Certificate of Calibration

Appendix 14.3

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 23 April 2013 Certificate N° 07104

UKAS CALIBRATION
0653

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Approved Signatory
G.Parry

CLIENT	Arcus Consultancy Services 7th Floor 145 St Vincent Street Glasgow G2 5JF
F.A.O.	Michel Baron
REF.	- Job N° UKAS13/04083/01
DATE OF RECEIPT	9 April 2013
PROCEDURE	AV Calibration Engineer's Handbook, Section 2
IDENTIFICATION	Sound calibrator Rion type NC-74 serial number 34372738, with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	15 April 2013
PREVIOUS CALIBRATION	Calibrated on 27 April 2012 Certificate Nº 06490 issued by this laboratory

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate N° 07104

MEASUREMENTS

The sound pressure level generated by the sound calibrator in its half-inch configuration was measured five times using a B&K type 4134 microphone with its protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output, corrected to the standard atmospheric pressure of 101.3 kPa using manufacturers' data, was

94.11 ± 0.12 dB rel 20 µPa

The fundamental frequency of the sound output was 1002 Hz ± 0.06%, and its total distortion was (1.32 ± 0.1) %.

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.

During the measurements the laboratory environmental conditions were:

temperature: 23 to 24 °C
barometric pressure: 101.0 to 101.1 kPa
relative humidity 35 to 46 %.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 6 November 2012 Certificate N° 06808

UKAS CALIBRATION
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Approved Signatory
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CLIENT	Arcus Renewable Energy Consulting Ltd 507 - 511 Baltic Chambers 50 Wellington Street Glasgow G2 6HJ
F.A.O.	Michel Baron
REF.	- Job N° UKAS12/10246/01
DATE OF RECEIPT	26 October 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 [serial no. 00503852] connected via a preamplifier type NH-21 [serial no. 32628] to a half-inch microphone type UC-53A [serial no. 316627] fitted with a foam windshield type WS-10. Associated calibrator Rion type NC-74 [serial no. 34372738] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	6 November 2012
PREVIOUS CALIBRATION	None known

The sound level meter was set to frequency weighting A and adjusted to read 93.9 dB (corresponding to 93.9 dB at standard atmospheric pressure) in response to the sound calibrator supplied. This reading was derived from the Calibration Certificate no. 06490 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield.

The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with clause 5 of BS 7580:Part 1:1997†.

The acoustic calibration at 1 kHz specified in subclause 5.6.1 of the standard was performed by application of a standard sound calibrator, whilst the tests at 125 Hz and 8 kHz (subclause 5.6.2) were performed by the electrostatic actuator method.

At the end of the test, the sound calibrator was reapplied to the sound level meter and the meter reading was recorded.

RESULTS

The sound level meter was found to conform to BS 7580:Part 1:1997† for a Type 1 meter.

The self-generated noise recorded in the test specified in subclause 5.5.2 was:

10.0 dB (A) ; 15.2 dB (C) ; 22.4 dB (Lin)

The sound level meter reading obtained at the end of the test in response to the sound calibrator was 93.9 dB (corresponding to 93.9 dB at standard atmospheric pressure). This reading, corrected for ambient pressure, should be used henceforth to set up the sound level meter for field use.

The expanded level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.22 dB; that of the calibrator supplied with the sound level meter is ± 0.22 dB.

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 data are held at AV Calibration for a period of at least six years.

Typical case reflection factors specified by the manufacturer have been used for this verification.

The reference range, linearity range and primary indicator range specified by the manufacturers have been used.[see note 4]

The Rion NL-31 sound level meter design has successfully undergone pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB). It was found to meet the requirements of BS EN 60651* and BS EN 60804* and was granted pattern approval as a Type 1 sound level meter.

No component of uncertainty for manufacturer-specified corrections has been included in the uncertainty budget and, in accordance with Amendment No. 1 to BS 7580:Part 1:1997†, the measured values obtained during the verification have not been extended by any measurement uncertainty when assessing conformance to the standard.

NOTES

*1 BS EN 60651:1994 and BS EN 60804:1994 were formerly numbered BS 5969:1981 and BS 6698:1986 respectively.

†2 BS 7580:Part 1:1997 was formerly numbered BS 7580:1992 .

3 The NL-31 does not have a "max hold" function available when operating with time weighting I. The results given for the tests of time weighting I are therefore the highest instantaneous reading shown on the display. Whilst these results meet the requirements of the standard, those for response to a single tone burst in particular may give a misleading impression of the accuracy of time weighting I on this instrument.

