FRANCO MANCA BRIGHTON

Plant Noise Assessment

REPORT 6815/PNA
Prepared: 21 September 2015
Revision Number: 0

StuART Consultancy Ltd.
7 The Workshops
Pulloxhill Business Park
Greenfield Road
Pulloxhill
MK45 5BF

Plant Noise Assessment

FRANCO MANCA
BRIGHTON

REPORT 6815/PNA
Prepared: 21 September 2015

Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	22 May 2015	Guillermo Alfaro	Torben Andersen
1	Revised following EHO comments	21 September 2015	Paul Taylor	Torben Andersen

Terms of contract:

RBA Acoustics Ltd has prepared this report in accordance with our Scope of Works 6815/PT dated 7 May 2015. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

In line with our Environmental Policy, up to two hard copies of the report will be provided upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.

RBA ACOUSTICS
44 Borough Road
London SE1 0AJ
T. +44 (0) 20 7620 1950
W. www.rba-acoustics.co.uk

Contents

1.0 QUALIFICATIONS AND EXPERIENCE

This report was originally prepared by Guillermo Alfaro (AMIOA), who no longer works at RBA Acoustics Ltd., but did have sufficient knowledge in noise measurements and plant noise prediction to prepare a report of this nature.

The original draft report was review by Torben Andersen, Director of RBA Acoustics Ltd. for over 12 years, who has extensive knowledge and experience in predicting and assessing plant noise emissions. Torben Andersen has been a Member of the Institute of Acoustics (MIOA) for X years and has been producing comparable reports for X years.

Following feedback from Scott Castle, Senior Environmental Health Officer for Brighton and Hove Council and following the departure of Guillermo Alfaro, Paul Taylor (MIOA) has prepared Revision 1 of this report, who has extensive experience in plant noise assessments and has y prepared reports for similar restaurants now successfully operating.

Based on the above, this report has been prepared and reviewed by people with sufficient knowledge and expertise in the appropriate fields.

2.0 INTRODUCTION

In order to support the planning application for the location of new mechanical services units at the proposed Franco Manca restaurant at Church Street, Brighton, consideration has been given to atmospheric noise emissions from the proposed equipment at the nearest noise sensitive property.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with Brighton & Hove City Council's requirements. This report presents the results of the noise measurements and associated criteria.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 General

Unattended monitoring of the prevailing background noise was undertaken by Guillermo Alfaro of RBA Acoustics between 12:00 hours on Wednesday 13 May and 12:00 hours on Thursday 14 May 2015. Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration. The reported measurements are based on a fast meter response.

Weather Conditions

During the survey period strong winds and rains occurred on occasions during the morning of Thursday 14 May 2015. The affected measurement periods have been filtered from our assessment. Outside of these occurrences the weather conditions were considered as being appropriate for the noise measurement exercise.

Weather conditions representative of those at the measurement location are provided in Appendix C. The measurement data relates to a weather monitoring station in Norfolk Square which is approximately 1km from the noise measurement location.

3.2 Measurement Location

Measurements were undertaken with the microphone mounted on a tripod at the first floor flat roof of the existing building. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the proposed plant. During the daytime period the prevailing noise climate was noted to mainly consist of screened traffic noise from the nearby roads. The surrounding area to the site was noted to be particularly busy during the night-time period due to the entertainment venues and drinking establishments located nearby.

The measurement location is not considered to be subject to façade reflection effects.

The measurement position is illustrated on the attached Site Plan 6815/SP1 and Photograph 6815/P1. The mechanical plant located close to the measurement position in the attached Photograph 6815/P1 was not operational during the survey.

3.3 Instrumentation

The following equipment was used for the measurements.

Table 6815/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Calibration Due
01dB A&V Type 1 Sound Level Meter	Blue Solo 01	60611	02003/2	26 September 2016
01dB A&V Pre Amplifier	PRE 21 S	13678		
01dB A&V ½" Microphone	MCE 212	84967		
01dB-Stell Calibrator	Cal 21	50441920	02003/1	26 September 2016

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

Calibration certificates for the equipment used during the survey are provided in Appendix D.

3.4 Measurement Notes

Between the hours of 23:45 and 00:00 an average noise level of 59dB $L_{Aeq,15minutes}$ occurred, which is 7-8dB above the measured average around this time. The sound level meter was set to capture audio during high noise level events. Between 23:45 and 00:00, a maximum noise level occurred due to a glass collection vehicle tipping glass.

Construction works were being undertaken close to the measurement location. Works would not have occurred beyond 18:00 hours and as such, night-time measurements would not be influenced by construction noise.

4.0 RESULTS

The noise levels at the measurement position are shown as time-histories on the attached Graphs 6815/G1 and G2. Raw measurement data is provided in Appendix B.

The graphs depict measurements undertaken between 12:30 hours on Wednesday 13 May and 11:15 hours on Thursday 14 May 2015. Measurements undertaken outside of these times have not been presented as they are affected by adverse weather conditions.

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

Table 6815/T2 – Measured Levels

Measurement Period	Minimum $L_{90,15min}$ (dBA)	Period Average L_{eq} (dBA)
Daytime (07:00 – 23:00)	45	58
Night-time (23:00 – 07:00)	40	50
Plant Operational Hours (08:00 - 00:30)	44	58

We understand the proposed opening hours of the restaurant are between 11:30 and 23:00 hours every day. In order to ensure a worst-case assessment, we have allowed for plant items to be run for three and a half hours before opening and an hour and a half after closure of the restaurant to allow for staff to complete preparation and other works before and after the restaurant opens and closes.

The minimum $L_{A90,15minute}$ period during plant operational hours (08:00 – 00:30) was measured between 00:15 and 00:30 on Thursday 14 May 2015.

5.0 CRITERIA

From previous experience with Brighton & Hove City Council's Environmental Health Department's standard criteria for plant noise emissions, we understand that any noise generated by new building services plant should be designed to a level 5dB below the lowest background $L_{A90\ 15\ minute}$ sample during operational hours, as measured or calculated 1m outside the nearest affected residential window, in line with the requirements of BS4142:2014.

With reference to the above and the noise levels referred to in Table 6815/T2, an overall plant noise emission limit of 39dBA should be designed to for the ventilation equipment operational hours at the most noise sensitive properties.

There are windows belonging to the commercial building belonging to 1 Jubilee Street overlooking the location of the future plant. In situations such as this it is common to design any plant to operate at a level less than 50-55dBA at the nearest window during office hours only, so as suitable internal noise levels in line with BS 8233 recommendations for commercial properties should be achieved. It is noted that windows belonging to 1 Jubilee Street overlooking the location of future plant, and as such we consider it appropriate to allow noise levels up to 55dBA outside of the office windows.

Additionally, there are rooflights to the rear of 100 Church Road serving offices, approximately 5m from proposed plant discharge/intake locations. As noted above, it is common to design any plant to operate at a level of less than 50-55dBA during office hours only to allow suitable internal noise levels in line with guidance from BS 8233 to be achieved. As these rooflights are openable we recommend that the restaurant plant noise levels are below 50dBA to allow appropriate internal office noise levels to be achieved, assuming a 15dB reduction is allowed for an open window.

A measurement interval period of 15 minutes has been used a basis to derive the criteria outlined above. Although BS4142:2014 provides guidance interval periods of 15 minutes during daytime hours (07:00 – 23:00) and 1 hour during night-time periods (23:00 – 07:00), the use of 15 minute intervals during the night-time period ensures that minimum background noise levels are used as a comparison, since it is likely that the minimum $L_{A90,15minute}$ period will be lower than the minimum $L_{A90,1hour}$ period.

5.1 Low Frequency Noise Criteria

Low frequency noise from mechanical plant items e.g. continuous humming can be particularly disturbing to existing residents. In order to ensure low frequency noise from the proposed plant installation is not problematic, we propose introducing low frequency noise criteria to be achieved at the most noise sensitive residential locations.

We propose that low frequency octave-band noise levels (63Hz to 250Hz) are no higher than existing measured low frequency background noise levels, as indicated in Table 6815/T3.

Table 6815/T3 – Low Frequency Noise Criteria

Measurement Period	Minimum Measured Octave-band $L_{90,15minutes}$ at Octave-band Centre Frequencies (Hz)		
	63	125	250
Plant Operational Hours (08:00 - 00:30)	53	50	43

Achievement of the above criteria will minimise the risk of disturbance to local residents due to operation of the plant.

6.0 ASSESSMENT

Our assessment has been based upon the following information:

6.1 Proposed Plant Items

Air Conditioning Plant

The air conditioning plant is located at ground floor level within a yard at the rear of the property, indicated in Site Plan 6815/SP2. The following air conditioning items are proposed to be installed on the flat roof plant area:

- 2No. Toshiba RAV-SM1404ATP-E AC Condensing Units (CU1-CU2)

Ventilation Plant

Ground Floor

- 1No. Systemair Circular Duct Fan K250L (EF1)
- 1No. Systemair K100XL Circular Duct Fan (EF2)
- 1No. Systemair K315M Circular Duct Fan (SF1)

First Floor

- 1No. Systemair Circular Duct Fan K250L (EF3)
- 2No. Systemair Circular Duct Fan K150XL (EF4-5)
- 1No. Systemair K100XL Circular Duct Fan (EF6)

Flat Roof

The pizza oven extract ductwork discharges at roof level:

- 1No. Smoki 250 oven extract system (EF7)

No other noise generating mechanical plant items are proposed. No plant is proposed to operate outside of the times between 08:00 and 00:30.

