Report No. NVE2679-1
Issued on 11th March 2014

11 Chalcot Gardens, London NW3 4YB

An Assessment of the Impact of the Noise from the a/c Unit on the Nearest Noise-Sensitive Window

For a Planning Application

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CONTENT

1. Introduction

Cubit Consulting Ltd (Agents) are applying, on behalf of Mathieu Guillemin, for a retrospective planning application to install an air conditioning unit to the rear of the premises at 11 Chalcot Gardens, London NW3 4YB.

Cubit Consulting Ltd have commissioned Noise & Vibration Engineering Ltd (NVE) to carry out an assessment of the impact of the noise on the nearest noise-sensitive window in support of the planning application.

This report describes the noise survey, presents results, assesses the impact of the noise on the nearest noise-sensitive window and draws conclusions.

2. The Site

The site is a semi-detached family house with a rear lower ground garden situated in a residential area at 11 Chalcot Gardens in Camden, see Figure 1.

There is a rear extension on the lower ground level with a glazed ground story conservatory constructed above it. There is also a glazed external staircase serving the ground and first floor storeys constructed between the side elevations of the premises at No. 11 and the adjacent premises at No. 10.

The noise source under investigation is an outdoor Mitsubishi MUZ-GF71VE air conditioning unit that runs (on and off) 24 hours a day as required, see Appendix A for details.

The unit is fixed to the north east (side) elevation at the ground storey level directly under the external staircase and approx. 2m away from the rear elevation.

It is proposed to install the MUZ-GF71VE a/c unit within Environ ELV1.1.25ACS4 acoustic enclosure, see Appendix B for details. The enclosure is a fully encapsulating system with noise reduction performance of 25dB.

The nearest noise-sensitive window from the outdoor a/c unit is the ground floor window/door with a balcony in the rear elevation of the adjacent premise at No. 10. The window is situated approx. 4m away from the a/c unit, however, there is no direct line of site between the window and the a/c unit, see Figures 2, 3 & 4.

3. Camden Council's Noise Requirements

Camden Council's noise requirements on this project is the guidance regarding noise from mechanical services plant given in Policy DP 28 'Noise and vibration' of Camden Development Policies – 2010-2025.

The noise criteria are based on the guidance in BS4142: 1997 – Method for rating noise affecting mixed residential and industrial areas, see Appendix C for Scope.

The noise thresholds from plant and machinery at which planning permission will not be granted is presented in Table E of Camden Development Policy 28, see below.

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq}

Development that exceeds Camden's Noise Thresholds will not be permitted. The Council will only grant permission for plant or machinery if it can be operated without causing harm to amenity.

4. The survey of background noise

The survey of the background noise was carried out between 12:00 on 17th and 12:00 on 19th January 2014. During the survey it was generally calm and dry, however, there were occasional spells of light rain.

It consisted of measuring levels of the existing background noise levels at the rear of the premises at 11 Chalcot Gardens, see Figures 2, 3 & 4. The a/c unit was inoperative during the measurements.

The microphone was located approx. 1.2m above the roof of the lower ground rear extension, (i.e. measurement location), only a short distance away from the ground floor window of the adjacent premises at 10 Chalcot Gardens, (i.e. the nearest noise-sensitive window from the a/c units).

For this purpose the following instrumentation was used:

The 01dB-Stell Solo Master Class 1 Sound Level Meter (Serial No. 10669) together withPRE21S ½" preamplifier (Serial No. 11015) and a GRAS 40AE condenser microphone (Serial No. 100481). The

meter was checked for calibration just before and after the measurements with a B&K 4231 calibrator (Serial No. 2084931). No drift in the noise level was found.

The above instrumentation was laboratory calibrated on 1st November 2012 by AV Calibration Ltd.

Results of the noise survey are presented graphically and numerically in Chart 1 and Table 1 respectively, see Appendix A. Chart 1 shows a full time history of the noise in terms of consecutive $L_{Aeq,\ 5m}$. Table 1 lists sound pressure levels in terms of consecutive $L_{Aeq,5m}$ and $L_{A90,\ 5m}$ for the night-time periods between 23:00 and 07:00 only, when the background noise levels are normally at their lowest. Glossary of Terms and Noise Principles see Appendix D.

From Table 1 it can be seen that the lowest measured background noise level was at 37dB, $L_{A90,5\ min}$ (rounded to nearest whole number) during the period starting at 04:25 on 19th January 2014.

