60.5	63.0	59.3	59.6	49.5
2	29/04/2019 10:31	05:00	Leq	62.9	64.5	58.3	58.9	57.3	60.7	54.8	45.0	36.8
2	29/04/2019 10:37	05:00	Leq	63.8	71.0	60.7	59.9	57.3	61.1	56.7	47.1	39.6
2	29/04/2019 10:43	05:00	Leq	64.2	73.6	63.6	61.3	59.0	61.0	56.5	49.4	42.8
3	29/04/2019 09:48	05:00	Leq	54.2	65.3	59.2	52.4	47.8	50.2	47.2	40.9	31.9
3	29/04/2019 09:53	05:00	Leq	53.9	65.5	56.8	52.9	47.2	49.5	46.8	43.3	36.5
3	29/04/2019 09:58	05:00	Leq	52.2	66.5	60.0	51.1	46.6	47.6	44.8	37.5	28.9
3	29/04/2019 10:55	05:00	Leq	52.9	66.1	57.3	52.7	48.5	48.4	44.8	39.1	30.9
3	29/04/2019 11:06	05:00	Leq	52.3	62.4	56.0	50.3	47.2	48.8	44.4	37.4	29.9
3	29/04/2019 11:11	05:00	Leq	51.1	61.2	53.1	49.6	45.9	47.7	43.4	35.5	25.9
3	29/04/2019 12:00	05:00	Leq	53.4	63.7	55.4	52.3	51.4	49.2	44.3	37.1	29.3
3	29/04/2019 12:06	05:00	Leq	53.6	65.5	57.2	52.2	48.5	49.7	45.3	41.5	32.0
3	29/04/2019 12:11	05:00	Leq	53.5	67.3	58.6	54.6	49.0	48.7	44.8	40.2	29.8
4	29/04/2019 09:03	05:00	Leq	49.9	60.5	55.5	51.5	46.8	43.7	39.2	39.7	31.4
4	29/04/2019 09:09	05:00	Leq	47.7	61.3	54.5	47.4	44.5	42.4	38.1	34.7	23.8
4	29/04/2019 09:14	05:00	Leq	48.7	63.0	56.4	49.2	45.4	43.2	39.0	34.6	25.6
4	29/04/2019 10:06	05:00	Leq	46.2	61.5	52.6	45.8	41.6	41.2	36.3	36.0	25.6
4	29/04/2019 10:12	05:00	Leq	47.3	63.8	54.5	49.6	43.7	41.2	36.1	33.9	22.9
4	29/04/2019 10:17	05:00	Leq	46.2	61.3	52.9	47.7	42.5	40.9	35.7	31.9	24.4
4	29/04/2019 11:21	05:00	Leq	48.0	61.8	53.1	46.1	45.4	43.3	38.7	33.5	24.4
4	29/04/2019 11:27	05:00	Leq	47.2	62.7	53.5	49.0	43.2	41.4	37.2	34.6	25.9
4	29/04/2019 11:32	05:00	Leq	48.9	61.4	56.5	51.6	47.6	41.5	36.6	27.6	20.0
5	29/04/2019 09:21	05:00	Leq	49.0	60.7	54.2	52.4	47.0	42.0	37.1	34.5	27.3
5	29/04/2019 09:26	05:00	Leq	46.2	59.2	54.1	47.0	42.9	41.0	35.9	31.3	23.3
5	29/04/2019 09:31	05:00	Leq	45.6	58.4	51.0	46.5	42.7	40.5	36.0	31.3	22.9
5	29/04/2019 10:24	05:00	Leq	51.2	56.1	50.6	47.8	48.4	41.1	37.3	47.2	37.4
5	29/04/2019 10:29	05:00	Leq	48.9	58.8	52.5	49.1	45.2	40.7	37.2	43.4	31.5
5	29/04/2019 10:35	05:00	Leq	48.4	57.9	52.3	49.6	44.5	40.8	36.6	42.4	33.6
5	29/04/2019 11:38	05:00	Leq	46.3	60.3	53.1	47.8	43.0	40.1	36.0	31.3	32.6