The location of the ventilation plant items is shown in the attached Site Plans 6815/SP2, 6815/SP3 and 6815/SP4.

6.2 Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturer of the units. The octave band sound levels are detailed as follows:

Table 6815/T4 – Manufacturer's Noise Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Toshiba RAV-SM1404ATP-E (CU1,CU2)	L_p at 1m (inc. ground reflections)	58	59	56	53	50	46	41	32
Systemair Circular Duct Fan K250L (EF1, EF3)	In-duct L_w (Outlet)	81	79	78	68	67	64	55	49
Systemair Circular Duct Fan K100XL (EF2,EF6)	In-duct L_w (Outlet)	84	81	78	67	63	59	50	40
Systemair Circular Duct Fan K150XL (EF4, EF5)	In-duct L_w (Outlet)	72	81	81	72	67	61	55	44
Systemair Circular Duct Fan K315M EC (SF1)	In-duct L_w (Inlet)	76	65	74	72	67	62	57	57
Smoki/ 250 Extract System (EF7)	L_p at 4m, 90° from centre axis	<46dBA*^							

*Measured noise levels have been obtained in-situ at a similar installation and are background limited. Due to the levels being background limited only the overall noise level is presented in Table 6815/T4. Octave-band noise data has been used within our calculations, based on these background limited measurements. The equipment was understood to be operating at maximum capacity during the measurements. If required, further measurement information pertaining to these measurements can be made available.
^Duct breakout noise levels were not audible 1m away from the similarly installed duct.

The above noise levels reflect the noise levels generated with the equipment running at the anticipated duties.

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

6.3 Location of Nearest Windows

1 Jubilee Street

Windows belonging to the offices at 1 Jubilee Street are approximately 10m from the eastern façade discharge locations at ground and first floor levels. However, it is noted that the windows on the western façade of 1 Jubilee Street are not openable. Noise levels of below 55dBA at these windows are considered to be sufficiently low to ensure noise will not be audible within the offices.

3A Regent Street

The property at 3A Regent Street has east facing windows approximately 15m from fan discharge locations on the eastern façade of restaurant building. We have therefore assessed noise transfer from plant items discharging on the eastern wall to this receptor location.

100 Church Road

Rooflights belonging to the offices at the rear of 100 Church Road are approximately 5m from 1st floor discharge locations on the western façade of the restaurant building. We have therefore assessed noise levels from plant items discharging on the western façade at this receptor location. Due to these windows serving an office, we consider it appropriate to ensure noise levels are below 50dB L_{Aeq} at the window, which, based on a level difference of 15dB offered by the window, would result in noise levels of 35dB L_{Aeq} within the office space.

Rear Windows of Properties along Gardner Street

Residential windows belonging to the properties along Gardner Street are approximately 12m from the proposed plant discharge and condenser locations on the west side of the proposed restaurant premises. Noise from these plant items has been assessed at this receptor location.

These windows are indicated on Site Plan 6815/SP2.

6.4 Mitigation Measures

In order to achieve the target criteria at the nearest noise sensitive windows, in-line attenuators will be required to be installed on various extract and intake systems on the atmospheric side of the fans. The required insertion losses for each relevant system are provided in Table 6815/T5.

Table 6815/T5 – Required Attenuator Insertion Losses

Unit	Typical Attenuator Specification	Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
EF1 Systemair Circular Duct Fan K250L	50% free area, 600mm long	1	2	7	10	11	9	8	7
EF2 Systemair Circular Duct Fan K100XL	50% free area, 600mm long	1	2	7	10	11	9	8	7
EF3 Systemair Circular Duct Fan K250L	50% free area, 600mm long	1	2	7	10	11	9	8	7
EF4 Systemair Circular Duct Fan K150XL	35% free area, 600mm long	3	6	10	14	20	19	14	13
EF5 Systemair Circular Duct Fan K150XL	35% free area, 600mm long	3	6	10	14	20	19	14	13
EF6 Systemair Circular Duct Fan K100XL	50% free area, 600mm long	1	2	7	10	11	9	8	7
SF1 Systemair Circular Duct Fan K315M EC	35% free area, 600mm long	3	6	10	14	20	19	14	13

In order to reduce the risk of regenerated noise, the attenuators should have the necessary cross sectional area to ensure the pressure drop across the attenuator is below 50Pa.

6.5 Calculation of Noise Levels at Nearest Windows

Our calculation method for predicting noise levels from the proposed plant at the nearest sensitive windows, based on the information stated above, is summarised below.

- Source term (L_p / L_w)
- Applicable distance attenuation
- Directivity of source
- Duct losses (for ducted system only)
- Reflections
- Mitigation measures

Example calculation sheets are attached for further information in Appendix B.

The results of the calculations indicate the following noise levels at the window worst-affected windows:

Table 6815/T5 – Predicted Noise Levels

Operating Period	Predicted Noise Level at Receptor Location (dBA)	Criterion (dBA)	Achieves Criterion?
1 Jubilee Street	42	55	Yes
3ARegent Street	34	39	Yes
100 Church Road	47	50	Yes
Rear of properties along Gardner Street	39	39	Yes

Noise levels from the proposed plant items are below the target criteria at the nearest noise sensitive windows, provided that mitigation measures meeting the requirements in Section 6.4 are installed.

We therefore consider the proposed plant proposals to be compliant Brighton & Hove's plant noise requirements.

6.6 Calculation of Low Frequency Noise

Based on the calculation procedures outlined in Section 6.5, we predict the following low frequency noise levels at the nearest residential receptors

Table 6815/T5 – Predicted Low Frequency Noise Levels

Measurement Period	Minimum Measured Octave-band $L_{90,15minutes}$ at Octave-band Centre Frequencies (Hz)		
	63	125	250
Criteria	53	50	43
3A Regents Street	39	41	39
Rear of properties along Gardner Street	46	45	42

As indicated above, low frequency noise generated by proposed plant items as predicted at the nearest residential receptors will be below existing low frequency noise levels and as such should be considered acceptable.

7.0 NOISE BREAKOUT

Based on previous experience of noise levels within restaurants of a similar size and operation we predict that internal noise levels during a typical busy period will be approximately 75- 80dBA.

At this level we do not consider noise breakout via the external walls to give rise to audible noise levels externally.

The main source of noise breakout is likely to be the front entrance door to be located on Church Street. It should be noted that Church Street is a generally busy road with traffic regularly passing giving rise to transient maximum noise levels.

The nearest noise sensitive residential properties to the entrance door are located approximately 20m along Regent Street.

These properties are afforded significant screening from the front door by the building envelope.

Based on a level difference of 15dB provided by an open door, noise levels immediately outside of the restaurant are likely to be 60-65dBA when the door is open.

Given the distance to the receptor locations and the amount of screening provided by the building, noise levels at the receptor locations whilst the entrance door is open are likely to be approximately 25-30dBA, based on the above assumptions.

7.1 World Health Organisation: Guidelines for Community Noise

The document describes guideline levels that are "essentially values for the onset of health effects from noise exposure".

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure.

The following is an extract from Table 4.1: Guideline values for community noise in specific environments, as stated in the document.

Table 6815/T6 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

7.2 Discussion

As outlined in Table 6815/T6, the anticipated temporary noise levels of below 45-50dBA are below the noise levels considered as moderately annoying during the daytime and evening by WHO, and are below external maximum noise levels considered to give rise to sleep disturbance assuming an open window.

On this basis, we do not consider noise breakout from the proposed restaurant to be problematic, considering the locality and existence of other public houses and similar establishments in the surrounding areas.

8.0 DISCUSSION OF UNCERTAINTY

The following items of uncertainty or certainty have been identified, which provide an indication in the level of confidence in the measurement procedure, predictions and assessment.

Measurement Procedure

- Weather conditions were ideal for undertaking noise measurements during the minimum background level period, providing confidence in the background noise level.
- The background $L_{A90,15minutes}$ noise level was stable when the minimum period occurred, providing confidence in the background noise level.
- The distance and level of screening from Church Road to the measurement location and receptor locations is similar, reducing uncertainty of differing background noise levels at each receptor.

Based on the above, uncertainty of the measurement does not have any significant impact on the outcome of the assessment.

Predictions

- The operating times of all associated plant items are known, which reduces uncertainty relating to duration of operation.

Based on the above, uncertainty of the predictions does not have any significant impact on the outcome of the assessment.

9.0 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 plant be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

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 plant and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

The chimney flue should be fixed back at each floor level rather than at a mid-span point in the wall.

10.0 CONCLUSION

Measurements of the existing background noise levels at the proposed Franco Manca, Brighton have been undertaken. The results of the measurements have been used in order to predict noise emission limits from the proposed plant items to the nearest sensitive receptors in accordance with the Local Authority's criteria.