4 After consultation with the manufacturers and their European agents, it has been established that the specifications given in the standard English-language handbook for the NL-31 are both incomplete and incorrect. An addendum to the handbook based on the PTB tests has been provided by Rion, and this revised specification has been used for the purposes of the present verification. For information, extracts from the addendum have been appended as page 8 of this certificate.

5 The instrument was tested with integral software as received.

6 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not covered by our accreditation.

7 It was noted that the instrument was reading 1.0 dB low in response to the associated sound calibrator as received.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate Number 06808

Measurement data - linearity at 4 kHz

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
28.0	0.0	0.0
29.0	0.0	0.0
30.0	0.0	0.0
31.0	0.0	0.0
32.0	0.0	0.0
33.0	0.0	0.0
34.0	0.0	0.0
39.0	0.0	0.0
44.0	0.0	0.0
49.0	0.0	0.0
54.0	0.0	0.0
59.0	0.0	0.0
64.0	0.0	0.0
69.0	0.0	0.0
74.0	0.0	0.0
79.0	0.0	0.0
84.0	0.0	0.0
89.0	0.0	0.0
94.0	0.0	0.0
99.0	0.0	0.0
104.0	0.0	0.0
109.0	0.0	0.0
114.0	0.0	0.0
119.0	0.0	0.0

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
122.0	0.0	0.0
123.0	0.0	0.0
124.0	0.0	0.0
125.0	0.0	0.0
126.0	0.0	0.0
127.0	0.0	0.0

Other measurement ranges		
Instrument reading, dB	Range	Leq error, dB
94.0	20 - 90	0.1
94.0	20 - 100	0.0
94.0	20 - 110	0.0
94.0	40 - 130	0.1
85.0	20 - 80	0.1
95.0	20 - 90	0.1
105.0	20 - 100	0.0
115.0	20 - 110	0.0
135.0	40 - 130	0.0
34.0	20 - 80	0.1
34.0	20 - 90	0.1
34.0	20 - 100	0.1
34.0	20 - 110	0.1
40.0	40 - 130	0.0

continued.....

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

.....continued

Largest overall errors, dB		
Positive	Negative	Tolerance
0.1	0.0	± 0.7*
0.1	0.0	± 1.0**

*= within primary indicator range

**= outside primary indicator range

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

Measurement data - frequency response. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	Largest error in A-weighting, dB		Largest error in C-weighting, dB		Largest error in Lin-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
31.5	0.1	-0.1	0.2	0.0	0.0	-0.2	± 1.5
63	0.1	-0.1	0.1	-0.1	0.0	-0.2	± 1.5
125	0.0	-0.2	0.1	-0.1	-0.1	-0.3	± 1.0
250	0.0	-0.2	0.1	-0.1	0.0	-0.2	± 1.0
500	-0.1	-0.3	0.1	-0.1	0.0	-0.2	± 1.0
1000	0.0	-0.1	0.0	-0.1	0.0	-0.1	± 1.0
2000	0.4	0.2	0.2	0.0	0.0	-0.2	± 1.0
4000	0.6	0.4	0.4	0.2	0.4	0.2	± 1.0
8000	0.7	0.5	0.5	0.3	0.3	0.1	+ 1.5, – 3.0
12500	0.8	0.6	0.8	0.6	0.2	0.0	+ 3.0, – 6.0

The estimated expanded measurement uncertainty for frequency response measurements is ± 0.23 dB except for those shaded above, where ± 0.26 dB applies.

Measurement data - Time weightings F, S and I

Time weighting	Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
F	Single toneburst	106.0	106.0	106.0	106.0 ± 1.0
S		102.9	102.9	102.9	102.9 ± 1.0
I		100.9	100.6	101.0	102.2 ± 2.0
	Pulse chain	108.2	N/A	N/A	108.3 ± 1.0

The estimated expanded measurement uncertainty for measurements of Time Weighting F, S and I is ± 0.20 dB

Measurement data - Peak response

Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
+ve 10 ms pulse	109.7	109.9	109.6	≥ 108.0
-ve 10 ms pulse	109.9	109.6	109.5	

The estimated expanded measurement uncertainty for measurements of Peak response is ± 0.29 dB

