



8 MULBERRY CLOSE,
LONDON, NW3

Plant Noise
Assessment

REPORT 6965/PNA
Prepared: 18 August 2015
Revision Number: 0

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Plant Noise Assessment



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Revision	Comment	Date	Prepared By	Approved By
Zero	First issue of report	18 August 2015	Claire Parker	Torben Anderson

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1.0 INTRODUCTION

There has been the installation of two outdoor heat pump units (Daikin 4MXS80E 8kW) at 8 Mulberry Close, Camden, London. One of the units is sitting on anti-vibration brackets on the flat roof of the building and the other attached to an outer wall. Camden Council state that planning permission for these two units is now required.

In order to determine the acceptability of atmospheric noise emissions limits from the installed plant, RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site. This report presents the results of the noise measurements alongside new plant data and reviews the conclusions to be made from undertaking a noise assessment of the outdoor heat pump units.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

Monitoring of the prevailing background noise was undertaken over the following weekday period:

Tuesday 4 August to Wednesday 5 August 2015.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period, however the weather was generally considered satisfactory it being predominantly dry with little wind.

Measurements were made of the L_{A90} and L_{Aeq} noise levels over sample periods of 15 minutes.

2.2 Measurement Location

To determine the existing noise climate at the location of the new outdoor pump units plant measurements were undertaken at 2m above the flat roof along the north-side wall, positioned approximately 8m from the closest receiver window. The microphone was attached to a pole which itself was positioned along the north-side wall. The microphone was positioned 1.5m from the second outdoor heat pump unit. While the background noise levels were being recorded both heat pump units were switched off.

The measurement position is also illustrated on the attached Site Plan 6965/SP1 and in more detail in 6965/SP2.

2.3 Instrumentation

The following equipment was used for the measurements.

Table 6965/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1406116	473721533	13 November 2016
Norsonic Pre Amplifier	1209	20295		
Norsonic ½" Microphone	1225	215486		
Norsonic Sound Calibrator	1251	34307	CAL 022-2015-5048	13 January 2017

The sound level meter was calibrated both prior to and on completion of the survey with no calibration drifts observed.

3.0 RESULTS

The noise levels measured are shown as time-histories on the attached Graphs 6965/G1-G2.

In order to ensure a worst case assessment the lowest background L_{A90} noise levels measured have been used in our analysis. The lowest L_{A90} and $L_{Aeq, 15min}$ dB noise levels measured are summarised below.

Table 6965/T2 – Measured Levels

Measurement Period	L_{A90} (dBA)	$L_{Aeq, 15min}$ (dBA)
Daytime (07:00 – 23:00)	45	54
Night-time (23:00 – 07:00)	35	48

4.0 CRITERIA

It is recommended that plant noise should be designed so that levels achieve 5dB below lowest (worst case) L_{A90} measured noise levels (see Table 6965/T2) in order to safeguard the existing noise climate for both daytime and night-time periods. This is to ensure that the installed heat pump units comply with the acoustic standards set by Camden Council, London.

In order to provide a worst case scenario we propose targeting levels 5dBA below the lowest measured background noise level (L_{A90}).

- Daytime (07:00 – 23:00) 40 dBA
- Night-time (23:00 – 07:00) 30 dBA

5.0 ASSESSMENT

Our assessment has been based upon the following information:

5.1 Proposed Air Conditioning Units

Both are Daikin 4MXS80E 8kW.

5.2 Position of Units

The outdoor heat pump units are already installed, one mounted on the wall and the other sitting on anti-vibrational brackets on the flat roof at 8 Mulberry Close. The equipment positions are indicated on the attached Site Plan 6965/SP1.

5.3 Noise Levels

Information regarding the noise levels of the installed plant has been provided by Daikin. From this it was determined that the heating unit is the louder of the two, and therefore the data in Table 6965/T3 are for the heating unit. The octave band sound power levels of the unit and overall sound pressure levels are detailed as follows:

Table 6965/T3 – Manufacturer's Noise Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Air Heating Unit (4MXS80E 8kW)	Lw	-	64	62	63	56	48	42	37	62
	Lp at 1m	-	53	51	52	45	37	31	26	51
	Lp at 10m	-	33	31	32	25	17	11	6	31

Review of the octave band data concludes that there are no tonal characteristics associated with the proposed plant.