Based on the mitigation measures outlined being adopted, the criteria levels will be achieved.

Furthermore, consideration has been given to noise breakout levels from the proposed restaurant. We do not consider that noise breakout from restaurant operation will be problematic to nearby residents, based on WHO guideline noise levels.

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

Date	Time (HH:MM:SS)	$L_{Aeq,15minutes}$ (dB)	$L_{A90,15minutes}$ (dB)	$L_{Amax,f}$ (dB)
13/05/2015	12:30:00	53	50	68
13/05/2015	12:45:00	58	50	84
13/05/2015	13:00:00	61	50	84
13/05/2015	13:15:00	54	50	72
13/05/2015	13:30:00	54	50	73
13/05/2015	13:45:00	56	50	74
13/05/2015	14:00:00	55	50	74
13/05/2015	14:15:00	57	52	77
13/05/2015	14:30:00	63	52	85
13/05/2015	14:45:00	59	51	79
13/05/2015	15:00:00	59	51	83
13/05/2015	15:15:00	58	50	78
13/05/2015	15:30:00	58	50	87
13/05/2015	15:45:00	58	50	82
13/05/2015	16:00:00	58	51	83
13/05/2015	16:15:00	57	50	80
13/05/2015	16:30:00	58	49	81
13/05/2015	16:45:00	53	48	71
13/05/2015	17:00:00	52	49	64
13/05/2015	17:15:00	52	48	68
13/05/2015	17:30:00	52	48	65
13/05/2015	17:45:00	52	48	62
13/05/2015	18:00:00	53	48	76
13/05/2015	18:15:00	52	48	66
13/05/2015	18:30:00	53	48	79
13/05/2015	18:45:00	53	48	73
13/05/2015	19:00:00	51	48	64
13/05/2015	19:15:00	51	48	61
13/05/2015	19:30:00	51	48	63
13/05/2015	19:45:00	51	49	59
13/05/2015	20:00:00	59	53	81
13/05/2015	20:15:00	61	56	85
13/05/2015	20:30:00	65	58	88
13/05/2015	20:45:00	60	57	70
13/05/2015	21:00:00	60	57	72
13/05/2015	21:15:00	62	58	87
13/05/2015	21:30:00	61	57	76
13/05/2015	21:45:00	60	56	70
13/05/2015	22:00:00	60	55	79
13/05/2015	22:15:00	60	56	71
13/05/2015	22:30:00	61	55	87
13/05/2015	22:45:00	57	54	76
13/05/2015	23:00:00	55	52	67
13/05/2015	23:15:00	53	50	68
13/05/2015	23:30:00	52	49	65
13/05/2015	23:45:00	59	47	90
14/05/2015	00:00:00	49	44	70
14/05/2015	00:15:00	49	44	80
14/05/2015	00:30:00	47	44	60
14/05/2015	00:45:00	47	43	63

14/05/2015	01:00:00	47	42	65
14/05/2015	01:15:00	47	42	65
14/05/2015	01:30:00	45	41	62
14/05/2015	01:45:00	44	40	67
14/05/2015	02:00:00	44	40	61
14/05/2015	02:15:00	43	40	60
14/05/2015	02:30:00	42	40	59
14/05/2015	02:45:00	43	40	62
14/05/2015	03:00:00	45	40	62
14/05/2015	03:15:00	43	40	56
14/05/2015	03:30:00	44	40	57
14/05/2015	03:45:00	42	40	56
14/05/2015	04:00:00	43	40	61
14/05/2015	04:15:00	46	41	70
14/05/2015	04:30:00	47	40	66
14/05/2015	04:45:00	44	41	63
14/05/2015	05:00:00	49	41	67
14/05/2015	05:15:00	53	43	72
14/05/2015	05:30:00	54	42	76
14/05/2015	05:45:00	52	43	71
14/05/2015	06:00:00	49	43	65
14/05/2015	06:15:00	53	44	71
14/05/2015	06:30:00	52	44	73
14/05/2015	06:45:00	53	45	69
14/05/2015	07:00:00	51	45	66
14/05/2015	07:15:00	51	45	66
14/05/2015	07:30:00	52	46	67
14/05/2015	07:45:00	53	48	76
14/05/2015	08:00:00	57	49	79
14/05/2015	08:15:00	55	50	73
14/05/2015	08:30:00	57	52	75
14/05/2015	08:45:00	57	52	74
14/05/2015	09:00:00	55	50	71
14/05/2015	09:15:00	55	51	74
14/05/2015	09:30:00	60	52	84
14/05/2015	09:45:00	60	52	82
14/05/2015	10:00:00	59	51	80
14/05/2015	10:15:00	56	51	76
14/05/2015	10:30:00	54	50	70
14/05/2015	10:45:00	54	50	66
14/05/2015	11:00:00	54	51	69
14/05/2015	11:15:00	55	51	73

APPENDIX C – WEATHER DATA

13 May 2015

Time	Temp.	Humidity	Pressure	Wind Dir	Wind Speed	Gust Speed	Conditions
12:00 AM	**8** °C	91%	**1023** hPa	NNW	**1.9** km/h /		
1:00 AM	**7** °C	92%	**1023** hPa	North	**5.6** km/h /		
2:00 AM	**7** °C	83%	**1023** hPa	West	**5.6** km/h /		
3:00 AM	**5** °C	90%	**1022** hPa	ENE	**1.9** km/h /		
4:00 AM	**6** °C	79%	**1022** hPa	North	**13.0** km/h /		
5:00 AM	**6** °C	79%	**1022** hPa	North	**13.0** km/h /		
6:00 AM	**6** °C	81%	**1022** hPa	North	**14.8** km/h /		
7:00 AM	**8** °C	74%	**1022** hPa	North	**9.3** km/h /		
7:50 AM	**10.0** °C	76%	**1021** hPa	North	**9.3** km/h / **2.6** m/s		Clear
8:00 AM	**10** °C	69%	**1021** hPa	North	**9.3** km/h /		
8:20 AM	**11.0** °C	76%	**1021** hPa	North	**5.6** km/h / **1.5** m/s		Clear
8:50 AM	**13.0** °C	67%	**1020** hPa	Calm	Calm		Clear
9:00 AM	**12** °C	58%	**1021** hPa	SE	**5.6** km/h /		
9:20 AM	**13.0** °C	67%	**1020** hPa	SSE	**9.3** km/h / **2.6** m/s		Clear
9:50 AM	**13.0** °C	67%	**1020** hPa	SE	**9.3** km/h / **2.6** m/s		Partly Cloudy
10:00 AM	**13** °C	56%	**1020** hPa	SSE	**9.3** km/h /		
10:20 AM	**13.0** °C	72%	**1020** hPa	SSE	**9.3** km/h / **2.6** m/s		Partly Cloudy
10:50 AM	**13.0** °C	63%	**1020** hPa	South	**11.1** km/h / **3.1** m/s		Partly Cloudy
11:00 AM	**13** °C	55%	**1020** hPa	South	**11.1** km/h /		
11:20 AM	**14.0** °C	59%	**1019** hPa	South	**9.3** km/h / **2.6** m/s		Partly Cloudy
11:50 AM	**14.0** °C	63%	**1019** hPa	South	**13.0** km/h / **3.6** m/s		Partly Cloudy
12:00 PM	**14** °C	55%	**1020** hPa	South	**13.0** km/h /		
12:20 PM	**14.0** °C	59%	**1019** hPa	South	**11.1** km/h / **3.1** m/s		Partly Cloudy
12:50 PM	**15.0** °C	55%	**1018** hPa	South	**11.1** km/h / **3.1** m/s		Partly Cloudy
1:00 PM	**15** °C	44%	**1018** hPa	South	**11.1** km/h /		
1:20 PM	**15.0** °C	55%	**1018** hPa	SSE	**11.1** km/h / **3.1** m/s		Partly Cloudy
1:50 PM	**15.0** °C	55%	**1017** hPa	SSE	**13.0** km/h / **3.6** m/s		Partly Cloudy
2:00 PM	**14** °C	47%	**1018** hPa	SSE	**13.0** km/h /		
2:20 PM	**14.0** °C	59%	**1017** hPa	South	**13.0** km/h / **3.6** m/s		Partly Cloudy
2:50 PM	**14.0** °C	67%	**1017** hPa	SSE	**14.8** km/h / **4.1** m/s		Partly Cloudy
3:00 PM	**15** °C	58%	**1018** hPa	South	**14.8** km/h /		
3:20 PM	**13.0** °C	72%	**1017** hPa	South	**13.0** km/h / **3.6** m/s		Clear
3:50 PM	**14.0** °C	72%	**1017** hPa	South	**13.0** km/h / **3.6** m/s		Clear
4:20 PM	**14.0** °C	67%	**1017** hPa	South	**11.1** km/h / **3.1** m/s		Clear
4:50 PM	**14.0** °C	67%	**1017** hPa	South	**9.3** km/h / **2.6** m/s		Clear
5:00 PM	**14** °C	61%	**1017** hPa	South	**9.3** km/h /		
5:20 PM	**13.0** °C	72%	**1016** hPa	South	**9.3** km/h / **2.6** m/s		Clear
5:50 PM	**14.0** °C	63%	**1016** hPa	South	**7.4** km/h / **2.1** m/s		Clear
6:20 PM	**15.0** °C	59%	**1016** hPa	South	**5.6** km/h / **1.5** m/s		Clear
6:50 PM	**13.0** °C	63%	**1016** hPa	SSE	**5.6** km/h / **1.5** m/s		Clear
7:00 PM	**13** °C	53%	**1016** hPa	South	**3.7** km/h /		
7:20 PM	**14.0** °C	55%	**1016** hPa	ESE	**3.7** km/h / **1.0** m/s		Clear
7:50 PM	**13.0** °C	63%	**1016** hPa	SSE	**1.9** km/h / **0.5** m/s		Clear
8:00 PM	**13** °C	55%	**1016** hPa	SSW	**1.9** km/h /		
8:20 PM	**13.0** °C	58%	**1016** hPa	SSE	**3.7** km/h / **1.0** m/s		Clear
8:50 PM	**11.0** °C	71%	**1016** hPa	NE	**3.7** km/h / **1.0** m/s		Clear
9:00 PM	**11** °C	64%	**1016** hPa	NNE	**3.7** km/h /		
10:00 PM	**8** °C	77%	**1016** hPa	North	**1.9** km/h /		
11:00 PM	**8** °C	84%	**1016** hPa	North	**5.6** km/h /		