5. Assessment of the Noise Impact

The assessment of the impact of the a/c unit noise was made at a point 1m in front of the ground floor window in the rear elevation of the premises at 10 Chalcot Gardens, (i.e. assessment position).

For the purpose of this assessment we have assumed that the background noise level at the assessment position is equivalent to that at the measurement location.

According to a subjective assessment performed just before the measurements the a/c unit was making clicking and rattling noise, i.e. acoustic features are therefore present.

Table 2. Calculations of a noise level at the assessment position

Description	Results	Relevant clauses of BS4142	Commentary
Measured background level	$L_{A90,\ 5min}$ = 37dB	7.2	The background noise was measured over a typical 24h period during a temporary shutdown of the a/c unit
Noise level from the a/c unit	$L_{Aeq,5min}$ = 55dB	6.3	Specified level of the noise at R_0 = 1m from the Mitsubishi MUZ-GF71VE a/c unit
Reference time interval	5 min	6.2	Assessment is made during the night when the background noise level is the lowest thus the reference time period is 5 min
Noise reduction of acoustic enclosure	-25dB	Appendix B	Environ ELV1.1.25ACS4 acoustic enclosure
Distance attenuation for the point source	$-[20\log(R_1/R_0)]$ = $-[20\log(4/1)]$ = -12dB	Appendix D	Assessment position is situated approx. R_1 = 4m away from the a/c unit.
Predicted specific noise level	$L_{Aeq,5min}$ = 55dB – 12dB - 25dB = 18dB	6.3	Specific level of the noise from the a/c unit at the assessment position
Acoustic features	+5dB	8.1	Acoustic features are present in the noise from the a/c unit
Rating level	18dB + 5dB = 23dB	8.2	Rating level of the noise from the a/c unit at the assessment position
Background level	$L_{A90,\ 5min}$ = 37dB	7.2	See above
Excess of rating over background noise level	$L_{Aeq,5min}$ - $L_{A90,5min}$ = 23dB – 37dB = -14dB	9	Assessment indicates complaints are unlikely

Table 2 shows that the rating level of the a/c noise is more than 10dB below the lowest background noise level at the nearest noise-sensitive window.

6. Conclusions

From the above assessment we conclude that the noise from the a/c unit will meet the Camden Council's noise requirements.

