Technical Appendix 15.3: Background Noise Monitoring Results

A15.3.1 As noted in Paragraph 15.6.3 of the Environmental Impact Assessment Report (EIA Report) baseline noise measurements were carried out at two locations (Badintaggart and Glencassley Castle), selected on the basis of the Proposed Development's initial working layout of June 2020. However, the Proposed Development has evolved through the design process, resulting in the Proposed Development (including cumulative effects) being complaint with the ETSU-R-97 'simplified assessment' methodology, thereby negating the requirement for background monitoring. Notwithstanding this, the background noise survey methodology and results are presented here the interest of completeness.

Survey Methodology

- A15.3.2 The survey was carried out between 16 July 2020 and 11 September 2020¹, in accordance with the method specified in ETSU-R-97² and following the advice contained in the Institute of Acoustics Good Practice Guide³ (GPG). The following specific measures ensured this compliance:
 - Type 1 measuring equipment was used, which was calibrated at the start of the survey and at each site visit. No significant calibration drift occurred;
 - Noise monitoring equipment was equipped with specially-designed, dual-layer windshields manufactured by Rion, which have been confirmed by the supplier as being suitable for use in elevated wind speeds;
 - Measurements were performed at a height of 1.4m above ground level (AGL), in free-field conditions, i.e., a minimum of 3.5m from any reflective surface other than the ground;
 - Background noise levels were recorded at continuous 10-minute intervals, as L_{A90}, 10min;
 - During the survey, wind speeds were measured using a LiDAR monitoring system. Hub height (86m) wind speeds were calculated from measurements at 60m and 80m using the method described in the GPG and subsequently used to derive standardised 10m wind speeds;
 - A logging rain gauge was deployed at each monitoring location, and data from periods potentially affected by rainfall were excluded from further analysis;
 - Periods of elevated background noise levels which were not considered representative of the location were identified and excluded from analysis; and
 - The GPG recommends at least 200 valid data points in each quiet daytime and night time period for each monitoring location, after exclusions are taken into account. In practice, this minimum was comfortably exceeded.
 - Survey record sheets provided specific details of each monitoring location, along with photographs showing the monitoring equipment in situ, is presented in Annex 1 to this Technical Appendix.

¹ Monitoring at Badintaggart ended on 2nd September 2020 due to batteries becoming depleted

² ETSU-R-97 (1996) The Assessment and Rating of Noise from Wind Farms, ETSU: DTI.

³ A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind turbine Noise, IOA, 2013.

Background Noise Levels

- A15.3.3 Following analysis of the data as described above, trendlines (lines of best fit) were applied to scatter plots of each dataset to represent 'prevailing background noise level' curves.
- A15.3.4 Table A15.3.1 details the resulting background noise levels for quiet daytime and night time measurement periods.

	Standardised 10 m Wind Speed, m/s								
Receptor	4	5	6	7	8	9	10	11	12
			Backg	round N	oise Leve	I, dB, LA9	0,10min		
Quiet Daytime									
Badintaggart	28.6	29.3	30.0	30.9	31.9	33.0	34.4	35.9	35.9
Glencassley Castle	33.0	33.6	34.4	35.3	36.3	37.4	38.6	39.9	41.3
Night-time									
Badintaggart	27.4	27.8	28.5	29.5	30.8	32.4	34.2	34.2	34.2
Glencassley Castle	32.9	33.3	34.0	34.7	35.7	36.8	38.0	39.4	40.9

Table A15.3.1: Prevailing Background Noise Levels

A15.3.5 These background noise levels are presented graphically in Charts A15.3.1 to A15.3.4, along with data points which have been excluded from analysis, as recommended in the GPG.