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	Duration (mm:ss)	Metric	$L_{Aeq,5min}$ (dB) / $L_{AFmax,5min}$ (dB) / $L_{A90,5min}$ (dB)	$L_{Zeq,5min}$ and $L_{Zmax,5min}$ and $L_{Z90,5min}$ (dB) at octave band centre frequency							
					63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
5	29/04/2019 11:43	05:00	Leq	46.5	59.6	52.9	49.5	43.7	39.1	34.3	34.5	32.2
5	29/04/2019 11:49	05:00	Leq	45.6	58.0	50.1	45.8	42.7	40.4	36.1	32.8	27.8
6	29/04/2019 09:38	05:00	Leq	46.1	61.6	50.3	45.0	41.9	41.6	37.3	33.7	22.2
6	29/04/2019 09:49	05:00	Leq	46.8	60.6	54.6	47.6	41.4	41.9	37.8	33.4	22.5
6	29/04/2019 09:54	05:00	Leq	45.9	62.2	52.3	47.4	40.4	40.6	36.7	33.4	25.9
6	29/04/2019 10:41	05:00	Leq	48.3	62.3	51.9	48.2	45.6	41.8	38.9	38.8	31.7
6	29/04/2019 10:47	05:00	Leq	50.4	60.8	52.8	54.3	46.2	42.0	44.4	35.5	24.3
6	29/04/2019 10:55	05:00	Leq	49.6	64.6	56.4	51.1	46.8	41.5	39.9	40.0	31.9
7	29/04/2019 11:45	05:00	Leq	64.3	67.2	60.0	60.3	59.7	61.6	56.1	47.2	40.2
7	29/04/2019 11:51	05:00	Leq	64.6	71.2	64.9	62.3	60.5	61.1	56.6	50.4	44.4
7	29/04/2019 12:02	05:00	Leq	65.0	68.4	59.8	60.1	60.3	62.6	56.6	47.3	41.4
7	30/04/2019 22:03	05:00	Leq	61.5	61.8	59.5	57.4	55.9	59.2	53.5	42.5	34.6
7	30/04/2019 22:08	05:00	Leq	61.1	61.1	55.2	56.4	55.8	58.7	53.1	42.6	36.6
7	30/04/2019 22:14	05:00	Leq	63.1	67.9	59.2	59.2	58.1	60.2	55.4	48.2	43.3
7	30/04/2019 22:19	05:00	Leq	59.5	67.9	56.5	56.5	55.2	56.8	51.2	42.5	34.1
7	02/05/2019 03:00	05:00	Leq	49.5	53.1	47.3	45	44.2	47.1	41.4	31	21.7
7	02/05/2019 03:05	05:00	Leq	46.7	53.7	48.7	44	41.8	43.7	38.5	29.3	20.4
7	02/05/2019 03:10	05:00	Leq	49.2	53	48.5	47.2	44.4	46.7	40.2	30.3	20.3
8	29/04/2019 12:22	05:00	Leq	50.9	60.3	53.5	50.4	47.1	46.0	43.9	36.2	31.4
8	29/04/2019 12:31	05:00	Leq	48.6	59.9	52.3	50.4	45.9	43.7	38.9	32.4	26.4
8	29/04/2019 12:36	05:00	Leq	48.1	59.5	51.7	48.9	45.4	43.3	38.7	33.2	28.6
9	30/04/2019 22:27	05:00	Leq	45.5	54.6	48.5	44.8	41.1	41.8	36.8	30.6	24.6
9	30/04/2019 22:32	05:00	Leq	45.1	55.6	49.3	47.1	43.5	39.5	33.6	26.5	20.0
9	30/04/2019 22:37	05:00	Leq	45.2	54.0	47.9	44.8	41.0	41.6	36.5	28.4	24.1
9	02/05/2019 03:24	05:00	Leq	39.7	50.6	44.8	38.9	37	36.2	28.1	19.8	16.5