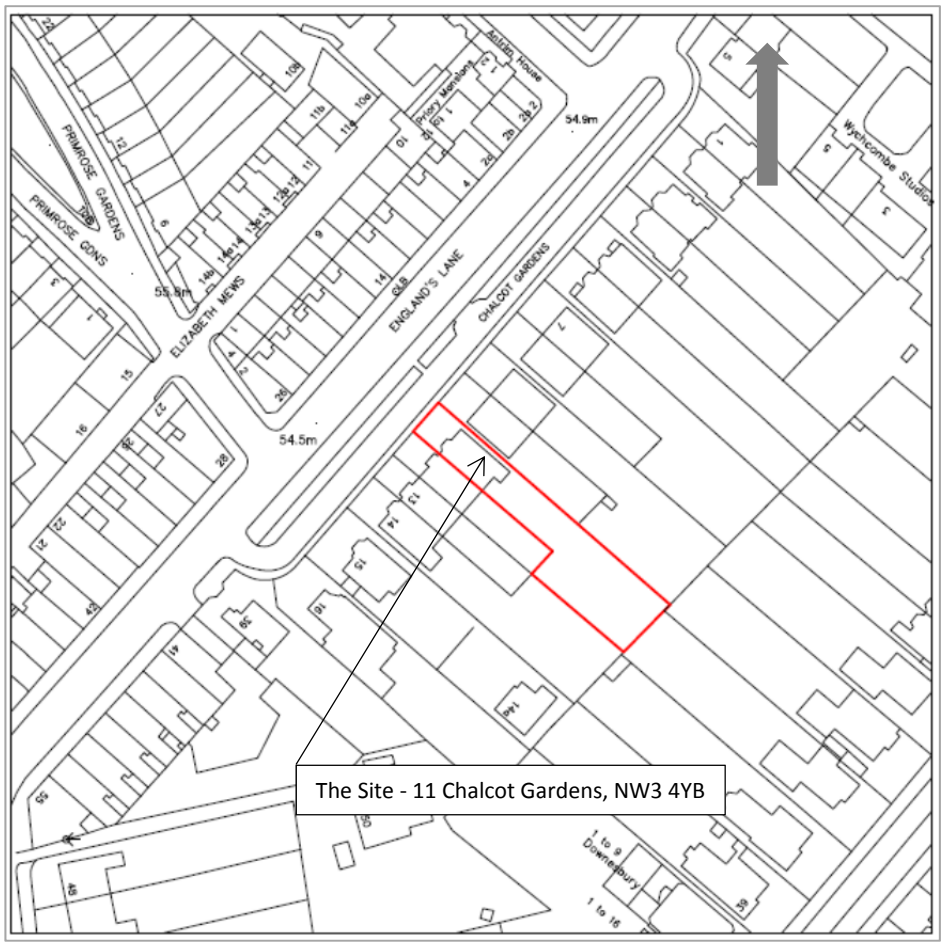


Figure 1. Site Plan

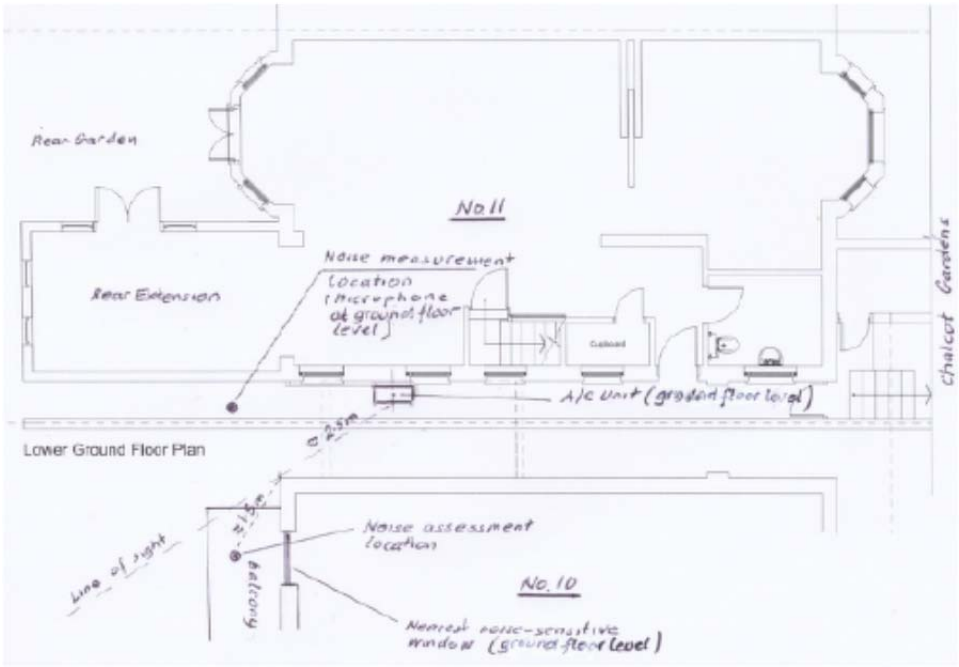


Figure 2. Ground floor plan showing the noise measurement and assessment locations

