Noise Assessment Report NS113

Mr. Rice, 47F BROAD STREET, BANBURY, OX16 5BT

Timothy Sherlock-Brown A.M.I.O.A. MSc (27.07.15)

Blue Acoustics

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Contents

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1 Executive Summary

This report has been compiled from measurements taken by Blue Acoustics and carried out in accordance with guidance from **BS8233:2014** for **'Mr. Rice' Chinese Takeaway, 47F BROAD STREET, BANBURY, OX16 5BT** for **Zeyuan Lin** of the same address.

2 main complaints have been made regarding the noise levels within the adjacent property 19 Newland Place :

1. The noise breakout from the exterior flu assembly, in particular into the adjacent 1st floor bedroom.
2. General kitchen noise transmission through the kitchen wall to the ground floor living rooms. The main contributors of this noise were stated as being from food preparation chopping and 'clangs' from the metal woks and wok spoons.

1.1 Conclusions

The assessment levels at the assessment location were found to be profoundly excessive

The main noise source was found to be the exterior fan and flu assembly

There was a strong possibility that a proportion of the measured noise level was due to vibration transmission through the building structure.

1.2 Mitigation

To reduce the specific noise level to that of the recorded background noise level within the 1st floor rear bedroom of 19 Newland Place, Blue Acoustics recommends the following action be taken :

The relocation of the main flu assembly to the East facade of Mr Rice, by extension from the existing kitchen outlet. The assembly should remain the same with the silencer, anti vibration pads and flexible duct connectors in tact.

The construction of a box housing structure to reduce direct noise emissions from the fan assembly.

No use of the extraction system after 11pm on any day.

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Replace the existing vents on the East Wall door, and the kitchen doors to Newline Place with acoustic ventilation systems with a minimum Rw, Ctr of 30 dB with Ctr adjustment (when closed) to further reduce noise breakout.

To reduce the noise transmission through the kitchen wall to the downstairs living areas in 19 Newland Place, Blue acoustics recommends the use of wooden cooking implements where possible including chopping boards. These would reduce impact noise.

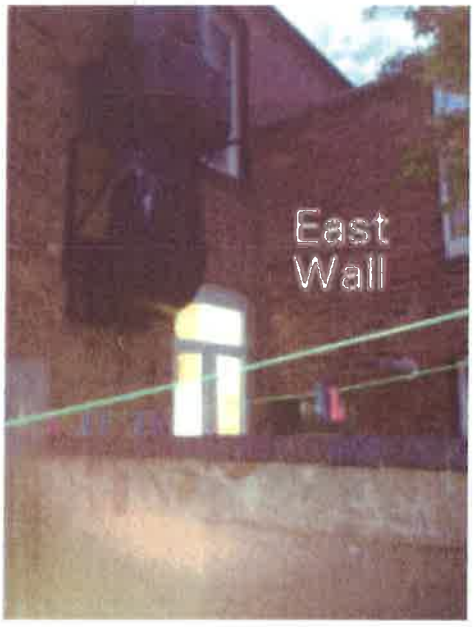
Should these measures be deemed inadequate Blue Acoustics recommends the re-positioning of the cooker hood to allow space behind for the application of a wall treatment as follows :

CAD20-WP panels applied directly onto the entire partition with 2 x 15mm Acoustic Plasterboard layers. This application is cited by Custom Audio Designs as achieving an increase in DnT,W+Ctr of 8 to 10 dB.
http://www.domesticsoundproofing.co.uk/soundproofing/acoustic_wall_panels.htm

Blue Acoustics also recommends the introduction of a minimum of 10m2 of absorption panels within the kitchen area to absorb excess noise energy as this is currently a highly reverberant space. These should preferably be positioned on the opposite wall to the cooker range.

The relocation of the fan / flu assembly would reduce direct noise energy and eliminate any structural vibration transmission.