14 May 2015

Time	Temp.	Humidity	Pressure	Wind Dir	Wind Speed	Gust Speed	Conditions
12:00 AM	**8** °C	80%	**1016** hPa	NE	**7.4** km/h /	-	
1:00 AM	**9** °C	72%	**1016** hPa	ENE	**9.3** km/h /	-	
2:00 AM	**9** °C	76%	**1016** hPa	East	**13.0** km/h /	-	
3:00 AM	**9** °C	74%	**1015** hPa	East	**16.7** km/h /	-	
4:00 AM	**10** °C	74%	**1015** hPa	East	**16.7** km/h /	-	
5:00 AM	**10** °C	76%	**1014** hPa	East	**16.7** km/h /	-	
6:00 AM	**10** °C	85%	**1013** hPa	East	**18.5** km/h /	-	
7:00 AM	**10** °C	81%	**1013** hPa	East	**20.4** km/h /	-	
7:50 AM	**10.0** °C	82%	**1012** hPa	East	**20.4** km/h / **5.7** m/s	-	Mostly Cloudy
8:00 AM	**10** °C	77%	**1012** hPa	East	**20.4** km/h /	-	
8:20 AM	**11.0** °C	76%	**1012** hPa	East	**20.4** km/h / **5.7** m/s	-	Mostly Cloudy
8:50 AM	**11.0** °C	76%	**1011** hPa	East	**22.2** km/h / **6.2** m/s	-	Mostly Cloudy
9:00 AM	**10** °C	68%	**1011** hPa	East	**20.4** km/h /	-	
9:20 AM	**11.0** °C	71%	**1011** hPa	East	**24.1** km/h / **6.7** m/s	-	Mostly Cloudy
10:00 AM	**10** °C	69%	**1011** hPa	East	**24.1** km/h /	-	
10:20 AM	**10.0** °C	87%	**1010** hPa	East	**27.8** km/h / **7.7** m/s	-	Light Drizzle
10:50 AM	**10.0** °C	87%	**1009** hPa	East	**25.9** km/h / **7.2** m/s	-	Light Drizzle
11:00 AM	**10** °C	82%	**1010** hPa	East	**27.8** km/h /	-	
11:20 AM	**10.0** °C	87%	**1009** hPa	East	**25.9** km/h / **7.2** m/s	-	Rain
11:50 AM	**10.0** °C	94%	**1008** hPa	East	**25.9** km/h / **7.2** m/s	-	Rain
12:00 PM	**10** °C	92%	**1009** hPa	East	**27.8** km/h /	-	
12:20 PM	**10.0** °C	94%	**1008** hPa	East	**29.6** km/h / **8.2** m/s	-	Rain
12:50 PM	**10.0** °C	94%	**1008** hPa	ESE	**24.1** km/h / **6.7** m/s	**42.6** km/h / **11.8** m/s	Rain
1:00 PM	**10** °C	90%	**1008** hPa	ESE	**25.9** km/h /	-	
1:20 PM	**10.0** °C	94%	**1008** hPa	East	**27.8** km/h / **7.7** m/s	-	Rain
1:50 PM	**11.0** °C	88%	**1008** hPa	East	**24.1** km/h / **6.7** m/s	-	Rain
2:00 PM	**10** °C	90%	**1008** hPa	East	**25.9** km/h /	-	
2:20 PM	**10.0** °C	94%	**1008** hPa	West	**29.6** km/h / **8.2** m/s	**48.2** km/h / **13.4** m/s	Rain
2:50 PM	**10.0** °C	87%	**1008** hPa	NNW	**20.4** km/h / **5.7** m/s	-	Light Drizzle
3:00 PM	**10** °C	87%	**1008** hPa	NNW	**16.7** km/h /	-	
3:20 PM	**11.0** °C	88%	**1009** hPa	WNW	**13.0** km/h / **3.6** m/s	-	Light Rain
3:50 PM	**11.0** °C	88%	**1009** hPa	West	**7.4** km/h / **2.1** m/s	-	Light Rain
4:00 PM	**11** °C	89%	**1009** hPa	WSW	**7.4** km/h /	-	
4:20 PM	**10.0** °C	94%	**1009** hPa	WSW	**13.0** km/h / **3.6** m/s	-	Light Rain
4:50 PM	**10.0** °C	94%	**1009** hPa	WSW	**14.8** km/h / **4.1** m/s	-	Light Rain
5:00 PM	**10** °C	89%	**1010** hPa	WSW	**16.7** km/h /	-	
5:20 PM	**10.0** °C	94%	**1010** hPa	SW	**16.7** km/h / **4.6** m/s	-	Mostly Cloudy
5:50 PM	**10.0** °C	100%	**1010** hPa	WSW	**13.0** km/h / **3.6** m/s	-	Light Rain
6:00 PM	**10** °C	91%	**1010** hPa	WSW	**13.0** km/h /	-	
6:20 PM	**10.0** °C	94%	**1010** hPa	West	**13.0** km/h / **3.6** m/s	-	Scattered Clouds
6:50 PM	**10.0** °C	94%	**1010** hPa	West	**11.1** km/h / **3.1** m/s	-	Light Rain
7:00 PM	**10** °C	94%	**1010** hPa	West	**13.0** km/h /	-	
7:20 PM	**10.0** °C	94%	**1010** hPa	WSW	**16.7** km/h / **4.6** m/s	-	Scattered Clouds
7:50 PM	**10.0** °C	94%	**1011** hPa	West	**14.8** km/h / **4.1** m/s	-	Scattered Clouds
8:00 PM	**10** °C	91%	**1011** hPa	West	**14.8** km/h /	-	
9:00 PM	**9** °C	92%	**1012** hPa	North	**7.4** km/h /	-	
10:00 PM	**9** °C	96%	**1013** hPa	NW	**5.6** km/h /	-	
11:00 PM	**10** °C	97%	**1013** hPa	North	**13.0** km/h /	-	

APPENDIX D –CALIBRATION CERTIFICATES

Certificate of Calibration Issued by University of Salford (Acoustics Calibration Laboratory) UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801	UKAS CALIBRATION 0801
Page 1 of 2	
APPROVED SIGNATORIES Claire Lomax [✓] Andy Moorhouse [ ] Gary Phillips [ ] Danny McCaul [ ]	
acoustic calibration laboratory [illegible] [illegible] [illegible]	University of Salford MANCHESTER

Certificate Number: 02003/1 **Date of Issue: 26 September 2014**

CALIBRATION OF A SOUND CALIBRATOR

FOR:	RBA Acoustics 44 Borough Road LONDON SE1 0AJ
FOR THE ATTENTION OF:	Ignacio Alonso-Martinez
DESCRIPTION:	Calibrator with housing for one-inch microphones and adaptor type BAC 21 for half-inch microphones.
MANUFACTURER:	01 dB
TYPE:	CAL 21
SERIAL NUMBER:	50441920 (2004)
DATE OF CALIBRATION:	26/09/2014
TEST PROCEDURE:	CTP06 (Laboratory Manual)

Test Engineer (initial): .... Name: Gary Phillips

Calibrations marked 'Not UKAS Accredited' in this certificate have been included for completeness.

Certificate Number: 02003/1 Date of Issue: 26 September 2014

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in the certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The manufacturer states that automatic compensation is applied for the effects of changes in atmospheric pressure.