Figure 3. South East (Rear) Elevation

Figure 4. North East (Side) Elevation

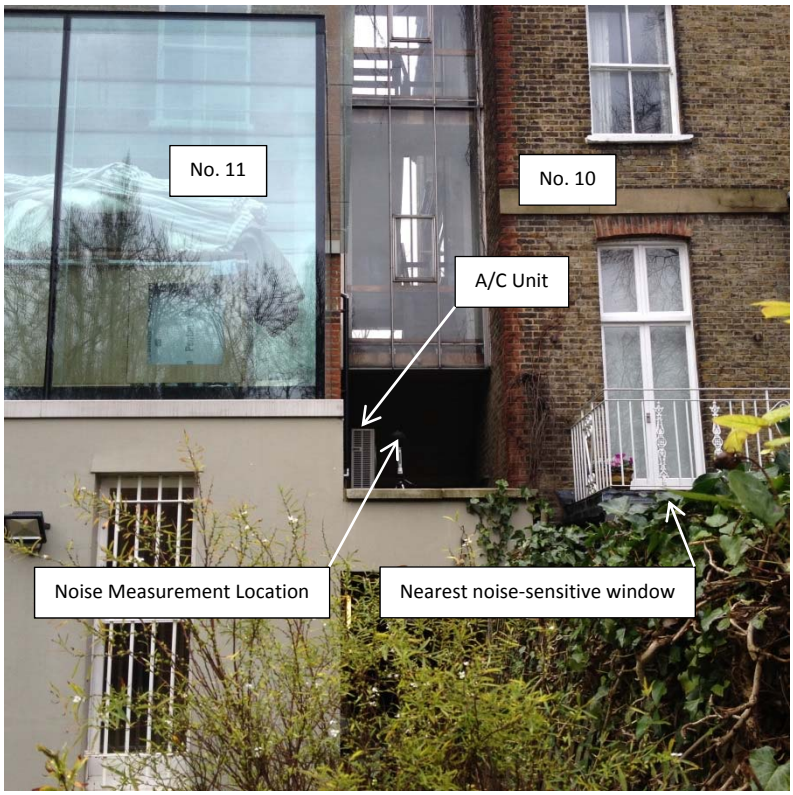


Photo 1. South East (Rear) Elevation

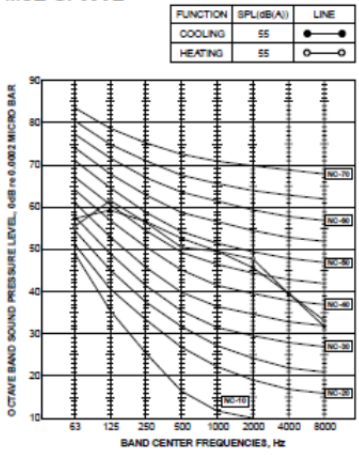
Appendix A

Specification of Outdoor Mitsubishi MUZ-GF71VE a/c unit

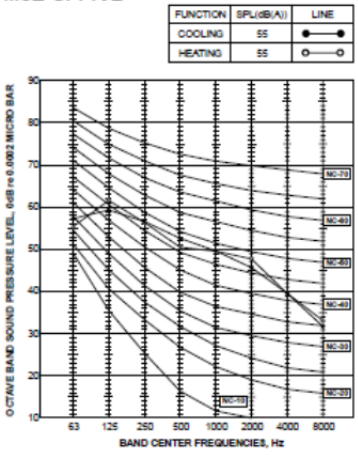
Model	Set name		MSZ-GF60VE		MSZ-GF71VE	
	Indoor		MSZ-GF60VE		MSZ-GF71VE	
	Outdoor		MUZ-GF60VE		MUZ-GF71VE	
Function			Cooling	Heating	Cooling	Heating
Power supply			~ /N, 230 V, 50 Hz			
Capacity		kW	6.10	6.80	7.10	8.10
Input		kW	1.79	1.81	2.13	2.23
Weight	Indoor	kg	16			
	Outdoor	kg	50		53	
Refrigerant filling capacity (R410A)		kg	1.55		1.9	
IP code	Indoor		IP 20			
	Outdoor		IP 24			
Permissible excessive operating pressure	LP ps	MPa	1.64			
	HP ps	MPa	4.15			
Noise level	Indoor (Super High/ High/Med./Low/Silent)	dB(A)	49/45/41/37/29		49/45/41/37/30	
	Outdoor	dB(A)	55	55	55	55

4 NOISE CRITERIA CURVES

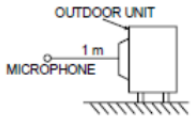
MUZ-GF60VE



MUZ-GF71VE



Test conditions
Cooling: Dry-bulb temperature 35°C
Heating: Dry-bulb temperature 7°C Wet-bulb temperature 6°C



Appendix B

environ™

Tel: 0870 383 3344
www.environ.co.uk

SELECTION MATRIX

environlite 1.1.25AC Series 4

28 January 2014

Acoustic enclosures for Split AC Unit Applications

CUSTOMER:	SITE / LOCATION / REFERENCE

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA

MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0m FREE FIELD

MAKE:	MODEL:	AIR IN	AIR OUT
Mitsubishi Electric	MUZ-GF71VE	Rear & 1 Side	Front

WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (M^3S^{-1})	SPL dB(A)	DISTANCE (M)
840+80	330	880	0.95	55	1

INNER CUBE DIMENSIONS		
1050	450	1035
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
0.95	1.0	55
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)

ENCLOSURE DETAIL		
1650	1000	1100
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
0.95	1.0	29-35
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A) Range

INLET AIRWAYS		
1035	250	1
WIDTH (MM)	HEIGHT (MM)	NO.