Measurement data - RMS accuracy for signal of crest factor 3

Instrument reading, dB	Requirement, dB
109.0	109.0 ± 0.5

The estimated expanded measurement uncertainty for measurements of RMS accuracy is ± 0.23 dB

Measurement data - Time averaging

Burst duty factor	Instrument reading, dB	Requirement, dB
1/1000	97.0	97.0 ± 1.0
1/10000	86.9	87.0 ± 1.0

The estimated expanded measurement uncertainty for measurements of time averaging is ± 0.23 dB

Measurement data - Pulse range

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	55.9	55.9	55.9	56.0 ± 1.7
67.0	94.8	94.8	94.8	95.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of pulse range is ± 0.23 dB

Measurement data - Sound exposure level

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	65.9	65.9	65.9	66.0 ± 1.7
67.0	104.8	104.8	104.8	105.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of SEL is ± 0.23 dB

Measurement data - Overload indicator (non-integrating)

Instrument reading, dB	Target, dB	Tolerance, dB
117.2	117.2	± 0.4

The estimated expanded measurement uncertainty for measurements of overload indicator response in non-integrating mode is ± 0.23 dB

Measurement data - Overload indicator (integrating)

Reading 1, dB	Reading 2, dB	Reading 3, dB	Target, dB	Tolerance, dB
86.1	86.1	86.1	86.2	± 2.2

The estimated expanded measurement uncertainty for measurements of overload indicator response in integrating mode is ± 0.23 dB

Measurement data - Electrostatic actuator tests at 125 Hz and 8 kHz. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	Averaged reading, dB	Target, dB	Tolerance, dB
125	78.3	78.4	± 1.0
8000	78.8		+1.5, -3.0

The estimated expanded measurement uncertainty for electrostatic actuator measurements is ± 0.22 dB

The following data supplied by Rion are included for completeness:

Addendum to the NL-31 Instruction Manual

Errata (page 133):

- Total range: 23 to 137 dB(A).
- Linearity range (on 30 - 120 dB reference range): 99 dB (28 to 127).

Additional information

- Primary indicator range (on 30 - 120 dB reference range): 32 - 111 dB, allowing a crest factor of 10 for Impulse time weighting.
- Pulse range: > 63 dB
- Measurement range for various LEVEL settings: See table below.

Measurement ranges

Measurement range for various "LEVEL" range settings (dB) *
Frequency weighting A-, C- and Lin.

"LEVEL" setting (dB)	Time weighting			Leq
	Fast/Slow	Impulse	Peak	
20 - 80	23 – 80 **	23 – 70 **	50 – 90	23 – 87 **
20 - 90	23 – 90 **	23 – 80 **	50 – 100	23 – 97 **
20 - 100	23 – 100**	23 – 90 **	50 – 110	23 – 107 **
20 - 110	23 – 110**	23 – 100 **	50 – 120	23 – 117 **
30 - 120	28 – 120**	28 – 110 **	50 – 130	28 – 127 **
40 - 130	38 – 130	38 – 120	50 – 140	38 – 137

*For time weighting Fast and Slow a crest factor 3, and for time weighting Impulse a crest factor 10, is taken into account.
**The lower limit of the measurement range is 30 dB(C) for C- weighting and 35 dB(Lin) for Lin- weighting.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 1 March 2012 Certificate N° 06399

UKAS CALIBRATION
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Approved Signatory
R.G.Tyler

CLIENT	Arcus Renewable Energy Consulting Ltd 2F Swinegate Court East 3 Swinegate York YO1 8AJ
F.A.O.	Alan Moore
REF.	Job N° UKAS12/02050/06
DATE OF RECEIPT	22 February 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 [serial no. 00593606] connected via a preamplifier type NH-21 [serial no. 30368] to a half-inch microphone type UC-53A [serial no. 316134] fitted with a foam windshield type WS-10. Associated calibrator Rion type NC-74 [serial no. 34104515] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	1 March 2012
PREVIOUS CALIBRATION	None known

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 1 March 2012 Certificate N° 06396

UKAS CALIBRATION
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CLIENT	Arcus Renewable Energy Consulting Ltd 2F Swinegate Court East 3 Swinegate York YO1 8AJ
F.A.O.	Alan Moore
REF.	Job N° UKAS12/02050/04
DATE OF RECEIPT	22 February 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 [serial no. 00593608] connected via a preamplifier type NH-21 [serial no. 30370] to a half-inch microphone type UC-53A [serial no. 316136] fitted with a foam windshield type WS-10. Associated calibrator Rion type NC-74 [serial no. 34104515] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	29 February 2012
PREVIOUS CALIBRATION	None known

The sound level meter was set to frequency weighting A and adjusted to read 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure) in response to the sound calibrator supplied. This reading was derived from the Calibration Certificate no. 06390 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield.