Figure 1 : Photo detailing existing flu position and proposed 'East Wall' position



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1.3 Housing Design

The recommended housing design is a 3 sided box / panel design. The housing should envelop the entire external flu assembly from the kitchen breakout point to 2m above the eaves of the east wall

All panels should be 5mm Plywood – 4mm VL65 sheet – 5mm Plywood sandwich, internally lined throughout with 50mm RW4 Rock wool

(http://www.customaudiodesigns.co.uk/vl65-acoustic-membrane.htm)

A minimum gap of 50mm between the flu assembly and the internal rock wool lining of the housing should be maintained throughout

Care should be taken to ensure the integrity of the housing throughout, including the use of acoustic sealant at the boundary of the panels and the premises wall.

The structure should be supported by wall adequate weight bearing brackets throughout

The structure should not connect directly to any part of the existing flu assembly including all supports, and utilise acoustic sealant where the housing 'top' encircles the flu.

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2 Introduction

Blue Acoustics has been asked to compile an acoustic report by **Zeyuan Lin** regarding the noise impact of the extraction system at **'Mr. Rice' Chinese Takeaway, 47F BROAD STREET, BANBURY, OX16 5BT** on the adjacent property **19 Newland Place.**

Mr. Rice has been trading for 2-3 years and has received complaints from the adjacent property's owner with respect to the noisy extraction flu assembly to the rear of the shop. The exterior assembly consists a fan, silencer and cylindrical flu assembly. The assembly has been built approximately 1.2m from the adjacent property windows (both upstairs bedroom and downstairs living). The system was recently upgraded to include a new 'quieter' fan, silencer and anti-vibration pads. This upgrade did not provide adequate attenuation with respect to the outstanding complaints.

The system has been designed to generate enough power to provide adequate vapour extraction from the large kitchen range hood, which covers several deep fat fryers, and a large range.

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2.1 Complaints

2 main complaints have been made as follows :

1. The noise breakout from the exterior flu assembly, in particular into the adjacent 1st floor bedroom.
2. General kitchen noise transmission through the kitchen wall to the ground floor living rooms. The main contributors of this noise were stated as being from food preparation chopping and 'clangs' from the metal woks and wok spoons.

2.2 Operational Information

Mr. Lin declared the following operational information :

Opening Hours : 5pm to 11pm 7 days / week.

The extraction system is used to cook orders and is generally turned off between use. When on, the system is not always at 100% power, however, during busy periods 100% power setting is necessary to adequately ventilate the kitchen.

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3 Site Details

Mr. Rice' Chinese Takeaway, 47F BROAD STREET, BANBURY, OX16 5BT

Figure 2 : Road map

Figure 3 : Ariel map

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Mr. Rice is located close to Banbury town centre, a built up area comprising a mix of commercial and residential premises.
It is situated at the North end of a row of shops on broad street which includes other fast food eateries. To the west of the shop are a row of residences down Newland Place.

Figure 4 : Corner view of Mr. Rice and Newline Place

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4 Methodology

LAeq measurements were taken inside the 1st floor rear bedroom of 19 Newland Place. 4 measurements were taken with the extraction system fully on & off in both open & closed window conditions, to determine internal specific and background noise levels for each state.

The open window state was considered a worst case scenario and the background noise level subtracted from the internal specific level to give a desired attenuation figure for the purpose of mitigation design.

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5 Guidance & References

This survey has been carried out according to the following British Standards :

BS 8233:2014 (Guidance on sound insulation and noise reduction for buildings) provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

BS 8233:2014 advises that in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the following guideline values :

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

Table 1 : BS8233:2014 guidelines for Indoor ambient noise levels for dwellings

WHO guidelines state that "based on limited data available, a level of less than 35 dB(A) is recommended to preserve the restorative process of sleep" and advises an internal LA,max of 45 dB

WHO and BS8233:2014 guidelines similarly state that external amenity areas should not be subjected to daytime averaged noise levels of greater than **55dB LAeq**, and ideally **50dB**.

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6 Specific Noise Source

The specific noise source was found to be the external kitchen extraction system assembly behind Mr. Rice.

The noise emitted from this assembly was found to be broadband in nature with a low level of low frequency tonal content.

The noise is of a constant nature, with no fluctuation in level or intermittency characteristic.