9	02/05/2019 03:29	05:00	Leq	40.4	50	44	38.9	37	36.5	28.9	21.9	31.6
9	02/05/2019 03:34	05:00	Leq	40	51.6	44.5	39.3	37	36.3	28.8	21.8	22.5
1	29/04/2019 09:08	05:00	Lmax	74.6	84.1	65.8	64.9	60.7	69.7	61.6	66.3	71.7
1	29/04/2019 09:13	05:00	Lmax	64.0	84.1	69.6	67.6	61.7	60.5	57.9	59.1	55.6
1	29/04/2019 09:18	05:00	Lmax	67.8	82.2	73.7	67.8	62.2	61.7	64.0	60.1	56.3
1	29/04/2019 10:07	05:00	Lmax	64.7	88.4	69.4	62.4	58.9	61.4	58.3	50.2	45.9
1	29/04/2019 10:12	05:00	Lmax	69.8	85.2	70.1	73.0	69.6	65.1	59.7	52.0	47.0
1	29/04/2019 10:17	05:00	Lmax	62.1	84.0	75.5	64.3	57.8	60.1	54.0	50.0	47.4
2	29/04/2019 09:28	05:00	Lmax	78.4	90.0	79.3	76.1	70.8	72.6	66.5	71.8	77.3
2	29/04/2019 09:33	05:00	Lmax	75.9	86.3	80.2	73.6	73.4	73.0	69.2	66.4	63.1
2	29/04/2019 09:39	05:00	Lmax	84.0	90.9	79.6	78.4	74.1	74.8	72.5	83.2	70.7
2	29/04/2019 10:31	05:00	Lmax	74.0	79.1	71.7	73.3	71.5	72.2	66.5	58.6	50.9
2	29/04/2019 10:37	05:00	Lmax	77.2	88.8	77.5	78.3	69.7	71.5	73.1	63.0	58.8
2	29/04/2019 10:43	05:00	Lmax	77.1	90.0	79.3	78.8	74.7	72.3	68.5	64.3	58.6
3	29/04/2019 09:48	05:00	Lmax	71.9	83.0	74.9	67.5	60.3	65.2	67.3	64.7	57.2
3	29/04/2019 09:53	05:00	Lmax	65.0	80.6	71.6	69.6	57.1	60.3	60.0	63.6	56.6

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	Duration (mm:ss)	Metric	$L_{Aeq,5min}$ (dB) / $L_{AFmax,5min}$ (dB) / $L_{A90,5min}$ (dB)	$L_{Zeq,5min}$ and $L_{Zmax,5min}$ and $L_{Z90,5min}$ (dB) at octave band centre frequency							
					63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
3	29/04/2019 09:58	05:00	Lmax	65.6	81.4	79.3	64.8	59.1	60.0	62.1	53.1	43.0
3	29/04/2019 10:55	05:00	Lmax	61.2	81.7	68.3	64.5	62.3	56.5	55.5	51.3	47.1
3	29/04/2019 11:06	05:00	Lmax	63.3	75.2	69.5	64.9	58.1	61.3	55.9	50.7	48.4
3	29/04/2019 11:11	05:00	Lmax	61.2	77.4	64.5	63.7	59.1	56.5	55.9	48.9	40.4
3	29/04/2019 12:00	05:00	Lmax	71.7	79.9	68.6	72.7	75.3	59.4	50.8	50.1	49.4
3	29/04/2019 12:06	05:00	Lmax	65.5	79.8	71.4	65.1	60.2	57.9	54.9	63.1	57.9
3	29/04/2019 12:11	05:00	Lmax	69.9	83.3	74.2	74.0	71.3	60.7	53.9	60.0	48.8
4	29/04/2019 09:03	05:00	Lmax	75.2	74.8	67.0	66.9	62.3	68.6	65.2	71.7	63.8