RESULTS

Coupler configuration:	Half-inch
Microphone type:	GRAS 40AG
Output level (dB re 20μPa):	94.05 dB ± 0.11 dB
Frequency (Hz):	1001.02 Hz ± 0.12 Hz
Total Harmonic Distortion (%):	1.50 % ± 0.16 % (Not UKAS Accredited)

Average environmental conditions at the time of measurement and maximum deviation from the stated average:

Pressure:	101.503 kPa ± 0.003 kPa
Temperature:	22.6 °C ± 0.4 °C
Relative humidity:	54.0 % ± 1.0 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [✓] Andy Moorhouse [ ]
Gary Phillips [ ] Danny McCaul [ ]

acoustic calibration laboratory
[illegible]

UKAS CALIBRATION
0801

University of Salford MANCHESTER

Certificate Number: 02003/2 **Date of Issue: 26 September 2014**

VERIFICATION OF A TYPE 1 SOUND LEVEL METER to BS7580 Part 1

FOR:	RBA Acoustics 44 Borough Road LONDON SE1 0AJ
FOR THE ATTENTION OF:	Ignacio Alonso-Martinez
CALIBRATION DATE:	26/09/2014
TEST PROCEDURE:	CTP08 (Laboratory Manual)

Sound Level Meter							
Manu:	01dB	Model:	Solo	Serial No:	60611		
Microphone							
Manu:	01dB	Model:	MCE212	Serial No:	84967		
Preamp							
Manu:	01dB	Model:	PRE 21 S	Serial No:	13678		
Associated Calibrator							
Manu:	01 dB	Model:	CAL 21	Serial No:	50441920 (2004)	Adaptor:	BAC21

Test Engineer (initial): ____ Name: Gary Phillips

Certificate Number: 02003/2 Date of Issue: 26 September 2014

SET-UP INFORMATION

The instrument version was Master 01 V1.401. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 94.0 dB (A) in response to the associated calibrator. This reading was obtained from the calibration certificate of the calibrator, 02003/2 and information in the manufacturer's instruction manual. The instrument was calibrated without a windshield. Consult manufacturer's instructions if using a windshield.

MEASUREMENTS

The levels of self-generated noise were:

A:	**11.7 dB***
B:	**11.3 dB***
C:	**12.8 dB***
Z:	**16.7 dB***

*Under-range indicated on instrument display

At the end of the tests the indication of the sound level meter in response to the associated sound calibrator was 94.0 dB (A) which corresponds to the following level at 101.325 kPa:

Sound Pressure Level 94.0 dB (A)
This reading should be used henceforth to set up the sound level meter for field use.

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

The microphone corrections applied as specified in BS 7580: Part 1: 1997 were obtained from a frequency response measurement by this Laboratory using the electrostatic actuator method. The response in isolation is not covered by our UKAS accreditation.

A stricter test than that specified in 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low level signal.

STATEMENT OF RESULT:

THE SOUND LEVEL METER CONFORMS TO THE TYPE 1 REQUIREMENTS OF BS7580: PART1 1997

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1 kHz test whilst the tests at 125 Hz and 8 kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1 kHz calibrator was ±0.11 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

APPENDIX E – CALCULATIONS

Calculations are provided for illustrative purposes only and the values presented are subject to rounding, and have not have been rounded within the calculation procedure.

1 Jubilee Street

EF1

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K250L fan (Extract) Lw (dB)	81	79	78	68	67	64	55	49	
Duct / Silencer Losses	-14	-10	-11	-11	-11	-9	-8	-7	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 10m	-28	-28	-28	-28	-28	-28	-28	-28	Overall (dBA)
Noise Level at Receiver	**39**	**42**	**41**	**32**	**32**	**32**	**25**	**20**	**38**

EF3

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K250L fan (Extract) Lw (dB)	81	79	78	68	67	64	55	49	
Duct / Silencer Losses	-14	-10	-11	-11	-11	-9	-8	-7	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 10m	-28	-28	-28	-28	-28	-28	-28	-28	Overall (dBA)
Noise Level at Receiver	**39**	**42**	**41**	**32**	**32**	**32**	**25**	**20**	**38**

Overall Levels

Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
EF1	39	42	41	32	32	32	25	20	39
EF3	39	42	41	32	32	32	25	20	39
Overall Level	**42**	**45**	**44**	**35**	**35**	**35**	**28**	**23**	**42**

3A Regent Street

EF1

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K250L fan (Extract) Lw (dB)	81	79	78	68	67	64	55	49	
Duct / Silencer Losses	-14	-10	-11	-11	-11	-9	-8	-7	
Directivity Losses (90° horizontal, 0° vertical)	0	0	+0	+0	0	-4	-7	-7	
Distance Losses @ 15m	-32	-32	-32	-32	-32	-32	-32	-32	Overall (dBA)
Noise Level at Receiver	35	37	36	26	24	19	8	3	31

EF3

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K250L fan (Extract) Lw (dB)	81	79	78	68	67	64	55	49	
Duct / Silencer Losses	-14	-10	-11	-11	-11	-9	-8	-7	
Directivity Losses (90° horizontal, 0° vertical)	0	0	+0	+0	0	-4	-7	-7	
Distance Losses @ 15m	-32	-32	-32	-32	-32	-32	-32	-32	Overall (dBA)
Noise Level at Receiver	**35**	**37**	**36**	**26**	**24**	**19**	**8**	**3**	**31**

Overall Levels

Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
EF1	35	37	36	26	24	19	8	3	31
EF3	35	37	36	26	24	19	8	3	31
Overall Level	**39**	**41**	**39**	**29**	**28**	**23**	**12**	**7**	**34**

100 Church Road

EF2

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K100XL Lw (dB)	84	81	78	67	63	59	50	40	
Duct / Silencer Losses	-18	-15	-16	-16	-16	-14	-13	-12	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 5m	-22	-22	-22	-22	-22	-22	-22	-22	Overall (dBA)
Noise Level at Receiver	**44**	**45**	**42**	**32**	**29**	**28**	**21**	**12**	**37**

EF4

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K150XL Lw (dB)	72	81	81	72	67	61	55	44	
Duct / Silencer Losses	-21	-19	-19	-19	-21	-19	-14	-13	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 5m	-22	-22	-22	-22	-22	-22	-22	-22	Overall (dBA)
Noise Level at Receiver	**29**	**41**	**42**	**34**	**28**	**25**	**25**	**15**	**37**

EF6

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Turbo K150XL Lw (dB) Lw (dB)	72	81	81	72	67	61	55	44	
Duct / Silencer Losses	-19	-15	-16	-15	-12	-9	-8	-7	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 5m	-22	-22	-22	-22	-22	-22	-22	-22	Overall (dBA)
Noise Level at Receiver	**31**	**45**	**45**	**38**	**37**	**35**	**31**	**21**	**43**

EF7

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Smoki 250, 4m from flue (90°)	55	52	46	44	41	36	30	23	
Directivity	0	0	-3	-3	-4	-4	-5	-5	
Distance Losses @ 7m	-5	-5	-5	-5	-5	-5	-5	-5	Overall (dBA)
Noise Level at Receiver	**50**	**47**	**38**	**36**	**32**	**27**	**20**	**13**	**38**

EF8

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Circular Duct Fan K315 Lw (dB)	76	75	74	72	67	62	57	57	
Duct / Silencer Losses	-17	-14	-15	-16	-16	-14	-13	-12	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 5m	-22	-22	-22	-22	-22	-22	-22	-22	Overall (dBA)
Noise Level at Receiver	**37**	**40**	**39**	**37**	**33**	**31**	**28**	**29**	**39**

CU1/CU2

Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
Toshiba RAV-SM1404ATP-E SPL at 1m, inc ground reflections (CU1-2)	58	59	56	53	50	47	40	31	56
2 No. units	+3	+3	+3	+3	+3	+3	+3	+3	-
Distance loss over 5m	-14	-14	-14	-14	-14	-14	-14	-14	-
Directivity	-5	-5	-5	-5	-5	-5	-5	-5	
Screening	-5	-5	-5	-5	-5	-5	-5	-5	-5
Predicted Level At Receiver	**37**	**38**	**35**	**32**	**29**	**26**	**19**	**10**	**35**

Overall Levels

Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
EF2	44	45	42	32	29	28	21	12	37
EF4	32	44	45	37	31	28	28	18	40
EF5	32	44	45	37	31	28	28	18	40
EF6	31	45	45	38	37	35	31	21	43
EF7	50	47	37	36	32	27	20	13	38
SF1	37	40	39	37	33	31	28	29	40
CU1 + CU2	37	38	35	32	29	26	19	10	35
Overall Level	**51**	**52**	**50**	**44**	**41**	**38**	**35**	**30**	**47**

Rear windows of properties along Gardner Street

EF2

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Circular Duct Fan K100XLLw (dB)	84.2	81.1	77.6	67.2	63	58.8	50	40.1	
Duct / Silencer Losses	-24	-20	-21	-20	-17	-14	-13	-12	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 12m	-30	-30	-30	-30	-30	-30	-30	-30	Overall (dBA)
Noise Level at Receiver	**31**	**33**	**29**	**21**	**20**	**20**	**13**	**5**	**27**