Figure 5 : Fan & flu assembly

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7 Measurement Details

7.1 Personnel & Equipment

All testing, calculation & evaluation was conducted by Timothy Sherlock-Brown A.M.I.O.A. of Blue Acoustics. Timothy is an Associate Member of the Institute of Acoustics and possesses an I.O.A. diploma in Applied Acoustics.

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Measurements were taken with the following equipment :

Cirrus Research CR 821A Class 1 Integrated Averaging Sound Level Meter :

Serial Number	b15061fe
Calibration Date	08.09.2014
Calibration Certificate No.	20140910

Calibrated before and after measurement with the following Cirrus Research CRL 513A Acoustic Calibrator :

Serial Number	031536
Calibration Date	08.09.2014
Calibration Certificate no.	20140906

Cirrus Research CR 171B Class 1 Integrated Averaging Sound Level Meter :

Serial Number	G068016
Calibration Date	06.01.2015
Calibration Certificate no.	224668

Calibrated prior to measurement with the following Cirrus Research CR515 Acoustic Calibrator :

Serial Number	69304
Calibration Date	06.01.2015
Calibration Certificate no.	100899

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Care was taken to eliminate external influence on the measurements by the application of a windshield, and wind speed monitoring. All measurements were taken at an angle of approx.. 60 degrees at approx.. 1.2m to 1.5m from the ground during average wind speeds < 5m/s unless otherwise stated.

Calibration was performed before and after each measurement or set of measurements and the offset drift noted. A drift of up to 0.5dB is considered reasonable and is generally the cause of gradients in variables such as temperature, humidity and battery power. Full measurement data files relating to this survey are available on request.

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7.2 Assessment Location(s)

The chosen assessment location was the adjacent 1st floor bedroom of 19 Newland Place.

The 1st floor bedroom window measures approximately 1.2m from the noise source.

7.3 Measurement Position(s)

The measurement position was located inside the first floor rear bedroom of 19 Newland Place. This position was chosen to represent both the noise levels inside the nearest noise sensitive dwelling and the complaints made. The meter was positioned approximately 1.5m from the bedroom window, in the centre of the room space.

7.4 Noise Climate :

Low level distant hum from traffic noise from the surrounding road network

7.5 Topography

NA

7.6 Climate

For all measurements taken on 06.07.15, there was an amount of cloud cover (too dark to estimate %). The evening was relatively humid & still with an average temperature of 15c. The measured average wind speeds were negligible.

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8 Presentation Of Results

Measure Details	Date	Time	Duration T in Min:sec	LAeq, T (dB) (Rounded Up)	LA90
System On, Window Open	06.07.2015	21:41	1:10	48	46
System Off, Window Open	06.07.2015	21:52	4:44	36	32
System On, Window Closed	06.07.2015	21:42	1:05	40	38
System Off Window Closed	06.07.2015	21:46	5:00	36	31

Table 2 : Measurements taken inside adjacent bedroom

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9 Octave Band Data Calculations

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
LAeq	28	46	43	38	38	40	30	23
LA90	20	24	26	28	32	27	20	20
Required	8	22	17	10	6	13	10	3
4mm VL65 loss	18	17	21	24	29	34	39	-
Predicted LAeq	10	29	22	14	9	6	0	-

Table 3: Octave Band Data Calculations including VL65 assessment

Table 3 shows the octave band calculations carried out to determine the necessary noise attenuation required to reduce noise levels in the 19 Newland Place rear 1st floor bedroom to those of background.
It also includes calculations based on octave band data regarding a sheet product VL65, the manufacturers state the following :

VL-65 is a high mass, viscolastic acoustic damping membrane with the added advantage of improved low frequency performance over our other acoustic membranes. Internally reinforced with a micro fibreglass carrier for improved dimensional stability.
VL-65 is acoustically equivalent to lead of the same surface weight.

Though these figures relate to a 'perfect' situation, High attenuation levels can be achieved using this material.
The level of attenuation in the 125Hz octave band falls 5dB short of the desired target. The overall predicted LAeq however, would be 30dB, 5dB within the WHO and BS8233:2014 guideline of 35dB for daytime rest.

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10 Conclusions

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There was a strong possibility that a proportion of the measured noise level was due to vibration transmission through the building structure.