4	29/04/2019 09:09	05:00	Lmax	58.7	78.8	63.8	54.1	51.2	54.0	52.0	51.9	42.1
4	29/04/2019 09:14	05:00	Lmax	55.7	77.2	65.8	57.2	50.7	51.6	51.9	47.0	43.4
4	29/04/2019 10:06	05:00	Lmax	60.0	74.8	63.3	61.5	54.2	50.1	52.9	58.0	47.9
4	29/04/2019 10:12	05:00	Lmax	60.9	77.6	67.4	67.6	59.9	52.9	49.1	56.6	45.1
4	29/04/2019 10:17	05:00	Lmax	59.5	76.4	67.9	59.3	55.7	52.8	47.7	56.9	45.5
4	29/04/2019 11:21	05:00	Lmax	64.8	75.4	66.4	61.9	67.3	60.3	57.1	54.3	46.0
4	29/04/2019 11:27	05:00	Lmax	60.9	82.0	70.4	66.7	56.5	52.0	47.4	59.6	47.8
4	29/04/2019 11:32	05:00	Lmax	61.1	77.1	67.1	64.5	62.5	51.3	50.7	45.1	39.3
5	29/04/2019 09:21	05:00	Lmax	60.1	74.7	69.1	65.1	61.3	52.1	48.0	51.5	51.9
5	29/04/2019 09:26	05:00	Lmax	57.0	73.2	71.5	60.2	53.3	50.2	47.5	49.1	43.0
5	29/04/2019 09:31	05:00	Lmax	52.0	70.8	63.1	56.8	52.2	47.8	47.3	42.8	40.9
5	29/04/2019 10:24	05:00	Lmax	65.9	67.2	58.4	59.4	61.6	56.7	58.2	62.3	59.3
5	29/04/2019 10:29	05:00	Lmax	60.4	70.0	61.5	60.2	55.3	52.2	50.0	59.4	53.3
5	29/04/2019 10:35	05:00	Lmax	62.8	73.8	60.5	62.7	54.6	52.9	48.8	62.0	54.2
5	29/04/2019 11:38	05:00	Lmax	66.5	74.3	74.4	72.3	62.6	56.8	51.1	51.3	49.6
5	29/04/2019 11:43	05:00	Lmax	59.0	76.7	68.4	64.4	55.7	54.4	47.4	55.1	50.9
5	29/04/2019 11:49	05:00	Lmax	57.3	70.8	62.5	58.1	54.1	55.2	54.1	49.2	47.0
6	29/04/2019 09:38	05:00	Lmax	55.1	77.0	61.6	56.4	57.9	52.0	49.9	51.7	38.3
6	29/04/2019 09:49	05:00	Lmax	63.1	76.8	71.0	61.8	55.5	56.5	58.8	55.2	44.8
6	29/04/2019 09:54	05:00	Lmax	54.1	75.9	66.8	62.9	50.2	49.5	47.9	52.4	44.7
6	29/04/2019 10:41	05:00	Lmax	61.3	77.4	65.5	63.4	60.1	51.0	54.5	60.0	51.5
6	29/04/2019 10:47	05:00	Lmax	64.6	75.7	65.2	72.2	57.9	53.3	63.0	54.7	42.9
6	29/04/2019 10:55	05:00	Lmax	60.4	80.2	70.5	65.9	59.8	52.1	54.6	58.0	49.1
7	29/04/2019 11:45	05:00	Lmax	76.0	81.5	72.1	74.2	74.8	71.8	70.1	68.0	64.0
7	29/04/2019 11:51	05:00	Lmax	77.6	86.7	83.9	80.6	74.2	70.6	68.2	66.1	62.2
7	29/04/2019 12:02	05:00	Lmax	77.2	83.3	72.7	72.5	73.0	75.9	72.8	67.9	64.1
7	30/04/2019 22:03	05:00	Lmax	73.5	78.1	82.1	76.4	69.2	71.6	65.6	55.0	59.8
7	30/04/2019 22:08	05:00	Lmax	73.2	75.1	68.5	70.5	70.3	71.2	65.0	65.2	68.3