The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with clause 5 of BS 7580:Part 1:1997†.

The acoustic calibration at 1 kHz specified in subclause 5.6.1 of the standard was performed by application of a standard sound calibrator, whilst the tests at 125 Hz and 8 kHz (subclause 5.6.2) were performed by the electrostatic actuator method.

At the end of the test, the sound calibrator was reapplied to the sound level meter and the meter reading was recorded.

RESULTS

The sound level meter was found to conform to BS 7580:Part 1:1997† for a Type 1 meter.

The self-generated noise recorded in the test specified in subclause 5.5.2 was:

7.1 dB (A) ; 11.2 dB (C) ; 19.2 dB (Lin)

The sound level meter reading obtained at the end of the test in response to the sound calibrator was 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure). This reading, corrected for ambient pressure, should be used henceforth to set up the sound level meter for field use.

The expanded level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.22 dB; that of the calibrator supplied with the sound level meter is ± 0.22 dB.

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 data are held at AV Calibration for a period of at least six years.

Typical case reflection factors specified by the manufacturer have been used for this verification.

The reference range, linearity range and primary indicator range specified by the manufacturers have been used.[see note 4]

The Rion NL-31 sound level meter design has successfully undergone pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB). It was found to meet the requirements of BS EN 60651* and BS EN 60804* and was granted pattern approval as a Type 1 sound level meter.

No component of uncertainty for manufacturer-specified corrections has been included in the uncertainty budget and, in accordance with Amendment No. 1 to BS 7580:Part 1:1997†, the measured values obtained during the verification have not been extended by any measurement uncertainty when assessing conformance to the standard.

NOTES

*1 BS EN 60651:1994 and BS EN 60804:1994 were formerly numbered BS 5969:1981 and BS 6698:1986 respectively.

†2 BS 7580:Part 1:1997 was formerly numbered BS 7580:1992 .

3 The NL-31 does not have a "max hold" function available when operating with time weighting I. The results given for the tests of time weighting I are therefore the highest instantaneous reading shown on the display. Whilst these results meet the requirements of the standard, those for response to a single tone burst in particular may give a misleading impression of the accuracy of time weighting I on this instrument.

4 After consultation with the manufacturers and their European agents, it has been established that the specifications given in the standard English-language handbook for the NL-31 are both incomplete and incorrect. An addendum to the handbook based on the PTB tests has been provided by Rion, and this revised specification has been used for the purposes of the present verification. For information, extracts from the addendum have been appended as page 8 of this certificate.

5. The instrument was tested with integral software as received.

6 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not covered by our accreditation.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate Number 06396

Measurement data - linearity at 4 kHz

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
28.0	0.0	0.0
29.0	-0.1	-0.1
30.0	-0.1	-0.1
31.0	-0.1	-0.1
32.0	0.0	0.0
33.0	0.0	0.0
34.0	-0.1	-0.1
39.0	0.0	0.0
44.0	0.0	0.0
49.0	0.0	0.0
54.0	0.0	0.0
59.0	0.0	0.0
64.0	0.0	0.0
69.0	0.0	0.0
74.0	0.0	0.0
79.0	0.0	0.0
84.0	0.0	0.0
89.0	0.0	0.0
94.0	0.0	0.0
99.0	0.0	0.0
104.0	0.0	0.0
109.0	0.0	0.0
114.0	0.0	0.0
119.0	0.0	0.0

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
122.0	0.0	0.0
123.0	0.0	0.0
124.0	0.0	0.0
125.0	0.0	0.0
126.0	0.0	0.0
127.0	0.0	0.1

Other measurement ranges		
Instrument reading, dB	Range	Leq error, dB
94.0	20 - 90	0.1
94.0	20 - 100	0.1
94.0	20 - 110	0.1
94.0	40 - 130	0.1
85.0	20 - 80	0.2
95.0	20 - 90	0.1
105.0	20 - 100	0.1
115.0	20 - 110	0.1
135.0	40 - 130	0.1
34.0	20 - 80	0.1
34.0	20 - 90	0.1
34.0	20 - 100	0.1
34.0	20 - 110	0.1
40.0	40 - 130	-0.1

continued.....