Chart A15.3.3: Quiet Daytime – Glencassley Castle







Annex 1: Survey Record Sheets



Noise Survey Record Sheet

Project No.	3538	Project Name:	Achany Ext
Location (x of y)	1 of 2	Installed By:	MR
Lat/Long	58.0531, -4.66476	Location Name	Badintaggart
Start Date	16/07/2020	Start Time	1800

Equipment Details	Make/Model	Serial No.		
Sound Level Meter:	Rion NL-31	593609		
Calibrator: Rion NC-74		34372738		
Source of Equipment:		Arcus		
Meter Timestamp (Start/End, GMT/BST):		Start BST		

Description of Location:	Front garden
Distance from façade::	10m approx
Noise sources observed:	River, pine trees, birds, potentially pole mounted transformer
Additional notes:	

Installation (Visit 1)

Date:	16/07/2020	Time:	1800
Filename:	AU2_0101	Calibration level:	94.0
Range setting:	20-100	Meas. period:	10min
Freq weighting:	А	Rain Gauge?	Yes
Notes:			

Visit 2

Date:	07/07/2020	Time:	1800
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	94.0	Batts replaced?	Yes
Equipment Removed?			No
Notes:			

Visit 3

Date:	21/08/2020	Time:	1800
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	93.9	Batts replaced?	Yes
Equipment Removed?			No
Notes:			

Visit 4

Date:	11/09/2020	Time:	1330
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	93.8	Batts replaced?	No
Equipment Removed?			Yes
Notes:			



Noise Survey Record Sheet - Photos



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Noise Survey Record Sheet - Photos



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Date of Issue: 05 November 2019

Issued by: ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL Telephone 01908 642846 Fax 01908 642814 E-Mail: info@noise-and-vibration.co.uk Web: www.noise-and-vibration.co.uk Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Certificate Number: TCRT19/1827

	Page Approved Signatory	1	of	3	Pages
s		_	_	-	

Customer	Arcus Consultancy Services Ltd
	Floor 7
	144 West George Street
	Glasgow
	G2 2HG

Order No.	NOISEBA20191101					
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator					
Identification	Manufacturer	Instrument	Туре	Serial No. / Version		
	Rion	Sound Level Meter	NL-31	00593609		
	Rion	Firmware		1.400		
	Rion	Pre Amplifier	NH-21	30371		
	Rion	Microphone	UC-53A	316137		
	Rion	Calibrator	NC-74	34536109		
		Calibrator adaptor type if applicable NC-74-002				
Performance Class	1					
Test Procedure	TP 2.SLM 61672	-3 TPS-49				
	Procedures from 1	EC 61672-3:2006 were use	ed to perform the p	eriodic test.		
Type Approved to IEC	61672-1:2002	No Approval N	umber			
	If YES above there applicable pattern e	is public evidence that the evaluation tests of IEC 616	SLM has success 72-2:2003	fully completed the		
Date Received	04 November 20	19 ANV	Job No. TRA	C19/11481		
Date Calibrated	05 November 20 ⁻	19				

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	25 October 2017	TCRT17/1705	ANV Measurement Systems
This certificate provides t	raceability of measuremen	t to recognised national st	andards, and to units of measurement
realised at the National P	hysical Laboratory or other	recognised national stand	dards laboratories. This certificate may
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Certificate Number TCRT19/1827

Page 2 of 3 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.					
SLM instruction manual title	NL-21 NL-31 Instr	uction	Manuai		
SLM instruction manual ref / issue	32006 09-0-	4			
SLM instruction manual source	Manufacture	ər			
Internet download date if applicable	N/A				
Case corrections available	Yes				
Uncertainties of case corrections	No		See comment on page 3		
Source of case data	Manufacture	er			
Wind screen corrections available	Yes				
Uncertainties of wind screen corrections	No		See comment on page 3		
Source of wind screen data	Manufacture	er			
Mic pressure to free field corrections	Yes				
Uncertainties of Mic to F.F. corrections	No		See comment on page 3		
Source of Mic to F.F. corrections	Manufacture	er			
Total expanded uncertainties within the requ	irements of IEC 616	72-1:2	002 Yes		
Specified or equivalent Calibrator	Specified				
Customer or Lab Calibrator	Lab Calibrate	or			
Calibrator adaptor type if applicable	NC-74-002				
Calibrator cal. date	10 October 20)19			
Calibrator cert. number	UCRT19/2133				
Calibrator cal cert issued by Lab.	ANV Measuremen	t Syste	ems		
Calibrator SPL @ STP	93.96	dB	Calibration reference sound pressure level		
Calibrator frequency	1001.95	Hz	Calibration check frequency		
Reference level range	30 - 120	dB			