11 Mitigation

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Figure 1 : Photo detailing existing flu position and proposed 'East Wall' position

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Appendix 1 – Glossary of Terms

Ambient Noise: Totally encompassing sound in a given situation at a given time usually composed of sounds from many sources near and far. [BS 4142]

Attenuation: A reduction in the intensity of a sound signal.

Background Noise Level : 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 the time weighting F, and quoted to the nearest number of whole decebels.

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 Pa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A): decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

Free Field: 1. A free sound field is a field in a homogeneous, isotropic medium free from boundaries. In practice it is a field in which the effects of the boundaries are negligible over the region of interest. The actual pressure impinging on an object (e.g., a microphone) placed in an otherwise free sound field will differ from the pressure which would exist at the point with the object removed, unless the acoustic impedance of the object matches the acoustic impedance of the medium.
2. An environment in which there are no reflective surfaces within the frequency region of interest. 3. A region in which no significant reflections of sound occur.
4. [BS4142] suggests that free-field environmental noise measurements need to be made at least 3.5m from any reflecting structure.

Hertz (Hz): unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.

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LA90,T : the A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 2014 it is used to define background noise level.

LAeq,T : the equivalent continuous sound level -the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). LAeq,T is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is written as Leq in connection with aircraft noise.

LAmax: the highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated.

Rating Level : 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 level is suppressed to a degree such that it does not contribute to the ambient noise.

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

Steady Noise: Noise that gives fluctuations over a range of not more than 5 dB on a sound level meter set to frequency weighting A and time weighting S. [BS 4142]

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Appendix 2 – Equipment Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY	Gracey & Associates	BSI CERTIFICATE	[illegible]
DATE OF ISSUE	08 September 2014	CERTIFICATE NUMBER	[illegible]
DATE OF CALIBRATION	08 September 2014		
CALIBRATION INTERVAL	12 months		PAGE 1 OF 2

Gracey & Associates
Barn Court Shelton Road
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Tel: 01234 708835
Fax: 01234 252332
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TEST ENGINEER [redacted] APPROVING SIGNATORY [redacted]

Equipment B&K 4189, s/n: 1625491
Description Microphone - 1/2" FF Bruel & Kjaer UK Limited
Customer Gracey & Associates
High Street, Chelveston, Northamptonshire, NN9 6AS

Standards
BS EN 61672 Class 1

Conditions
Atmospheric Pressure 101.3 kPa
Temperature 23.5 °C
Relative Humidity 48.0 %

Calibration Data

Sensitivity -27.20 dB

Calibration Reference Sources

Equipment	S/N	Last Cal	Equipment	S/N	Last Cal
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes

[illegible]

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CERTIFICATE OF CALIBRATION

ISSUED BY Gracey & Associates
DATE OF ISSUE 09 September 2014
DATE OF CALIBRATION 08 September 2014
CALIBRATION INTERVAL 12 months

BSI CERTIFICATE FS 25813
CERTIFICATE NUMBER 2014-0906

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TEST ENGINEER [redacted]

APPROVING SIGNATORY [redacted]

Equipment CRL 913A, s/n: 031536
Description Calibrator - Acoustic - Type 1, Cirrus Research Ltd

Customer Blue Acoustics
48 Elizabeth Road, Moseley, Birmingham, B13 8QJ

Standards
BS EN 60942 Class 1

Conditions
Atmospheric Pressure 101.3 kPa
Temperature 21.0 °C
Relative Humidity 47.7 %

Calibration Data

Output Level 94.00 dB
Frequency 1007.24 Hz

Calibration Reference Sources

Equipment	S/N	Last Cal	Equipment	S/N	Last Cal
B&K 4134 L	1675305	17-Jun-13	Druck DPI 141	419	08-Nov-13
HP 34401	3146A16728	24-Oct-13	Mot 1253	20849	19-Jun-13
Standard DS360	33213	24-Oct-13	Vaisala HMP23	S2430007	30-Oct-13

Notes

We certify that the above product was duly tested and found to be within the specification at the points measured (except where indicated). Measurements are traceable to UKAS reference sources from the UK National Physical Laboratory. Where no national or international standards exist, traceability is to standards maintained by the manufacturer. Our Quality Management System has been assessed to comply with BS EN ISO 9001:2008 - BSI Certificate number FS 25813. Tests were carried out in environmental conditions controlled to the extent appropriate to the instrument's specification. All relevant test certificates are available for inspection.