EF4

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
-Systemair Circular Extract Duct Fan K150XL Lw (dB)	72	81	81	72	67	61	55	44	
Duct / Silencer Losses	-21	-19	-19	-19	-21	-19	-14	-13	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 12m	-30	-30	-30	-30	-30	-30	-30	-30	Overall (dBA)
Noise Level at Receiver	**21**	**33**	**34**	**26**	**20**	**17**	**17**	**7**	**29**

EF6

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Circular Duct Fan K150XL Lw (dB)	72	81	81	72	67	61	55	44	
Duct / Silencer Losses	-19	-15	-16	-15	-12	-9	-8	-7	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 12m	-30	-30	-30	-30	-30	-30	-30	-30	Overall (dBA)
Noise Level at Receiver	**23**	**37**	**37**	**30**	**29**	**27**	**23**	**13**	**35**

EF7

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Smoki 250, 4m from flue (90°)	55	52	46	44	41	36	30	23	
Directivity	0	0	-3	-3	-4	-4	-5	-5	
Distance Losses @ 12m	-10	-10	-10	-10	-10	-10	-10	-10	Overall (dBA)
Noise Level at Receiver	**45**	**42**	**34**	**32**	**27**	**23**	**15**	**8**	**34**

SF1

Unit	Octave-band Noise Levels								
	63	125	250	500	1000	2000	4000	8000	
Systemair Circular Duct Fan K315 Lw (dB)	76	75	74	72	67	62	57	57	
Duct / Silencer Losses	-19	-18	-18	-20	-25	-24	-19	-18	
Directivity Losses (0° horizontal, 0° vertical)	0	+1	+2	+3	+4	+5	+6	+6	
Distance Losses @ 12m	-30	-30	-30	-30	-30	-30	-30	-30	Overall (dBA)
Noise Level at Receiver	**28**	**29**	**28**	**26**	**16**	**13**	**14**	**16**	**26**

CU1/CU2

Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
Toshiba RAV-SM1404ATP-E SPL at 1m, inc ground reflections (CU1-2)	58	59	56	53	50	47	40	31	56
2 No. units	+3	+3	+3	+3	+3	+3	+3	+3	-
Distance loss over 12m	-22	-22	-22	-22	-22	-22	-22	-22	-
Directivity	-5	-5	-5	-5	-5	-5	-5	-5	
Screening	-5	-5	-5	-5	-5	-5	-5	-5	-5
Predicted Level At Receiver	**29**	**30**	**27**	**24**	**21**	**18**	**11**	**2**	**27**

Overall Levels

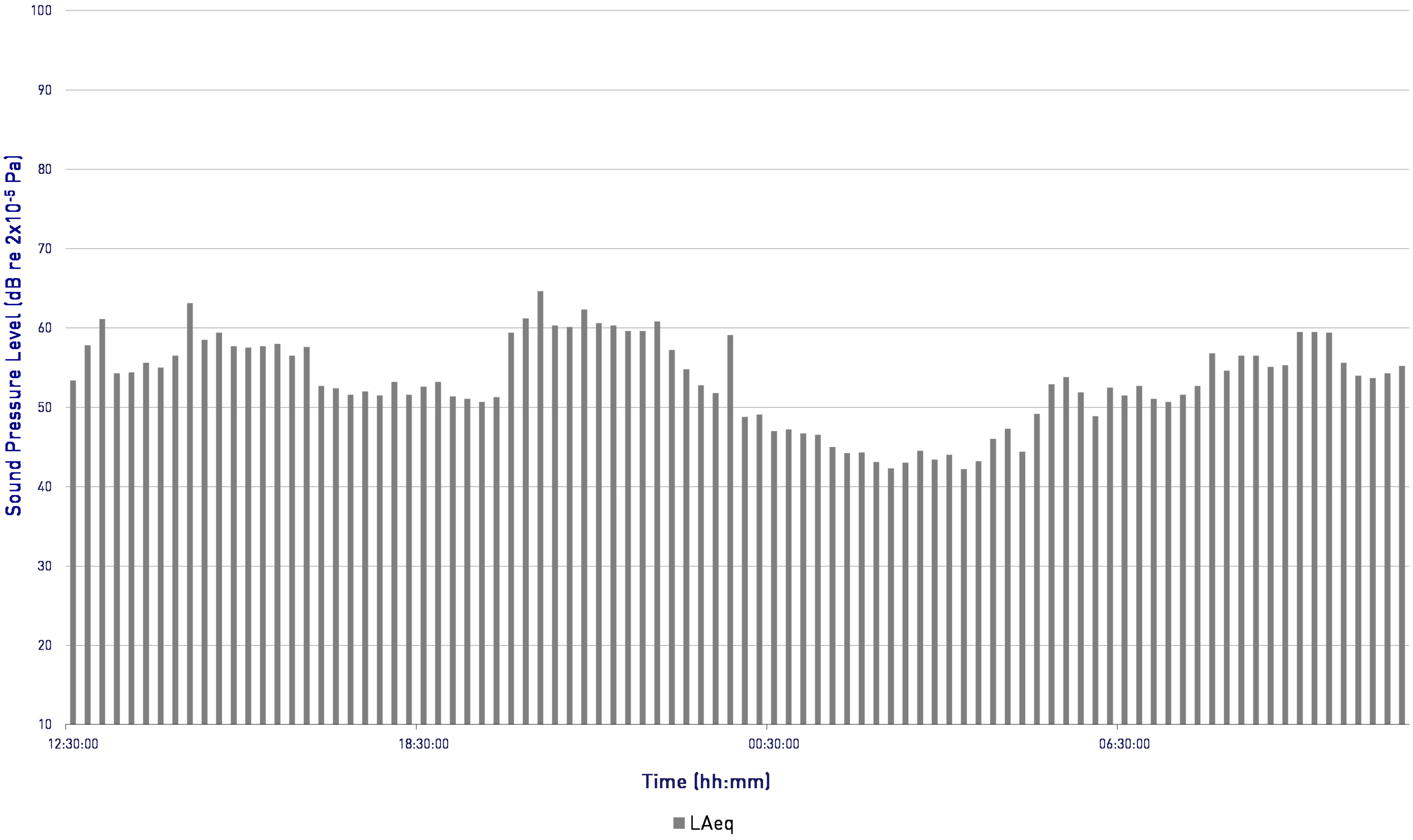
Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
EF2	31	33	29	21	20	20	13	5	27
EF4	21	33	34	26	20	17	17	7	30
EF5	21	33	34	26	20	17	17	7	30
EF6	36	38	34	26	25	25	18	10	32
EF7	45	42	34	32	27	23	15	8	34
SF1	28	29	28	26	16	13	14	16	26
CU1 + CU2	29	30	27	24	21	18	11	2	27
Overall Level	**45**	**45**	**42**	**36**	**33**	**30**	**26**	**19**	**39**