7	30/04/2019 22:14	05:00	Lmax	77.3	86.4	74.6	74.7	71.2	71.3	70.9	70.5	69.6
7	30/04/2019 22:19	05:00	Lmax	75.0	90.3	75.0	76.1	72.9	70.8	65.9	61.0	50.7
7	02/05/2019 03:00	05:00	Lmax	68.3	64.6	61.3	63	62.3	66.4	60.5	50.3	41.2
7	02/05/2019 03:05	05:00	Lmax	65.8	68.4	66.1	61.5	60.8	63.9	57.9	50.2	41.3

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	Duration (mm:ss)	Metric	$L_{Aeq,5min}$ (dB) / $L_{AFmax,5min}$ (dB) / $L_{A90,5min}$ (dB)	$L_{Zeq,5min}$ and $L_{Zmax,5min}$ and $L_{Z90,5min}$ (dB) at octave band centre frequency							
					63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
7	02/05/2019 03:10	05:00	Lmax	69.6	69.9	68.9	70.2	67.7	66.8	59	49	39
8	29/04/2019 12:22	05:00	Lmax	70.5	78.2	69.8	64.5	65.8	63.9	66.8	57.6	54.4
8	29/04/2019 12:31	05:00	Lmax	60.6	76.6	64.2	61.6	57.2	57.6	53.3	57.7	53.4
8	29/04/2019 12:36	05:00	Lmax	61.9	73.8	65.6	65.7	59.2	58.0	56.0	54.1	55.3
9	30/04/2019 22:27	05:00	Lmax	60.5	74.8	66.8	58.6	55.0	57.0	53.3	48.4	44.9
9	30/04/2019 22:32	05:00	Lmax	54.7	71.7	63.2	57.9	56.5	49.3	44.2	46.0	43.1
9	30/04/2019 22:37	05:00	Lmax	61.2	67.6	61.5	60.3	57.5	58.0	53.5	48.6	50.7
9	02/05/2019 03:24	05:00	Lmax	45.7	58.7	60.3	45.6	42.6	41.8	38.2	33.9	35.9
9	02/05/2019 03:29	05:00	Lmax	52.8	55	49.6	44.3	41.1	43	43.1	42	53.2
9	02/05/2019 03:34	05:00	Lmax	49.1	65	59.9	52.2	47.2	44.1	42.3	44.7	45.4
1	29/04/2019 09:08	05:00	L90	56.1	58.9	57.0	57.1	53.5	47.4	46.3	44.4	33.2
1	29/04/2019 09:13	05:00	L90	55.8	58.4	57.1	57.1	52.8	48.3	46.5	44.4	32.9
1	29/04/2019 09:18	05:00	L90	56.4	59.8	57.0	56.6	53.4	49.6	47.3	45.0	33.3
1	29/04/2019 10:07	05:00	L90	44.5	57.6	48.0	42.8	40.0	40.6	36.0	26.9	17.6
1	29/04/2019 10:12	05:00	L90	43.5	55.6	47.5	42.0	38.8	38.9	33.8	25.1	16.5
1	29/04/2019 10:17	05:00	L90	43.1	54.5	46.8	41.4	38.7	39.0	34.1	25.5	17.4
2	29/04/2019 09:28	05:00	L90	51.9	59.7	54.3	49.5	47.2	47.8	44.3	35.3	25.3
2	29/04/2019 09:33	05:00	L90	56.7	61.2	55.9	52.5	50.9	53.1	48.5	38.2	27.3
2	29/04/2019 09:39	05:00	L90	48.5	57.8	50.8	45.9	43.8	45.5	38.6	31.3	21.0
2	29/04/2019 10:31	05:00	L90	49.0	57.5	51.3	47.3	44.2	44.8	39.9	32.1	21.9
2	29/04/2019 10:37	05:00	L90	48.9	57.9	51.5	46.5	44.0	44.6	40.0	32.4	24.4