Accessories used or corrected for during calibration - None Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions	during tests	Start	End	İ	
	Temperature	24.26	23.94	±	0.30 °C
	Humidity	37.9	37.7	±	3.00 %RH
	Ambient Pressure	98.64	98.70	±	0.03 kPa

Response to associated C						
Initial indicated level	95.6	dB	Adjusted indicated	level	94.0	dB
The uncertainty of the ass	±	0.10	dB			

Self Generated NoiseThis test is currently not performed by this Lab.Microphone installed (if requested by customer) = Less ThanN/AdBUncertainty of the microphone installed self generated noise ±N/AdB

Micro	ohone replace	ed with elect	rical ir	put devi	ce -	UR =	Under	Range indi	cated	Ĩ
	Weighting		А			Ċ			Z	
-		14.2	dB	UR	17.5	dB	UR	24.6	dB	UR
Uncertainty of the electrical self generated noise ±						0.12	dB			

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by the International Organisation for Standards (ISO).

<u>Comments</u>

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.



If any of the "Uncertainties of" are set to NO above, then the following applies.

No information on the uncertainty of measurement, required by 11.7 of IEC 61672-3:2006, of the adjustment data given in the instruction manual or obtained from the manufacturer or supplier of the sound level meter, or the manufacturer of the microphone, or the manufacturer of the multi-frequency sound calibrator, or the manufacturer of the electrostatic actuator was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of the measurement of the adjustment data has therefore been assumed to be numerically zero for the purpose of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the sound level meter may not conform to the requirements of IEC 61672-1:2002.

Calibrated by: A.Escalona

MEASUREMENT SYSTEMS

R 2

.....

END

Additional Comments None



Date of Issue: 08 June 2020

Certificate Number: TCRT20/1274

Page 1 of 2 Pages Approved Signatory

Issued by: ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL Telephone 01908 642846 Fax 01908 642814 E-Mail: info@noise-and-vibration.co.uk Web: www.noise-and-vibration.co.uk Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Arcus Consultancy Services Limited
3 Swinegate
York
YO1 8AJ

Order No.	ET27052020			
Test Procedure	Procedure TP 2	Calibration of Sou	und Calibrators	
Description	Acoustic Calibr	ator		
Identification	<i>Manufacturer</i> Rion	<i>Instrument</i> Calibrator	Model NC-74	Serial No. 34372738

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No.	TRAC20/06162	
Date Received	05 June 2020	
Date Calibrated	08 June 2020	
Previous Certificate	Dated Certificate No. Laboratory	27 June 2019 TCRT19/1507 ANV Measurement Systems

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2 of 2 Pages

Measurements

The sound pressure level generated by the calibrator in its WS2 configuration was measured five times by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below. It is corrected to the standard atmospheric pressure of 101.3 kPa (1013 mBar) using original manufacturers information.

Test Microphone	Manufacturer	Туре
	Brüel & Kjær	4134

Results

The level of the calibrator output under the conditions outlined above was

93.96 ± 0.10 dB rel 20 µPa

Functional Tests and Observations

The frequency of the sound produced was	1001.65 Hz	\pm	0.13 Hz
The total distortion was	1.31 %	\pm	6.7 % of Reading

During the measurements environmental conditions were

Temperature	22	to	23	°C
Relative Humidity	41	to	47	%
Barometric Pressure	100.9	to	101.0	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by the International Organisation for Standards (ISO).