Franco Manca, Brighton

L_{Aeq} Time History

Measurement Position 1, Wednesday 13th May to Thursday 14th May 2014

Graph 6815/G1

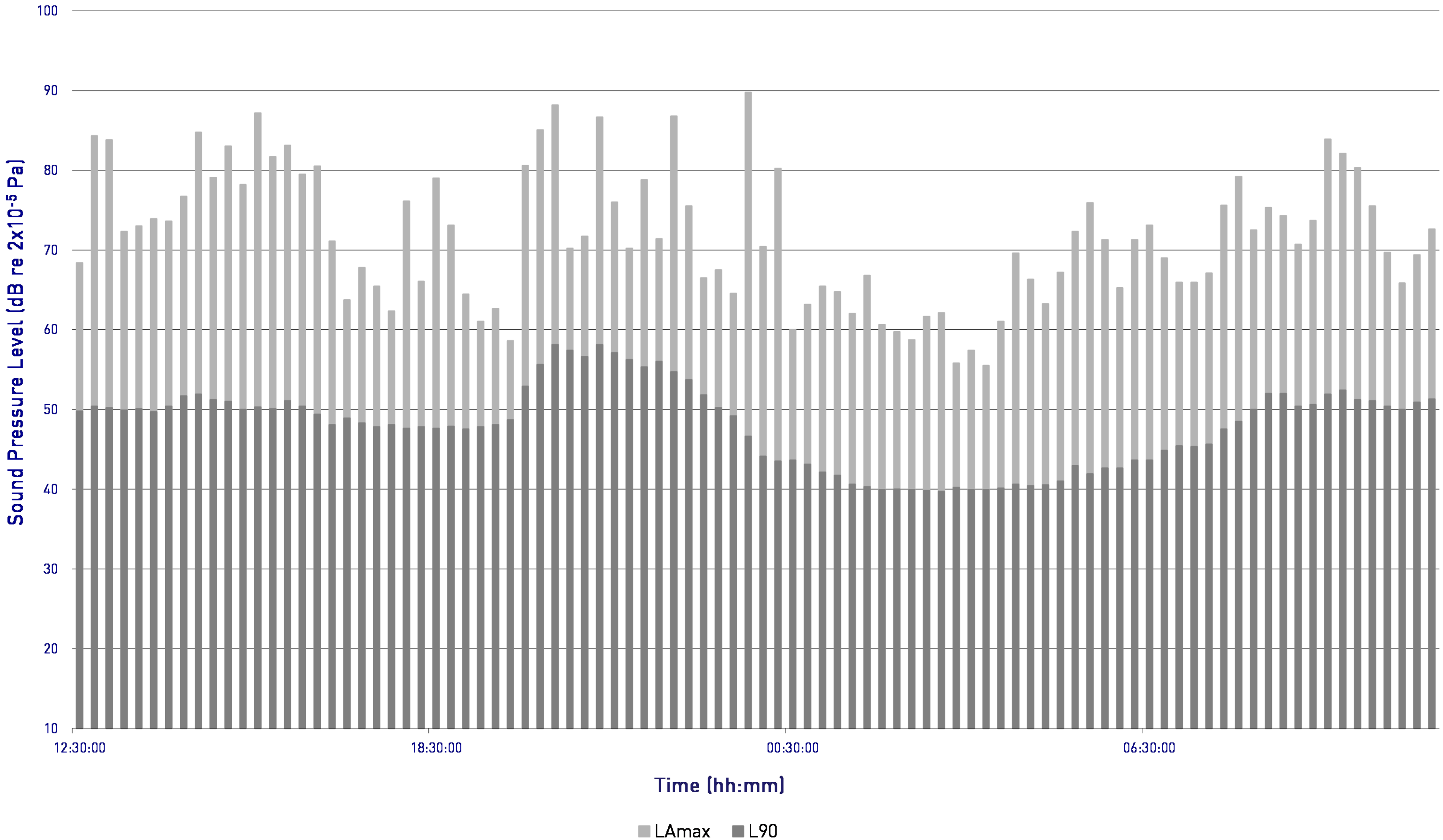


Franco Manca, Brighton

L_{Amax} and L_{A90} Time History

Measurement Position 1, Wednesday 13th May to Thursday 14th May 2014

Graph 6815/G2



Franco Manca, Brighton

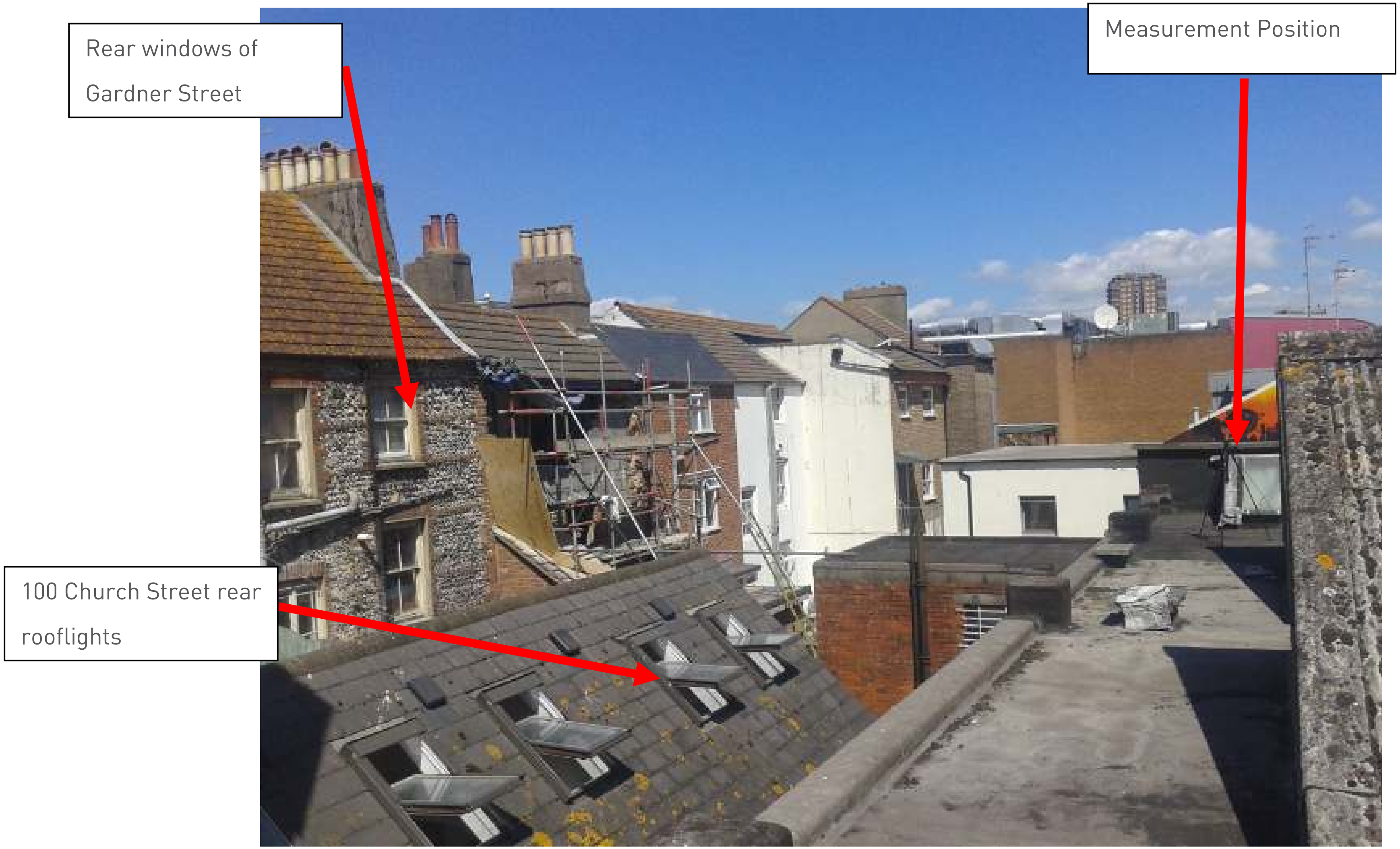
Site Plan Showing Measurement Position and Nearest Noise Sensitive Windows