DESIGN CRITERIA		
OK	OK	OK
UNIT SIZE	OUTLET	INLET

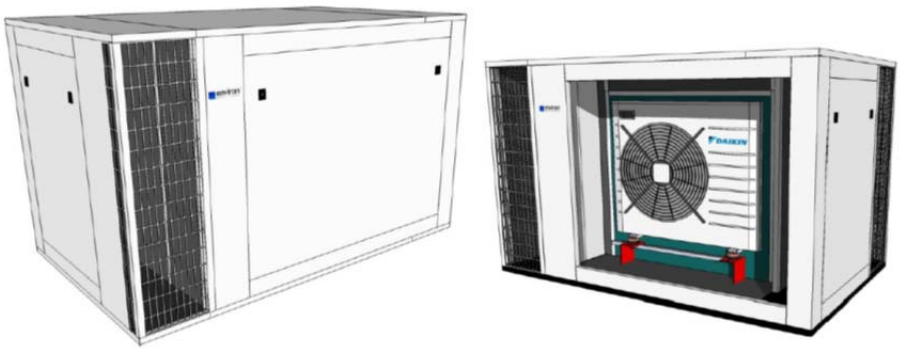
OUTLET AIRWAYS		
250	1035	1
WIDTH (MM)	HEIGHT (MM)	NO.

AIRFLOW INFORMATION		
16	3.7	3.7
PD (NM^{-2})	OUTLET (MS^{-1})	INLET (MS^{-1})

Select Inlet & Outlet Airway Sizes to Ensure Airflows are kept Below 6.0m/s

ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	250		1035
OUTLET AIRWAY	250		1035
EXTERNAL SIZE	1650	1000	1100
SOUND LEVEL RANGE @ 1.0m (FREE FIELD	29-35	SPL dB(A) Free Field	

NOTES CONCERNING ENCLOSURE DESIGN



Environ acoustic designs are protected under patent

The information contained in this Selection Matrix is Confidential and shall not be disclosed or used for any unauthorised purposes

Appendix C

BS4142 - Scope

The BS4142 describes a method of determining noise levels from the background noise, from factories, or industrial premises, or fixed installations, together with procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity.

Response to noise is subjective and affected by many factors (acoustic and non-acoustic). In general the likelihood of complaint in response to a noise depends on factors including the margin by which it exceeds the background noise level, its absolute level, time of day, changes in noise environment etc., as well as local attitudes to the premises and the nature of the neighbourhood.

The BS 4142 is only concerned with the rating of a noise of an industrial nature, based on the margin by which it exceeds a background noise level with an appropriate allowance for the acoustic features present in the noise. As this margin increases, so does the likelihood of complaint.

If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely. However, if the rating level is around 5 dB above the measured background noise level then it is of marginal significance. When the rating level is 10dB or more above the measured background noise level then it indicates that complaints are likely.

Appendix D

Glossary of Terms and Noise Principles

Noise is measured in units of dB on a logarithmic scale. This scale is accepted as the best way of measuring the wide range of sounds that can be heard by the human ear in a convenient manner. Being a logarithmic scale, a doubling of sound intensity results in a numerical increase of only 3dB. For example, if the sound produced by an a/c unit is 46dB, the effect of two similar units at the same time is 49dB, not 92dB. It should be noted that subjectively a 3dB increase in noise is hardly perceptible. Studies have shown that about a 10dB increase in measured noise is required to produce a perceived doubling of loudness. 10dB actually represents a ten-fold increase in sound energy.

Sound levels are measured in A-weighted dB. A decibel is a unit, which represents the overall sound pressure level, (as a ratio to a standard reference level). The A-weighting is a standard correction, which reproduces the varying sensitivity of the human ear to differing frequencies. The dBA level is thus a good indicator of the loudness or annoyance of a sound.

While the sound level meter can be set to respond to a sound at different rates of reaction, the response rate of the human ear is obviously most relevant in cases of noise complaints. The “fast” response rate on the meter is used extensively in noise measuring standards.

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as few seconds, a minute or one hour, the statistically determined results being used to quantify various aspects of noise.

$L_{Aeq,T}$	The average or "equivalent continuous" sound level, L_{Aeq} takes account of both the noisy activities and the quiet spells between. Thus it is a good measure of the long-term impact of noise over perhaps several hours. It can equally be used to describe the mean noise over short periods.
$L_{A90,T}$	The L_{A90} level is that level of sound which is exceeded for 90% of the time period being sampled. L_{A90} is widely considered to be the best method for expressing background noise level, (obtained using the time weighting F).