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

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Largest overall errors, dB		
Positive	Negative	Tolerance
0.2	-0.1	± 0.7*
0.3	-0.1	± 1.0**

*= within primary indicator range

**= outside primary indicator range

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

Measurement data - frequency response. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	bLargest error in A-weighting, dB		Largest error in C-weighting, dB		Largest error in Lin-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
31.5	0.0	-0.2	0.0	-0.2	0.0	-0.2	± 1.5
63	0.1	-0.1	0.1	-0.1	0.0	-0.2	± 1.5
125	-0.2	-0.4	0.0	-0.2	-0.1	-0.3	± 1.0
250	-0.1	-0.3	0.0	-0.2	0.0	-0.2	± 1.0
500	-0.2	-0.4	0.0	-0.2	0.0	-0.2	± 1.0
1000	0.0	-0.1	0.0	-0.1	0.0	-0.1	± 1.0
2000	0.2	0.0	0.0	-0.2	0.0	-0.2	± 1.0
4000	0.5	0.3	0.4	0.2	0.4	0.2	± 1.0
8000	0.5	0.3	0.3	0.1	0.2	0.0	+ 1.5, – 3.0
12500	0.4	0.2	0.4	0.2	-0.1	-0.3	+ 3.0, – 6.0

The estimated expanded measurement uncertainty for frequency response measurements is ± 0.23 dB except for those shaded above, where ± 0.26 dB applies.

Measurement data - Time weightings F, S and I

Time weighting	Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
F	Single toneburst	105.9	106.0	106.0	106.0 ± 1.0
S		102.9	102.9	102.9	102.9 ± 1.0
I		101.7	101.9	101.7	102.2 ± 2.0
	Pulse chain	108.2	N/A	N/A	108.3 ± 1.0

The estimated expanded measurement uncertainty for measurements of Time Weighting F, S and I is ± 0.20 dB

Measurement data - Peak response

Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
+ve 10 ms pulse	109.6	109.9	109.9	≥ 108.0
-ve 10 ms pulse	109.8	109.7	109.6	

The estimated expanded measurement uncertainty for measurements of Peak response is ± 0.29 dB

Measurement data - RMS accuracy for signal of crest factor 3

Instrument reading, dB	Requirement, dB
109.0	109.0 ± 0.5

The estimated expanded measurement uncertainty for measurements of RMS accuracy is ± 0.23 dB

Measurement data - Time averaging

Burst duty factor	Instrument reading, dB	Requirement, dB
1/1000	96.9	97.0 ± 1.0
1/10000	87.0	87.0 ± 1.0

The estimated expanded measurement uncertainty for measurements of time averaging is ± 0.23 dB

Measurement data - Pulse range

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	56.0	56.0	56.0	56.0 ± 1.7
67.0	94.9	94.9	94.9	95.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of pulse range is ± 0.23 dB

Measurement data - Sound exposure level

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	66.0	66.0	66.0	66.0 ± 1.7
67.0	104.9	104.9	104.9	105.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of SEL is ± 0.23 dB

Measurement data - Overload indicator (non-integrating)

Instrument reading, dB	Target, dB	Tolerance, dB
117.2	117.2	± 0.4

The estimated expanded measurement uncertainty for measurements of overload indicator response in non-integrating mode is ± 0.23 dB

Measurement data - Overload indicator (integrating)

Reading 1, dB	Reading 2, dB	Reading 3, dB	Target, dB	Tolerance, dB
86.1	86.1	86.1	86.2	± 2.2

The estimated expanded measurement uncertainty for measurements of overload indicator response in integrating mode is ± 0.23 dB

Measurement data - Electrostatic actuator tests at 125 Hz and 8 kHz. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	Averaged reading, dB	Target, dB	Tolerance, dB
125	79.2	79.4	± 1.0
8000	79.3		+1.5, -3.0

The estimated expanded measurement uncertainty for electrostatic actuator measurements is ± 0.22 dB

The following data supplied by Rion are included for completeness:

Addendum to the NL-31 Instruction Manual

Errata (page 133):

- Total range: 23 to 137 dB(A).
- Linearity range (on 30 - 120 dB reference range): 99 dB (28 to 127).

Additional information

- Primary indicator range (on 30 - 120 dB reference range): 32 - 111 dB, allowing a crest factor of 10 for Impulse time weighting.
- Pulse range: > 63 dB
- Measurement range for various LEVEL settings: See table below.