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

Note:	END	
Calibrator adjusted prior to calibration?	NO	
Initial Level	N/A	dB
Initial Frequency	N/A	Hz
Additional Comments		

None



Noise Survey Record Sheet

Project No.	3537	Project Name:	Achany Ext
Location (x of y)	2	Installed By:	MR
Lat/Long	58.03072, -4.64194	Location Name	Glencassley Castle
Start Date	16/07/2020	Start Time	1800

Equipment Details Make/Model		Serial No.
Sound Level Meter:	Rion NL-52	510114
Calibrator:	Rion NC-74	34372738
Source of Equipment:		Arcus
Meter Timestamp (Start/End, GMT/BST):		Start BST

Description of Location:	Front lawn
Distance from façade::	Approx 20m
Noise sources observed:	River, trees, birds, small watercourse to south is screened by building
Additional notes:	

Installation (Visit 1)

Date:	16/07/2020	Time:	1800
Filename:	AU2_0201	Calibration level:	94.0
Range setting:	20-100	Meas. period:	10min
Freq weighting:	А	Rain Gauge?	Yes
Notes:			

Visit 2

Date:	07/07/2020	Time:	1800
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	93.9	Batts replaced?	Yes
Equipment Removed?			No
Notes:	0		

Visit 3

Date:	21/08/2020	Time:	1800
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	93.6	Batts replaced?	Yes
Equipment Removed?			No
Notes:			

Visit 4

Date:	11/09/2020	Time:	1355
Visited by:	MR	Calibration level:	94.0
Level pre-calibration	93.8	Batts replaced?	No
Equipment Removed?			Yes
Notes:			



Noise Survey Record Sheet - Photos

Project No.	3537	Location (x of y)	2
The second second	a los de la composition de la	and the second second	-
S. angles			and the
the Alline of the second			
	Strengthe		
		1.000	and the second
a.		-	
	- And -		and the second
		and the second	1
			1 data

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Noise Survey Record Sheet - Photos



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Date of Issue: 20 September 2019

Certificate Number: TCRT19/1730

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Milton Keynes MK5 8HL					
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E-Mail: info@noise-and-vibration.co.uk					
Web: www.noise-and-vibration.co.uk					
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems					
Customer Arcus Consultancy Services	Ltd				

3 Swinegate

1C Swinegate Court East York YO1 8AJ

Drder No. ET030919 Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator							
Identification	Manufacturer	Instrument	Туре		Serial No. / Version		
	Rion	Sound Level Meter	NL-52		00510114		
	Rion	Firmware			2.0		
	Rion	Pre Amplifier	NH-25		10107		
	Rion	Microphone	UC-59		02807		
	Rion	Calibrator	NC-74		34536109		
		Calibrator adaptor	type if applicable	Э	NC-74-002		
Performance Class	1						
Test Procedure	TP 2.SLM 61672-	3 TPS-49					
	Procedures from IE	EC 61672-3:2006 were	e used to perform	the peri	iodic tests.		
Type Approved to IEC 6	61672-1:2002	YES Approv	al Number	21.21	/ 13.02		
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003						
Date Received Date Calibrated	20 September 20 20 September 20	2019 ANV Job No. TRAC19/09418 2019 TRAC19/09418					

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	04 September 2017	TCRT17/1570	ANV Measurement Systems
This certificate provides	traceability of measurement	nt to recognised national	standards, and to units of measurement
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Certificate Number TCRT19/1730 Page 2 of 2 Pages