The noise propagation from a point source in a free space is in accordance with the inverse square law by which sound pressure level decreases by 6dB per doubling of the distance from the point source.

The noise from a single air conditioning unit will therefore reduce by 6dB for each doubling of the distance between source and receiver, i.e. a noise of 50dB at one metre will be 44dB at 2 metres, 38dB at 4 metres, and so on.

For the purposes of BS4142, the following definitions apply:

Specific noise source: The noise under investigation for assessing the likelihood of complaints.

Specific noise level, $L_{Aeq,T}$ – The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given time interval.

Rating level, $L_{Ar,T}$: The specific noise level plus any adjustment for the characteristic features of the noise.

Residual noise – The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

Background noise level, $L_{A90,T}$ – The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting, F.

Appendix E

Results of the background Noise Survey

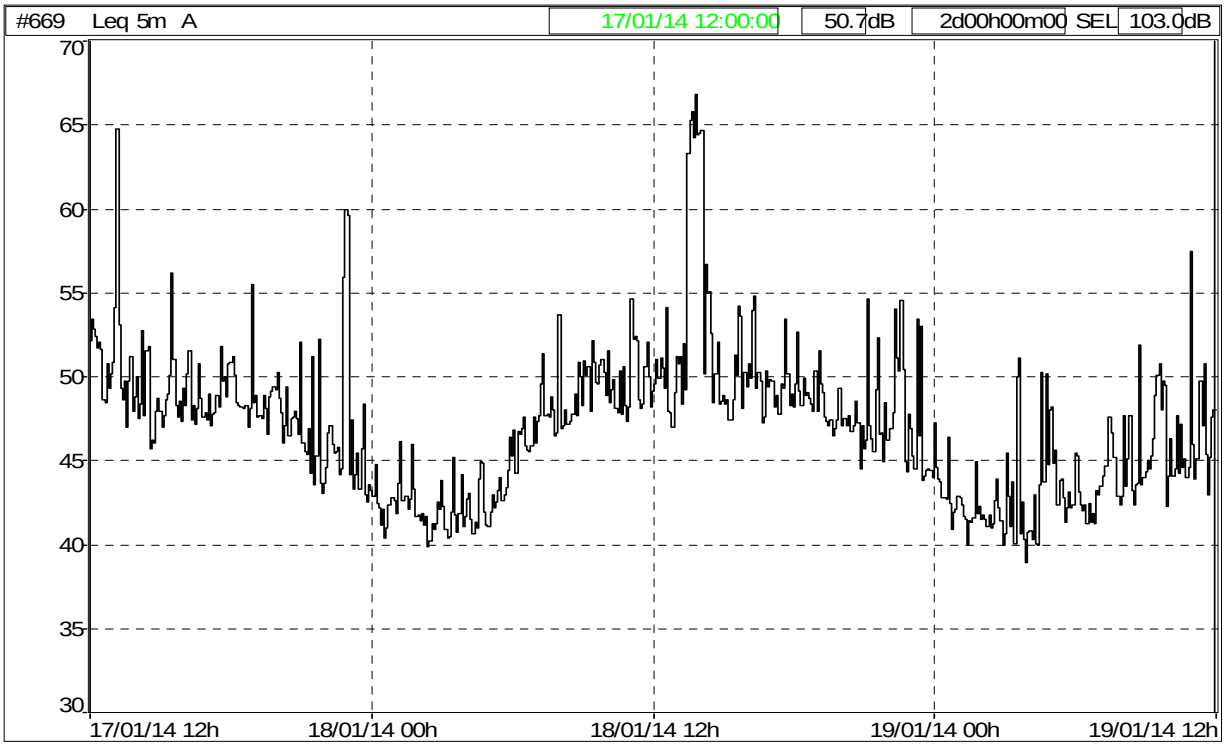


Chart 1. Full History of Noise

Table 1. Results of the Night-time (23:00-07:00) Noise Measurements (dB)