2	29/04/2019 10:43	05:00	L90	50.4	59.0	52.0	46.9	45.7	46.0	41.6	33.4	21.4
3	29/04/2019 09:48	05:00	L90	45.4	55.6	49.3	45.2	40.4	40.0	35.1	27.6	18.5
3	29/04/2019 09:53	05:00	L90	46.2	55.7	48.8	44.6	41.0	42.3	38.1	28.8	19.2
3	29/04/2019 09:58	05:00	L90	44.8	55.6	48.6	42.9	39.8	40.2	36.1	27.9	18.1
3	29/04/2019 10:55	05:00	L90	48.1	57.2	51.8	47.0	42.8	42.7	38.4	30.4	21.8
3	29/04/2019 11:06	05:00	L90	45.1	55.6	48.2	42.4	40.2	39.9	37.6	31.7	23.4
3	29/04/2019 11:11	05:00	L90	45.3	55.3	48.6	45.1	41.1	40.5	35.3	26.5	16.8
3	29/04/2019 12:00	05:00	L90	45.9	54.8	48.5	42.9	41.0	42.0	37.3	29.3	20.5
3	29/04/2019 12:06	05:00	L90	47.0	57.6	50.0	44.8	41.7	42.7	38.7	31.0	20.1
3	29/04/2019 12:11	05:00	L90	46.9	56.7	49.8	44.7	41.9	41.1	36.7	30.3	22.6
4	29/04/2019 09:03	05:00	L90	46.5	55.0	52.7	46.6	43.6	39.5	35.0	32.4	21.1
4	29/04/2019 09:09	05:00	L90	45.7	54.8	52.1	45.8	43.3	39.2	35.0	33.4	21.2
4	29/04/2019 09:14	05:00	L90	46.8	55.6	52.5	46.2	43.7	40.7	36.5	32.8	21.5
4	29/04/2019 10:06	05:00	L90	42.2	54.2	49.2	41.5	38.3	36.6	30.9	29.5	16.5
4	29/04/2019 10:12	05:00	L90	41.8	53.1	49.6	41.6	38.0	36.3	30.2	29.8	15.8
4	29/04/2019 10:17	05:00	L90	42.5	52.7	49.2	42.1	38.5	37.0	31.7	27.9	16.2
4	29/04/2019 11:21	05:00	L90	42.7	53.4	49.2	41.7	39.1	38.2	32.0	23.6	16.8
4	29/04/2019 11:27	05:00	L90	43.8	55.2	50.0	42.9	39.6	38.3	33.3	25.5	16.5
4	29/04/2019 11:32	05:00	L90	43.3	54.6	50.5	44.4	39.7	36.9	31.2	21.1	14.6

Measurement Position	Start Time (dd/mm/yyyy hh:mm)	Duration (mm:ss)	Metric	$L_{Aeq,5min}$ (dB) / $L_{AFmax,5min}$ (dB) / $L_{A90,5min}$ (dB)	$L_{Zeq,5min}$ and $L_{Zmax,5min}$ and $L_{Z90,5min}$ (dB) at octave band centre frequency							
					63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
5	29/04/2019 09:21	05:00	L90	44.8	55.9	49.3	45.1	41.6	39.5	33.5	29.4	18.1
5	29/04/2019 09:26	05:00	L90	43.8	54.0	48.2	44.1	41.0	38.6	32.7	29.3	18.7
5	29/04/2019 09:31	05:00	L90	43.7	53.3	47.9	43.6	40.8	38.6	32.5	29.1	17.6
5	29/04/2019 10:24	05:00	L90	45.7	52.8	48.3	44.9	41.3	38.2	32.5	31.7	21.0
5	29/04/2019 10:29	05:00	L90	45.3	53.7	48.5	45.2	42.0	38.9	33.7	29.7	17.6