The uncertainties are for a confidence probability of not less than 95%.

Gracey & Associates is the trading name of W T Gracey Ltd. Registered in Upper dean England No 1176412
BSI approved for the hire and calibration of noise and vibration instruments. Established 1972

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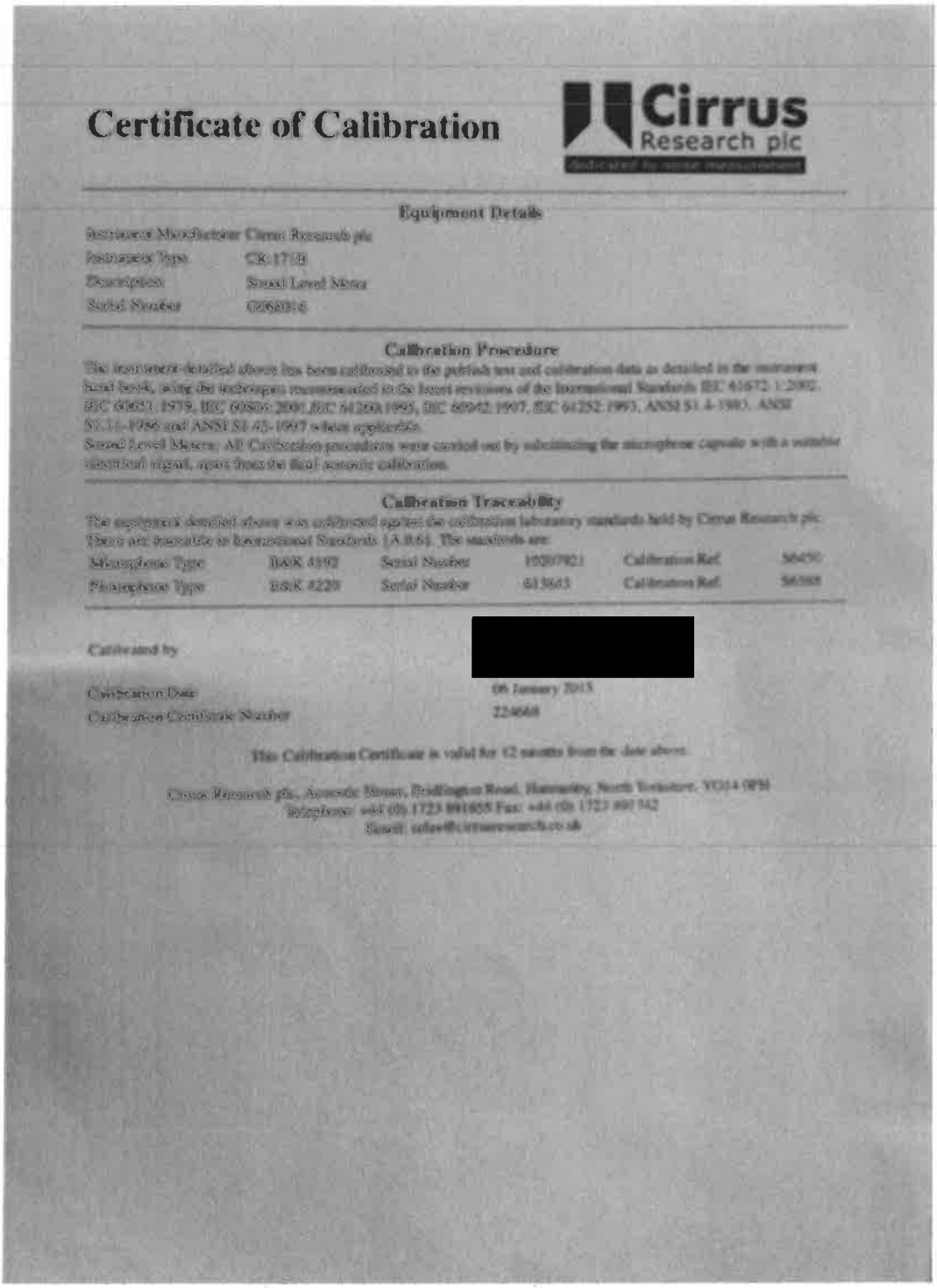