Period	LAeq,5m	LA90, 5m		Period	LAeq,5m	LA90, 5m
17/01/2014 23:00	59.5	58.7		18/01/2014 23:00	46.9	42.7
17/01/2014 23:05	44.1	41.2		18/01/2014 23:05	45.2	42.3
17/01/2014 23:10	47.4	41.5		18/01/2014 23:10	44.5	42
17/01/2014 23:15	43.3	41.4		18/01/2014 23:15	53.4	42.7
17/01/2014 23:20	44.2	41.3		18/01/2014 23:20	46.5	42.7
17/01/2014 23:25	45.4	41.4		18/01/2014 23:25	52.9	43.4
17/01/2014 23:30	43.3	41.4		18/01/2014 23:30	43.8	41.6
17/01/2014 23:35	45.7	42.1		18/01/2014 23:35	44	41.7
17/01/2014 23:40	48.4	40.5		18/01/2014 23:40	44.4	41.8
17/01/2014 23:45	42.9	40.8		18/01/2014 23:45	44.5	41.9
17/01/2014 23:50	42.5	39.9		18/01/2014 23:50	44.4	41.4
17/01/2014 23:55	43.5	40.1		18/01/2014 23:55	43.9	41.8
18/01/2014 00:00	43.2	40.2		19/01/2014 00:00	47.2	42.6
18/01/2014 00:05	42.9	39.8		19/01/2014 00:05	44.6	41.3
18/01/2014 00:10	44.7	40.3		19/01/2014 00:10	43.9	41.5
18/01/2014 00:15	42.4	39.7		19/01/2014 00:15	43.7	42
18/01/2014 00:20	42.1	39.7		19/01/2014 00:20	42.8	41.3
18/01/2014 00:25	41.1	38.8		19/01/2014 00:25	42.7	40.3
18/01/2014 00:30	42.1	39.5		19/01/2014 00:30	42.7	41
18/01/2014 00:35	40.4	38.7		19/01/2014 00:35	46.3	41.1
18/01/2014 00:40	41	38.5		19/01/2014 00:40	42.4	39.7
18/01/2014 00:45	42.3	39.4		19/01/2014 00:45	40.9	39.4
18/01/2014 00:50	42.7	40		19/01/2014 00:50	41.9	39.8
18/01/2014 00:55	42.7	40.1		19/01/2014 00:55	42	39.9
18/01/2014 01:00	42.6	39.4		19/01/2014 01:00	42.9	40.1
18/01/2014 01:05	41.8	39.1		19/01/2014 01:05	42.7	40.3