Measurement ranges

Measurement range for various "LEVEL" range settings (dB) *
Frequency weighting A-, C- and Lin.

"LEVEL" setting (dB)	Time weighting			Leq
	Fast/Slow	Impulse	Peak	
20 - 80	23 – 80 **	23 – 70 **	50 – 90	23 – 87 **
20 - 90	23 – 90 **	23 – 80 **	50 – 100	23 – 97 **
20 - 100	23 – 100**	23 – 90 **	50 – 110	23 – 107 **
20 - 110	23 – 110**	23 – 100 **	50 – 120	23 – 117 **
30 - 120	28 – 120**	28 – 110 **	50 – 130	28 – 127 **
40 - 130	38 – 130	38 – 120	50 – 140	38 – 137

*For time weighting Fast and Slow a crest factor 3, and for time weighting Impulse a crest factor 10, is taken into account.
**The lower limit of the measurement range is 30 dB(C) for C- weighting and 35 dB(Lin) for Lin- weighting.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 1 March 2012 Certificate N° 06397

UKAS CALIBRATION
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CLIENT	Arcus Renewable Energy Consulting Ltd 2F Swinegate Court East 3 Swinegate York YO1 8AJ
F.A.O.	Alan Moore
REF.	Job N° UKAS12/02050/05
DATE OF RECEIPT	22 February 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 [serial no. 00593610] connected via a preamplifier type NH-21 [serial no. 30372] to a half-inch microphone type UC-53A [serial no. 316138] fitted with a foam windshield type WS-10. Associated calibrator Rion type NC-74 [serial no. 34104515] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	1 March 2012
PREVIOUS CALIBRATION	None known

The sound level meter was set to frequency weighting A and adjusted to read 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure) in response to the sound calibrator supplied. This reading was derived from the Calibration Certificate no. 06390 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield.

The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with clause 5 of BS 7580:Part 1:1997†.

The acoustic calibration at 1 kHz specified in subclause 5.6.1 of the standard was performed by application of a standard sound calibrator, whilst the tests at 125 Hz and 8 kHz (subclause 5.6.2) were performed by the electrostatic actuator method.

At the end of the test, the sound calibrator was reapplied to the sound level meter and the meter reading was recorded.

RESULTS

The sound level meter was found to conform to BS 7580:Part 1:1997† for a Type 1 meter.

The self-generated noise recorded in the test specified in subclause 5.5.2 was:

8.7 dB (A) ; 13.1 dB (C) ; 20.8 dB (Lin)

The sound level meter reading obtained at the end of the test in response to the sound calibrator was 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure). This reading, corrected for ambient pressure, should be used henceforth to set up the sound level meter for field use.

The expanded level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.22 dB; that of the calibrator supplied with the sound level meter is ± 0.22 dB.

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 data are held at AV Calibration for a period of at least six years.

Typical case reflection factors specified by the manufacturer have been used for this verification.

The reference range, linearity range and primary indicator range specified by the manufacturers have been used.[see note 4]

The Rion NL-31 sound level meter design has successfully undergone pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB). It was found to meet the requirements of BS EN 60651* and BS EN 60804* and was granted pattern approval as a Type 1 sound level meter.

No component of uncertainty for manufacturer-specified corrections has been included in the uncertainty budget and, in accordance with Amendment No. 1 to BS 7580:Part 1:1997†, the measured values obtained during the verification have not been extended by any measurement uncertainty when assessing conformance to the standard.

NOTES

*1 BS EN 60651:1994 and BS EN 60804:1994 were formerly numbered BS 5969:1981 and BS 6698:1986 respectively.

†2 BS 7580:Part 1:1997 was formerly numbered BS 7580:1992 .

3 The NL-31 does not have a "max hold" function available when operating with time weighting I. The results given for the tests of time weighting I are therefore the highest instantaneous reading shown on the display. Whilst these results meet the requirements of the standard, those for response to a single tone burst in particular may give a misleading impression of the accuracy of time weighting I on this instrument.

4 After consultation with the manufacturers and their European agents, it has been established that the specifications given in the standard English-language handbook for the NL-31 are both incomplete and incorrect. An addendum to the handbook based on the PTB tests has been provided by Rion, and this revised specification has been used for the purposes of the present verification. For information, extracts from the addendum have been appended as page 8 of this certificate.