Certificate of Calibration

Cirrus Research plc

Dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research plc
Instrument Type	CR:171B
Description	Sound Level Meter
Serial Number	G060316

Calibration Procedure

The instrument detailed above has been calibrated to the pattern test and calibration data as detailed in the instrument manufacturers recommended to the latest revisions of the International Standards IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2000, IEC 61260:1995, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards (A.B.6). The standards are:

Microphone Type	B&K 4192	Serial Number	1920702	Calibration Ref.	36459
Preamplifier Type	B&K 4220	Serial Number	613663	Calibration Ref.	36369

Calibrated by [redacted]

Calibration Date 06 January 2015

Calibration Certificate Number 224668

This Calibration Certificate is valid for 12 months from the date above.

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Email: sales@cirrusresearch.co.uk

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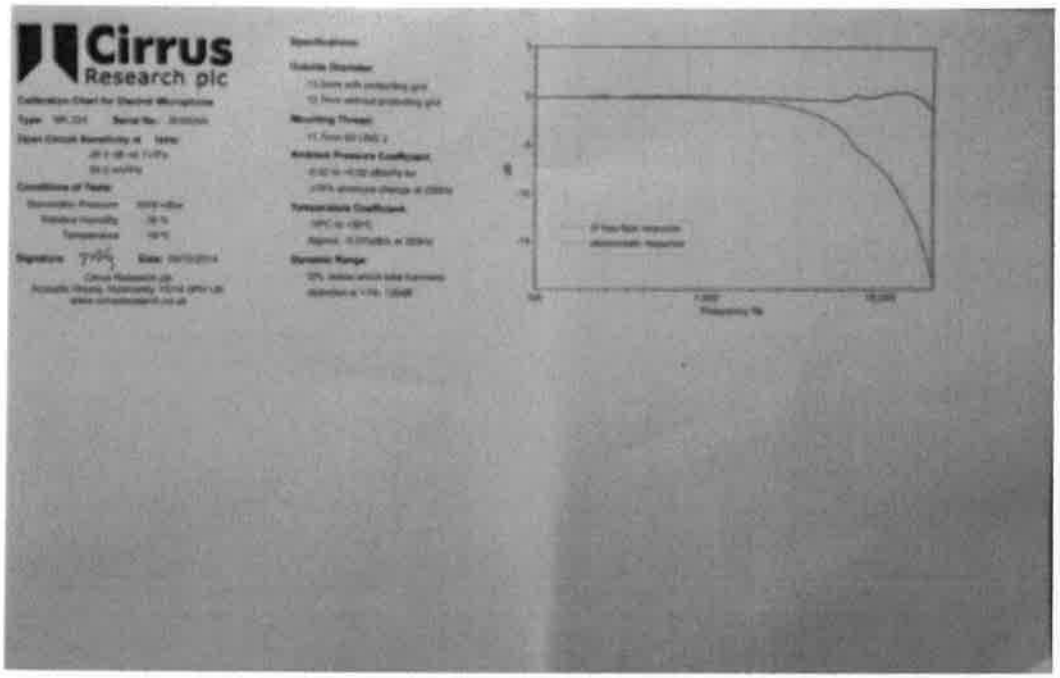

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Certificate of Calibration

Cirrus Research plc

Certificate Number: 100899
Date of Issue: 08 January 2015

Instrument

Manufacturer:	Cirrus Research plc	Type:	Acoustic Calibrator
Model Number:	CR:515	Serial Number:	59304

Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the test-mic configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

Date of Calibration: 05 January 2015

Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	94.02	1000.3	0.47
2	93.99	1000.3	0.35
3	94.02	1000.3	0.46
Average	94.01	1000.3	0.43
Uncertainty	± 0.13	± 0.1	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

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Email: info@cirrusresearch.co.uk
Web: www.cirrusresearch.co.uk
Registered in England No. 1847921

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