18/01/2014 01:10	43.6	40.1		19/01/2014 01:10	42.3	39.3
18/01/2014 01:15	46.1	40.3		19/01/2014 01:15	41.6	39.1
18/01/2014 01:20	42.5	39.9		19/01/2014 01:20	41.4	38.5
18/01/2014 01:25	42.9	40.1		19/01/2014 01:25	40	38.2
18/01/2014 01:30	42.8	39.1		19/01/2014 01:30	41.4	38.5
18/01/2014 01:35	42.1	39.2		19/01/2014 01:35	41.3	39.5
18/01/2014 01:40	42.7	40.5		19/01/2014 01:40	41.5	39.9
18/01/2014 01:45	45.9	40.8		19/01/2014 01:45	44.9	39.6
18/01/2014 01:50	43.3	40.3		19/01/2014 01:50	41.8	40
18/01/2014 01:55	41.6	39.8		19/01/2014 01:55	42.3	40
18/01/2014 02:00	41.8	39.8		19/01/2014 02:00	41.4	39.7
18/01/2014 02:05	41.4	39.6		19/01/2014 02:05	41.7	39.1
18/01/2014 02:10	41.8	39.2		19/01/2014 02:10	41.5	39.3
18/01/2014 02:15	41.2	39.7		19/01/2014 02:15	41	39.4
18/01/2014 02:20	41.6	39.4		19/01/2014 02:20	41.7	39.4
18/01/2014 02:25	39.9	38.9		19/01/2014 02:25	40.9	39.3
18/01/2014 02:30	40.2	38.9		19/01/2014 02:30	41.2	39.4
18/01/2014 02:35	41.2	39.2		19/01/2014 02:35	42.5	38.8
18/01/2014 02:40	40.9	38.9		19/01/2014 02:40	43.9	39.7
18/01/2014 02:45	41.2	39.4		19/01/2014 02:45	42.2	39.4
18/01/2014 02:50	42.5	39.4		19/01/2014 02:50	41.4	38.9
18/01/2014 02:55	42	39		19/01/2014 02:55	39.9	38.7
18/01/2014 03:00	43.7	39.3		19/01/2014 03:00	40.6	39.1
18/01/2014 03:05	42.2	39.1		19/01/2014 03:05	45.5	39.1
18/01/2014 03:10	40.8	38.2		19/01/2014 03:10	42.8	39.1
18/01/2014 03:15	40.3	38.7		19/01/2014 03:15	41.1	38.6
18/01/2014 03:20	40.4	38.3		19/01/2014 03:20	43.7	39.1
18/01/2014 03:25	41.9	38.7		19/01/2014 03:25	40	37.7
18/01/2014 03:30	45.2	39.8		19/01/2014 03:30	50	38.1
18/01/2014 03:35	41.7	39.4		19/01/2014 03:35	51.1	37.8
18/01/2014 03:40	40.7	38.9		19/01/2014 03:40	40.6	38.4
18/01/2014 03:45	41.8	39.3		19/01/2014 03:45	42.5	38.6
18/01/2014 03:50	44.1	40.2		19/01/2014 03:50	40.3	37.8
18/01/2014 03:55	41	39.1		19/01/2014 03:55	38.9	36.9
18/01/2014 04:00	41.6	39		19/01/2014 04:00	40.7	38.1
18/01/2014 04:05	42.7	39.8		19/01/2014 04:05	40.8	38.3
18/01/2014 04:10	43	40.1		19/01/2014 04:10	40.3	38
18/01/2014 04:15	41.4	39.3		19/01/2014 04:15	43	37.7
18/01/2014 04:20	40.6	38.8		19/01/2014 04:20	40	37.2
18/01/2014 04:25	41.3	39.1		19/01/2014 04:25	39.9	**36.8**
18/01/2014 04:30	40.9	39		19/01/2014 04:30	43.5	38.2
18/01/2014 04:35	43.9	40.8		19/01/2014 04:35	50.3	43.9
18/01/2014 04:40	44.9	39.8		19/01/2014 04:40	43.7	40.7
18/01/2014 04:45	44.8	42.4		19/01/2014 04:45	50.1	39.5
18/01/2014 04:50	41.9	40.2		19/01/2014 04:50	44.7	39.4
18/01/2014 04:55	41.1	39		19/01/2014 04:55	48	41.7
18/01/2014 05:00	41.1	39.3		19/01/2014 05:00	48.1	44.3
18/01/2014 05:05	41.9	39.3		19/01/2014 05:05	44.8	42.2
18/01/2014 05:10	42.9	39.8		19/01/2014 05:10	45.5	42.4
18/01/2014 05:15	42.2	39.8		19/01/2014 05:15	42.3	39.7
18/01/2014 05:20	42.5	40		19/01/2014 05:20	43.8	41
18/01/2014 05:25	43.2	40.5		19/01/2014 05:25	43.9	40.6
18/01/2014 05:30	44	40.6		19/01/2014 05:30	42.7	40.2
18/01/2014 05:35	42.6	40.8		19/01/2014 05:35	41.3	39.3
18/01/2014 05:40	42.9	41		19/01/2014 05:40	42.1	40
18/01/2014 05:45	43.4	41.3		19/01/2014 05:45	43.1	40.5
18/01/2014 05:50	44.4	41.8		19/01/2014 05:50	42.1	39.5
18/01/2014 05:55	46.4	42.9		19/01/2014 05:55	42.3	39.7
18/01/2014 06:00	45.3	42.4		19/01/2014 06:00	45.5	43.1
18/01/2014 06:05	46.8	42.5		19/01/2014 06:05	45.2	41.8
18/01/2014 06:10	44.2	42.2		19/01/2014 06:10	43.1	40
18/01/2014 06:15	46.7	43.2		19/01/2014 06:15	42.3	40
18/01/2014 06:20	46.5	43.5		19/01/2014 06:20	42	39.8
18/01/2014 06:25	46.9	44.3		19/01/2014 06:25	42.3	39.1
18/01/2014 06:30	47.6	44.5		19/01/2014 06:30	41.2	38.6
18/01/2014 06:35	45.8	43.9		19/01/2014 06:35	42.4	38.4
18/01/2014 06:40	45.6	43.7		19/01/2014 06:40	41.3	39.7
18/01/2014 06:45	45.5	44.1		19/01/2014 06:45	41.8	40.1
18/01/2014 06:50	45.8	44.3		19/01/2014 06:50	41.2	39.9
18/01/2014 06:55	47.6	44.7		19/01/2014 06:55	43.2	40.3