Sound Level Meter Inst	ruction manual an	d data used to a	djust th	e sound leve	els inc	licated.		
SLM instruction manual ti	tle Sound Leve	Meter NL-42 / N	L-52					
SLM instruction manual re	ef / issue	11-03						
SLM instruction manual s	ource	Manufactur	ər					
Internet download date if	applicable	N/A						
Case corrections available	е	Yes						
Uncertainties of case corr	rections	Yes						
Source of case data		Manufactur	er					
Wind screen corrections a	available	Yes						
Uncertainties of wind scre	en corrections	Yes						
Source of wind screen da	ta	Manufactur	ər					
Mic pressure to free field	corrections	Yes						
Uncertainties of Mic to F.I	corrections	Yes						
Source of Mic to F.F. corr	ections	Manufacture	er					
Total expanded uncertain	ties within the requir	ements of IEC 616	72-1:20	02 Yes				
Specified or equivalent Ca	alibrator	Specified						
Customer or Lab Calibrat	or	Lab Calibrat	or					
Calibrator adaptor type if	applicable	NC-74-002	2					
Calibrator cal. date		04 September	2019					
Calibrator cert. number		UCRT19/1974						
Calibrator cal cert issued	by	ANV Measuremer	t Syste	ms				
Calibrator SPL @ STP		93.97	dB	Calibration re	eferen	ce sound p	ressure	evel
Calibrator frequency		1001.86	Hz	Calibration c	heck f	requency		
Reference level range		25 - 130	dB					
Accessories used or corre	ected for during calib	oration - None	<u>)</u>					
Note - if a pre-amp extens	sion cable is listed th	en it was used bet	, ween th	e SLM and th	e pre-	amp		
Environmental conditions	during tests	Start	1	End	1			
	Temperature	24.00		24.10		0.30 °C		
	Humidity	46.7		46.7	 	3.00 %	ㅋ	
	Ambient Proceure	101 44		101.40	<u> </u>	0.03 40		
				101.40	L I	0.00 KPa	<u>.</u>	
Response to associated C	Calibrator at the envi	ronmental condition	ns abov	e.				_
Initial indicated level	93.9	dB Ad	usted ir	ndicated level		94.0	dB]
The uncertainty of the ass	ociated calibrator su	upplied with the sou	nd leve	l meter ±		0.10	dB	
Self Generated Noise	This test is currently	y not performed by	this Lat	b.				
Microphone installed (if requested by customer) = Less Than N/A dB A Weighting]			
Uncertainty of the microph	Uncertainty of the microphone installed self generated noise ± N/A dB							
Microphone replaced with	electrical input device	ce - UR =	Under	Range indica	ted]		
Weighting	A	C			Ζ			
12	2.7 dB UR	16.8 dB	JUR	23.6	dB	UR		
Uncertainty of the electric	al self generated noi	se ±		0.12	dB			
The reported expanded up	containty is based o	n a standard unger	tointy m	ultiplied by a	oovor	ago footor k		iding o

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

Calibrated by: B. Bogdan R 3 Additional Comments

None



Date of Issue: 08 June 2020

Issued by:

Certificate Number: TCRT20/1274

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Beaufort Court	Approved Signatory				
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Milton Keynes MK5 8HL					
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E-Mail: info@noise-and-vibration.co.uk					
Web: www.noise-and-vibration.co.uk					
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems					

Customer	Arcus Consultancy Services Limited
	1C Swinegate Court East
	3 Swinegate
	York
	YO1 8AJ

Order No.	ET27052020			
Test Procedure	Procedure TP 1	Calibration of Sound Ca	librators	
Description	Acoustic Calibrato	or		
Identification	<i>Manufacturer</i> Rion	<i>Instrument</i> Calibrator	<i>Model</i> NC-74	Serial No. 34372738

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No.	TRAC20/06162	
Date Received	05 June 2020	
Date Calibrated	08 June 2020	
Previous Certificate	Dated Certificate No. Laboratory	27 June 2019 TCRT19/1507 ANV Measurement Systems

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2 of 2 Pages

Measurements

The sound pressure level generated by the calibrator in its WS2 configuration was measured five times by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below. It is corrected to the standard atmospheric pressure of 101.3 kPa (1013 mBar) using original manufacturers information.

Test Microphone	Manufacturer	Туре
	Brüel & Kjær	4134

Results

The level of the calibrator output under the conditions outlined above was

93.96 ± 0.10 dB rel 20 µPa

Functional Tests and Observations

The frequency of the sound produced was	1001.65 Hz	\pm	0.13 Hz
The total distortion was	1.31 %	\pm	6.7 % of Reading

During the measurements environmental conditions were

Temperature	22	to	23	°C
Relative Humidity	41	to	47	%
Barometric Pressure	100.9	to	101.0	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by the International Organisation for Standards (ISO).

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

Note:	END	
Calibrator adjusted prior to calibration?	NO	
Initial Level	N/A	dB
Initial Frequency	N/A	Hz
Additional Comments		

None