5.4 Location of Nearest Residential Windows

The closest residential window to the installed outdoor heat pump units were advised as being the first floor of the building opposite, approximately 8m from the heat units' location. There are closer windows within the vicinity of the outdoor heat pump units however these are subject to screening via the building mass and hence less affected by noise from the heat pumps.

5.5 Calculation of Noise Levels at Measurement Position

Our calculation method for predicting noise levels from the installed outdoor heat pump units at the measurement position, based on the information stated above, is summarised below.

- Source Term SPL / SWL
- Cumulative noise levels from installed plant
- Screening Effect

Calculation sheets are attached for further information in Appendix B.

Noise levels at the closest receiver window were predicted to be 42dBA. While this allows both units to be run under normal conditions their usage will be restricted due to time limitations due to the decreasing

background noise level of the area throughout the day. In order to ensure plant noise levels are at least 5dBA below the prevailing background L_{A90} noise levels, the units will be able to be run between the hours of 06:15am to 10:00pm, while one unit can be run from 06:00am to midnight. This will ensure that the units will comply with the standards set by Camden Council.

After receiving the 4MXS80E 8kW product data book from Daikin it was found that these heating units are able to run at a reduced level as they come with the option of a night time quiet mode that will reduce the noise created by the units by 3dB. With this addition installed it would be possible to run both units between the hours of 06:15am to 11:45pm, and one unit from 05:45am to 00:15am. Therefore as a summary for a full day the units can be run as follows:

- 00:15am to 05:45am – No units running
- 05:45am to 06:15am – One unit running with night time quiet mode enabled
- 06:15am to 06:30am – Both units running with night time quiet mode enabled
- 06:30am to 10:00pm – Both units running with no restrictions
- 10:00pm to 11:45pm – Both units running with night time quite mode enabled
- 11:45pm to 00:15am – One unit running with night time quite mode enabled

Running the two outdoor heat pump units in this way will ensure compliance with the standards set by Camden Council. We understand that the system controls for the plant can be configured to ensure that these timings are fully adopted.

6.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that air cooling units be isolated from the supporting structure by means of adequately sized restrained spring isolators.

It is important the isolation is not “short-circuited” by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7.0 CONCLUSION

Measurements of the installed outdoor heat pump noise levels at 8 Mulberry Close, Camden, London have been undertaken.

The results of the assessment indicate that the installed units are able to run with no restrictions from 06:30am to 10:00pm. With the addition of the night time quiet mode, both units are able to run between 06:15am to 11:45pm, and with one unit running between 05:45am to 00:15am. This means that no units can be running between 00:15am to 05:45am in order to comply with that standards set by Camden Council. Therefore the installed heat pump units should be considered acceptable on an acoustic basis.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10} , L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Plant calculations

Table 6965/T4 – Predicted Noise Levels at Closest Receiver Postion

Unit	Sound Power level per unit (dBA)	Sound Power level addition for two units (dBA)	Distance loss at 8m – at receiver window (dBA)	dB change due to ¼ spherical radiation (dBA)	Received Level (dBA)
Daikin heat pump (4MXS80E 8kW)	62	+3	-18	-5	42