Site Plan 6815/SP1

Not to Scale

21 September 2015

RBA ACOUSTICS



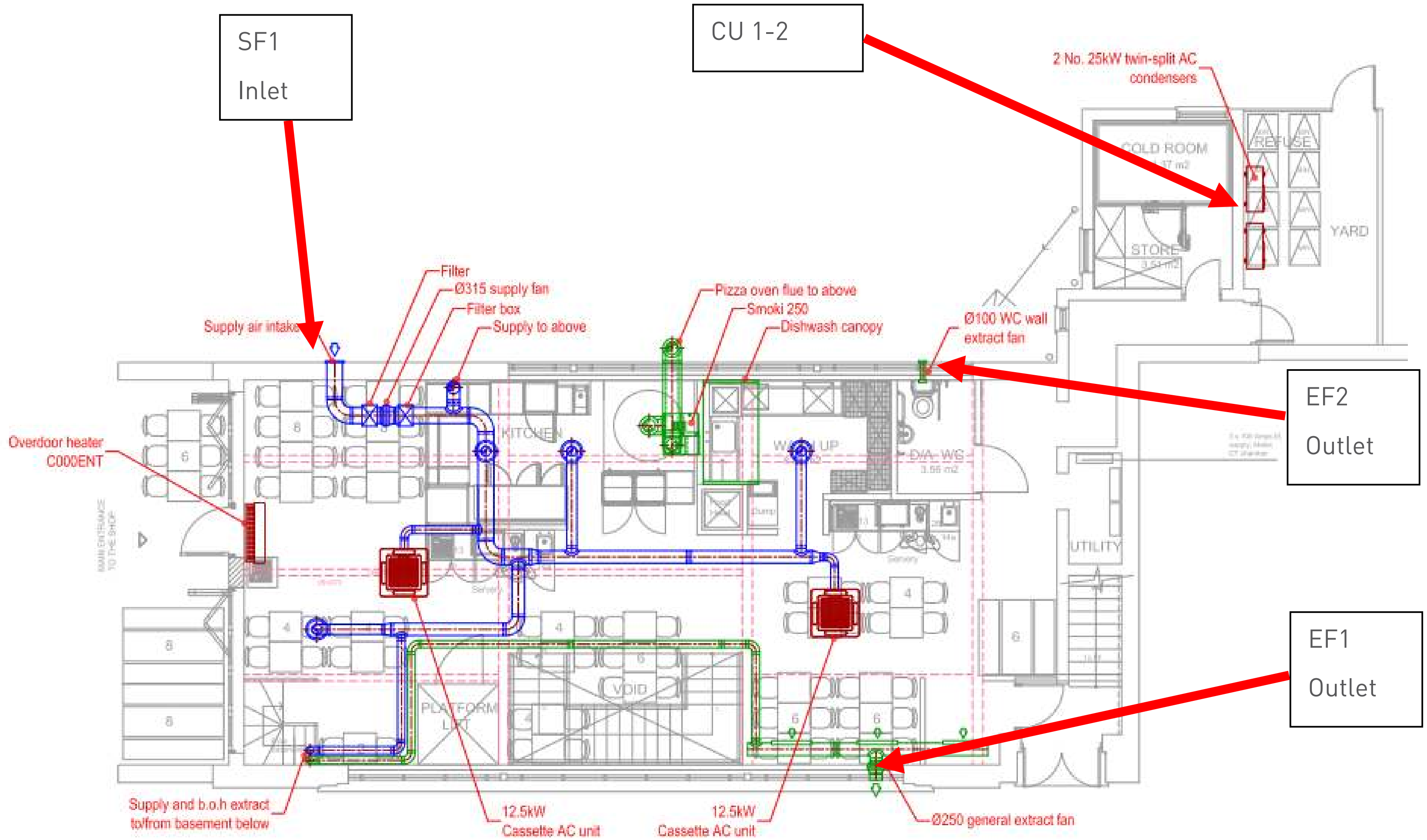
Franco Manca, Brighton

Photograph Showing Measurement Position and Nearest Residential Window

Site Plan 6815/P1

21 September 2015

RBA ACOUSTICS



Franco Manca, Brighton

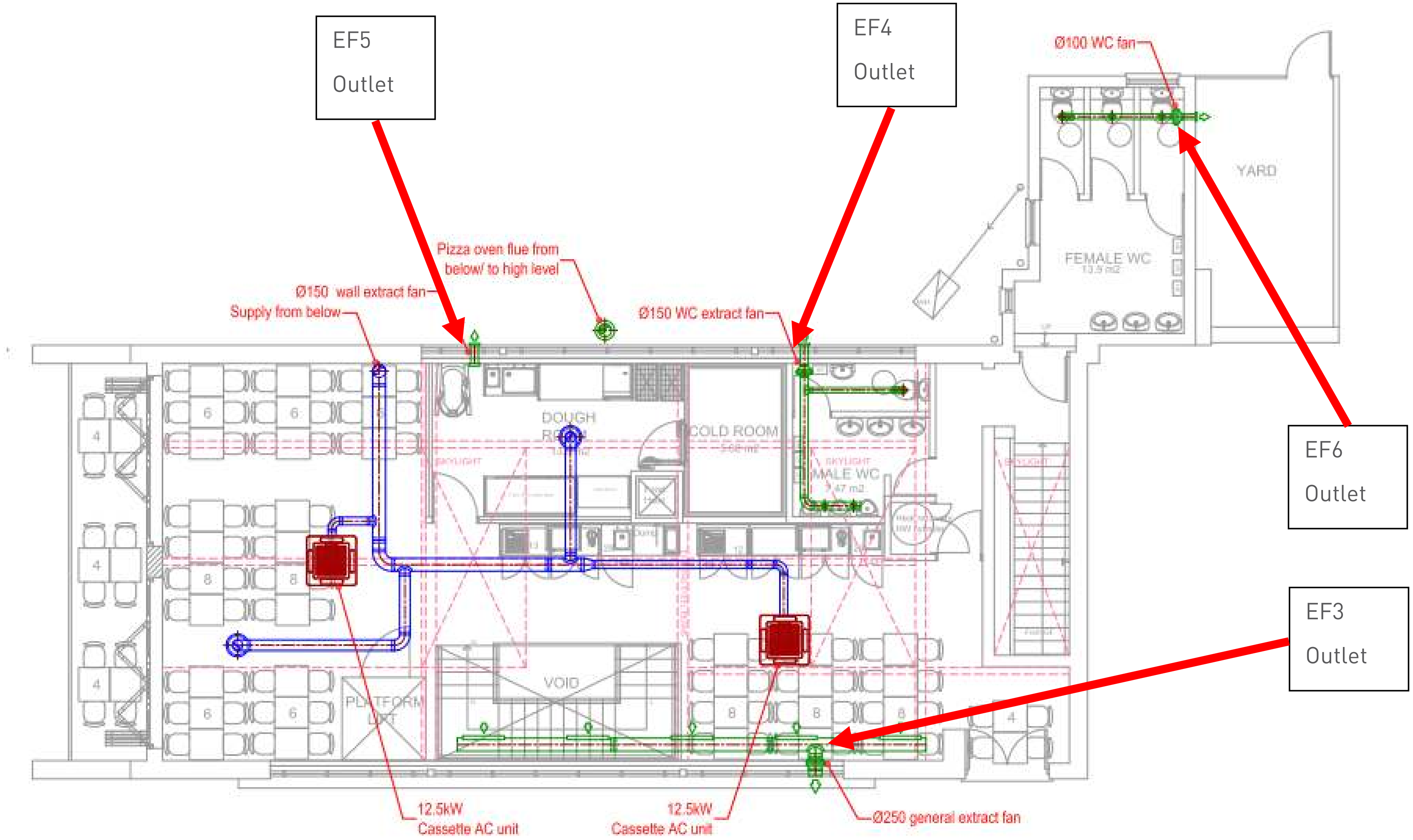
Ground Floor Site Plan Showing Plant Location

Site Plan 6815/SP2

Not to Scale

21 September 2015

RBA ACOUSTICS



Franco Manca, Brighton

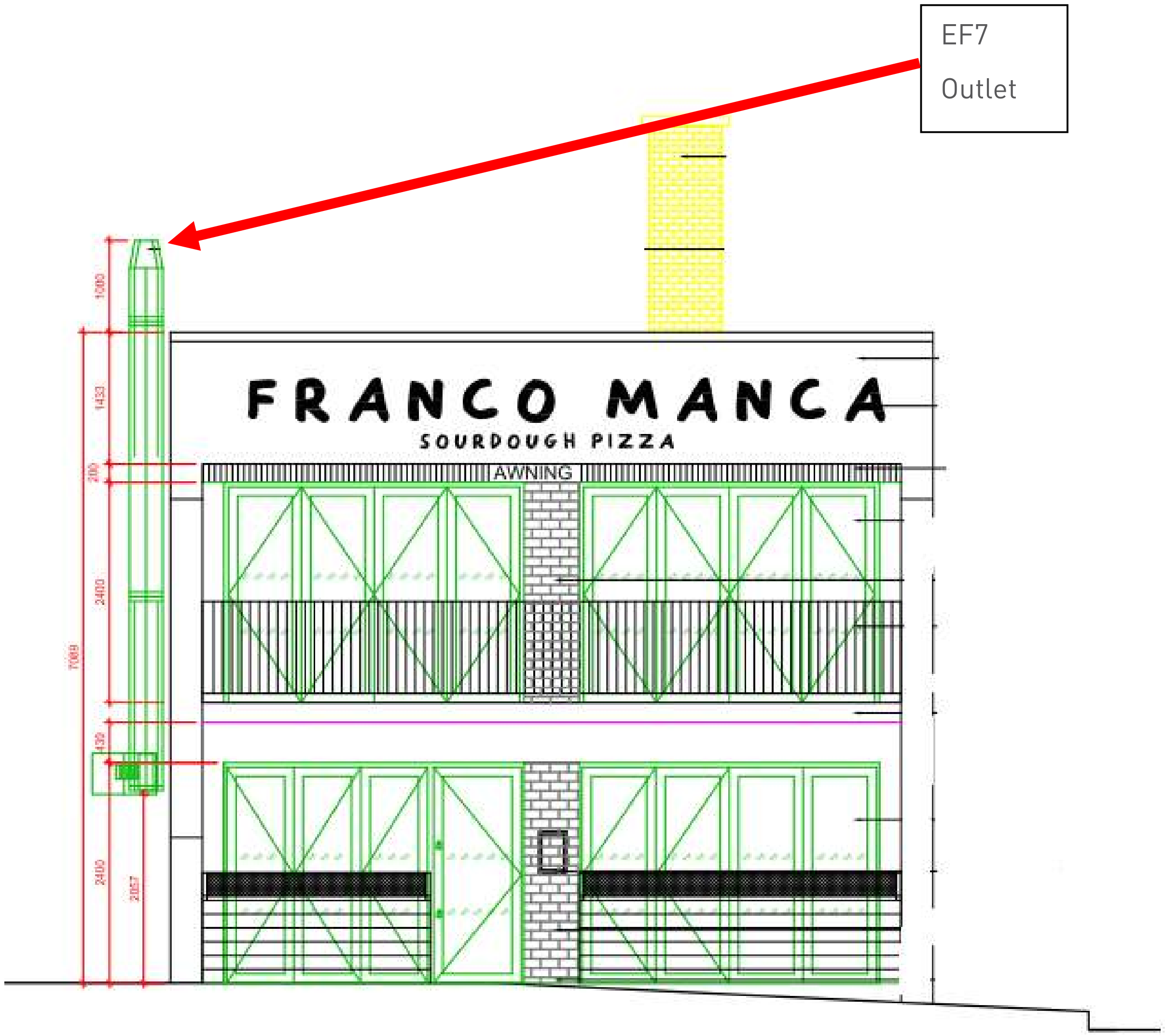
First Floor Site Plan Showing Plant Location

Site Plan 6815/SP3

Not to Scale

21 September 2015

RBA ACOUSTICS



Franco Manca, Brighton

Elevation Site Plan Showing Plant Location

Site Plan 6815/SP4

Not to Scale

21 September 2015

RBA ACOUSTICS

RBA ACOUSTICS
44 Borough Road
London SE1 0AJ

T. +44 (0) 20 7620 1950
W. www.rba-acoustics.co.uk