5	29/04/2019 10:35	05:00	L90	44.6	52.3	49.1	44.3	41.1	38.7	33.4	26.2	17.4
5	29/04/2019 11:38	05:00	L90	43.3	53.7	48.3	43.4	40.8	37.6	31.5	25.2	18.9
5	29/04/2019 11:43	05:00	L90	43.5	54.0	48.5	44.0	41.0	37.2	31.0	23.7	15.8
5	29/04/2019 11:49	05:00	L90	43.2	53.8	47.8	43.6	40.3	37.9	32.1	26.1	18.7
6	29/04/2019 09:38	05:00	L90	42.0	53.9	45.3	39.9	37.1	37.7	31.9	30.1	17.1
6	29/04/2019 09:49	05:00	L90	42.0	54.3	46.7	41.7	37.5	35.8	29.7	30.6	17.6
6	29/04/2019 09:54	05:00	L90	42.1	54.3	46.4	41.1	37.2	36.1	30.7	29.5	18.3
6	29/04/2019 10:41	05:00	L90	43.4	54.2	46.6	40.7	38.6	37.9	33.5	25.6	18.3
6	29/04/2019 10:47	05:00	L90	40.8	53.8	46.0	39.4	37.2	35.4	30.5	22.8	16.2
6	29/04/2019 10:55	05:00	L90	45.0	56.5	49.3	44.0	41.0	37.9	32.7	25.1	17.8
7	29/04/2019 11:45	05:00	L90	48.1	57.4	51.7	48.0	43.8	42.6	39.0	31.7	23.4
7	29/04/2019 11:51	05:00	L90	47.8	56.4	50.8	46.6	43.0	43.1	38.4	32.2	23.9
7	29/04/2019 12:02	05:00	L90	49.5	56.9	51.0	47.8	45.0	45.3	40.9	33.0	24.3
7	30/04/2019 22:03	05:00	L90	44.5	53.4	49.0	45.1	40.9	40.2	34.2	24.8	15.5
7	30/04/2019 22:08	05:00	L90	44.2	52.2	47.5	44.6	40.5	40.8	33.8	24.0	14.6
7	30/04/2019 22:14	05:00	L90	46.4	55.2	50.4	46.4	42.5	41.9	36.4	29.3	19.7
7	30/04/2019 22:19	05:00	L90	43.5	53.0	48.1	44.6	39.8	39.3	32.4	23.7	15.5
7	02/05/2019 03:00	05:00	L90	38.5	50.2	44.1	38.7	35.5	33.1	27.1	18.3	13.2
7	02/05/2019 03:05	05:00	L90	38.7	49.2	45.5	39.1	36.1	33.1	27	18	13.2
7	02/05/2019 03:10	05:00	L90	38.3	47.6	43.8	38.9	35.4	32.9	27.5	18.3	13.3
8	29/04/2019 12:22	05:00	L90	43.7	51.8	47.1	44.0	40.0	39.0	33.8	24.7	17.4
8	29/04/2019 12:31	05:00	L90	44.4	53.2	47.9	44.7	41.0	39.6	33.5	23.8	16.2
8	29/04/2019 12:36	05:00	L90	44.6	53.5	47.1	44.4	40.6	40.1	34.6	25.3	16.2
9	30/04/2019 22:27	05:00	L90	38.7	47.4	41.6	38.6	35.7	35.0	27.1	16.5	12.8
9	30/04/2019 22:32	05:00	L90	38.6	48.1	42.6	39.0	35.0	34.4	27.6	16.5	12.8
9	30/04/2019 22:37	05:00	L90	37.9	48.1	43.1	38.8	34.8	33.5	25.3	15.5	12.8
9	02/05/2019 03:24	05:00	L90	38.4	48.1	42.3	37.4	35.6	34.3	25.5	15.1	13.2
9	02/05/2019 03:29	05:00	L90	38.3	47.7	42.2	37.4	35.5	34.3	25.4	14.8	13.1
9	02/05/2019 03:34	05:00	L90	38.2	48.3	42.3	37.5	35.4	34.2	25.5	14.8	13.1