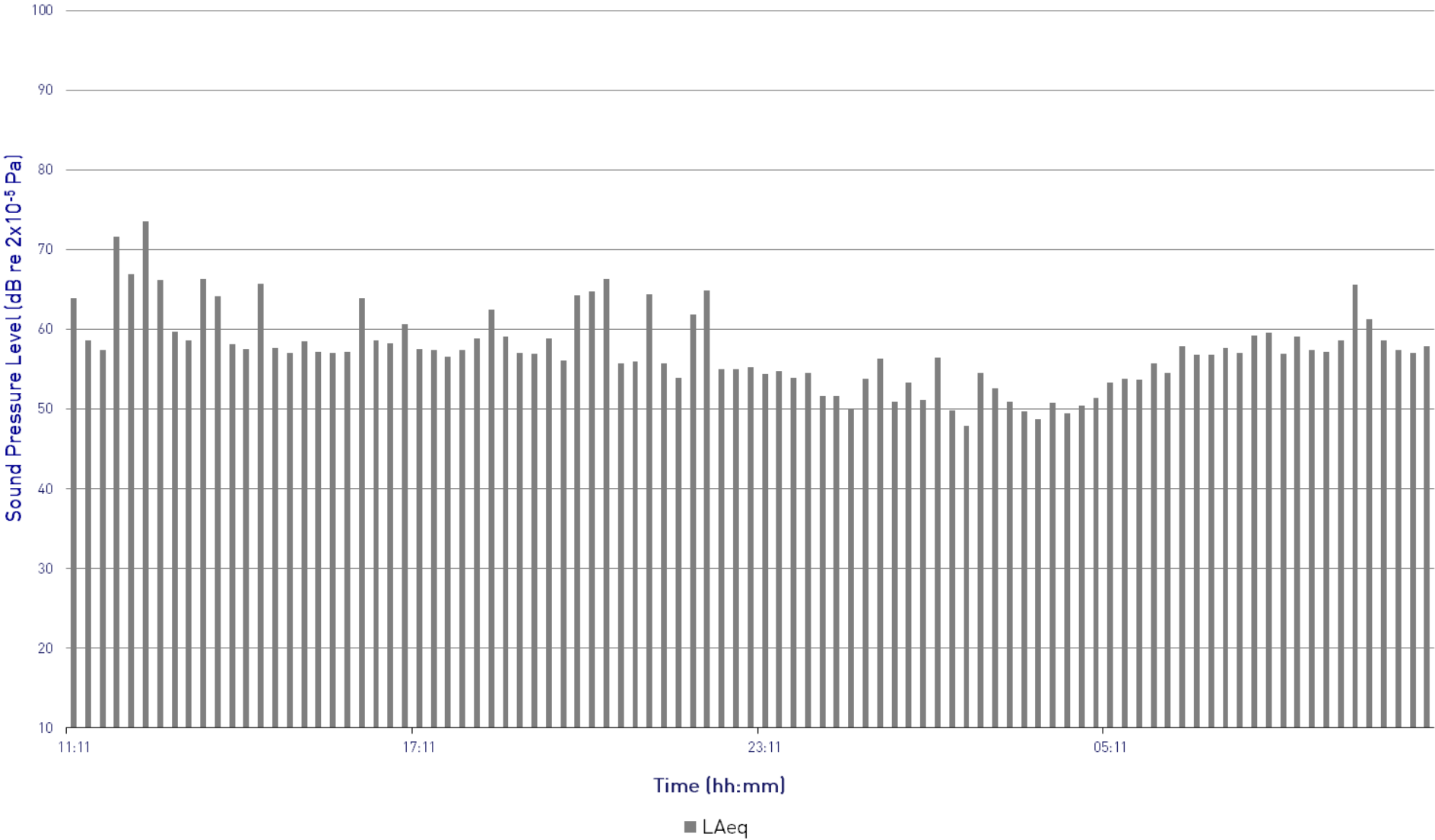
8 Mulberry Close, Camden

L_{Aeq, 15min} Time History

Tuesday 4 August to Wednesday 5 August 2015



Graph 6965/G1



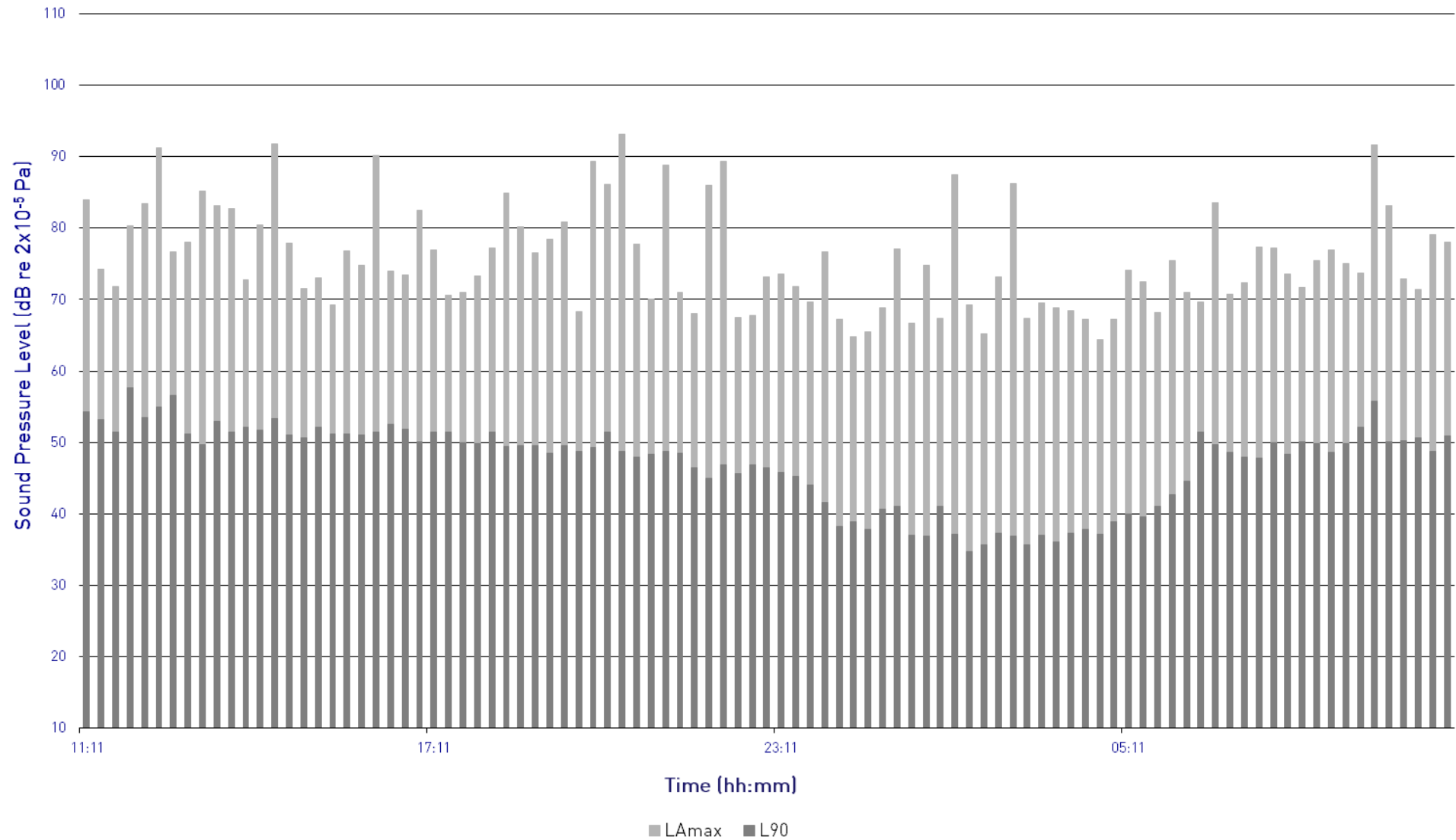
8 Mulberry Close, Camden

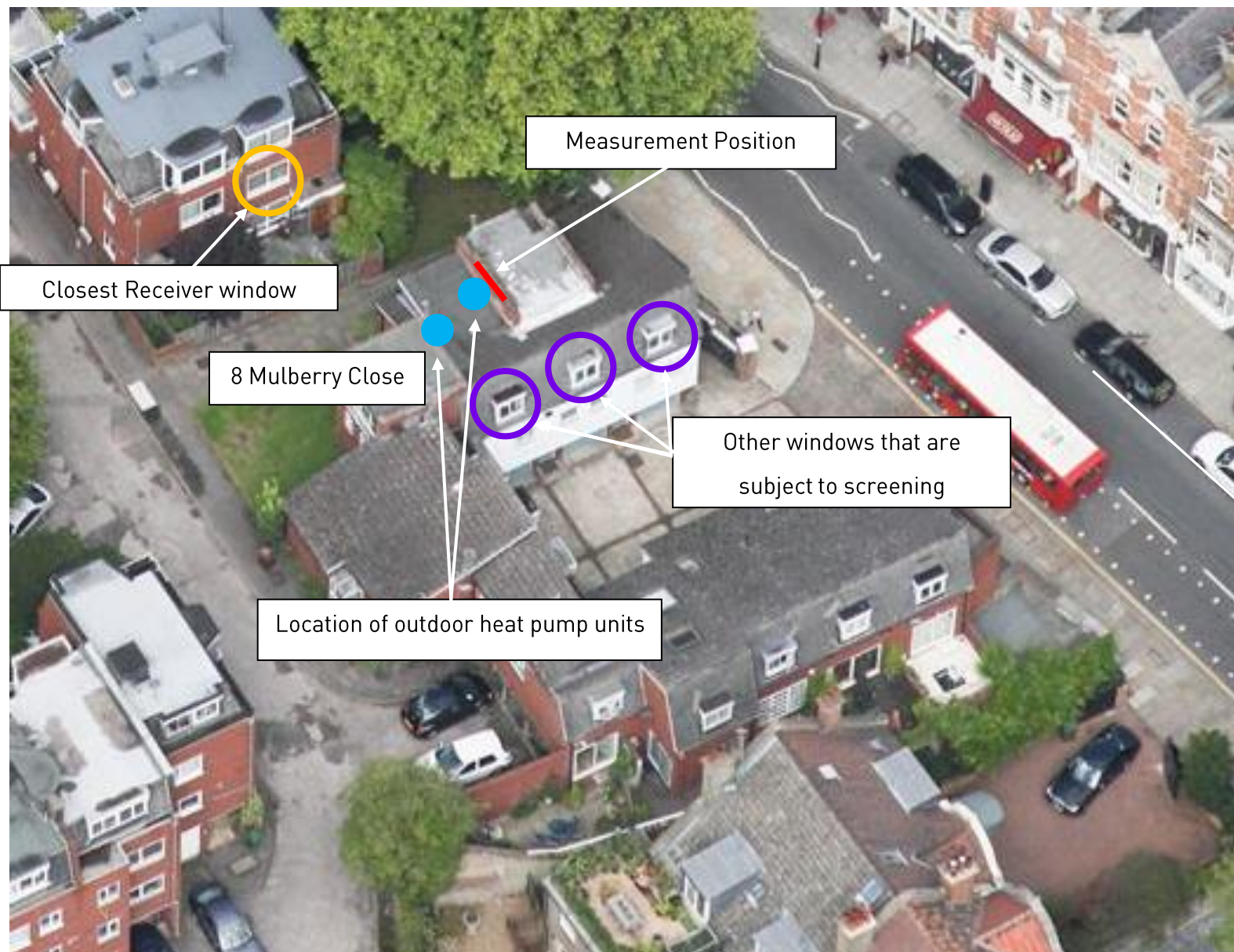
L_{Amax} and L_{A90} Time History

Tuesday 4 August to Wednesday 5 August 2015



Graph 6965/G2





8 Mulberry Close, Camden, London

Site Plan detailing measurement position and roof plant

Figure 6965/SP1

Not to Scale



Microphone on pole

Microphone on pole

Heat pump attached to the wall



Heat pump on anti-vibrational brackets



8 Mulberry Close, Camden, London

More detailed site plan of measurement position

Figure 6965/SP2

Not to Scale

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