5. The instrument was tested with integral software as received.

6 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not covered by our accreditation.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate Number 06397

Measurement data - linearity at 4 kHz

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
28.0	0.0	0.0
29.0	-0.1	-0.1
30.0	-0.1	-0.1
31.0	-0.1	-0.1
32.0	0.0	0.0
33.0	0.0	0.0
34.0	-0.1	-0.1
39.0	0.0	0.0
44.0	0.0	0.0
49.0	0.0	0.0
54.0	0.0	0.0
59.0	0.0	0.1
64.0	0.0	0.0
69.0	0.0	0.0
74.0	0.0	0.0
79.0	0.0	0.0
84.0	0.0	0.0
89.0	0.0	0.0
94.0	0.0	0.0
99.0	0.0	0.0
104.0	0.0	0.0
109.0	0.0	0.0
114.0	0.0	0.0
119.0	0.0	0.0

Reference range (30 - 120)		
Instrument reading, dB	Leq error, dB	SPL error, dB
122.0	0.0	0.0
123.0	0.0	0.0
124.0	0.0	0.0
125.0	0.0	0.0
126.0	0.0	0.0
127.0	0.0	0.0

Other measurement ranges		
Instrument reading, dB	Range	Leq error, dB
94.0	20 - 90	0.0
94.0	20 - 100	0.0
94.0	20 - 110	0.0
94.0	40 - 130	0.0
85.0	20 - 80	0.1
95.0	20 - 90	0.1
105.0	20 - 100	0.1
115.0	20 - 110	0.1
135.0	40 - 130	0.1
34.0	20 - 80	0.1
34.0	20 - 90	0.1
34.0	20 - 100	0.0
34.0	20 - 110	0.0
40.0	40 - 130	0.0

continued.....

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

.....continued

Largest overall errors, dB		
Positive	Negative	Tolerance
0.2	-0.1	± 0.7*
0.1	-0.1	± 1.0**

*= within primary indicator range

**= outside primary indicator range

The estimated expanded measurement uncertainty for linearity measurements is ± 0.20 dB

Measurement data - frequency response. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	Largest error in A-weighting, dB		Largest error in C-weighting, dB		Largest error in Lin-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
31.5	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	± 1.5
63	0.1	0.0	0.0	0.0	-0.1	-0.1	± 1.5
125	-0.2	-0.2	0.0	0.0	-0.1	-0.1	± 1.0
250	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	± 1.0
500	-0.2	-0.2	0.0	0.0	0.0	0.0	± 1.0
1000	0.0	0.0	0.0	0.0	0.0	0.0	± 1.0
2000	0.2	0.1	-0.1	-0.1	-0.1	-0.1	± 1.0
4000	0.1	0.0	-0.2	-0.2	-0.1	-0.1	± 1.0
8000	-0.4	-0.4	-0.6	-0.6	-0.7	-0.7	+ 1.5, – 3.0
12500	-0.1	-0.1	-0.1	-0.1	-0.6	-0.6	+ 3.0, – 6.0

The estimated expanded measurement uncertainty for frequency response measurements is ± 0.23 dB except for those shaded above, where ± 0.26 dB applies.

Measurement data - Time weightings F, S and I

Time weighting	Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
F	Single toneburst	106.0	106.0	106.0	106.0 ± 1.0
S		103.0	103.0	103.0	102.9 ± 1.0
I		101.0	100.8	101.9	102.2 ± 2.0
	Pulse chain	108.2	N/A	N/A	108.3 ± 1.0

The estimated expanded measurement uncertainty for measurements of Time Weighting F, S and I is ± 0.20 dB

Measurement data - Peak response

Signal type	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
+ve 10 ms pulse	109.7	109.8	109.6	≥ 108.0
-ve 10 ms pulse	109.8	109.8	109.9	

The estimated expanded measurement uncertainty for measurements of Peak response is ± 0.29 dB

Measurement data - RMS accuracy for signal of crest factor 3

Instrument reading, dB	Requirement, dB
108.9	109.0 ± 0.5

The estimated expanded measurement uncertainty for measurements of RMS accuracy is ± 0.23 dB

Measurement data - Time averaging

Burst duty factor	Instrument reading, dB	Requirement, dB
1/1000	97.0	97.0 ± 1.0
1/10000	87.0	87.0 ± 1.0

The estimated expanded measurement uncertainty for measurements of time averaging is ± 0.23 dB

Measurement data - Pulse range

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	55.9	55.8	55.9	56.0 ± 1.7
67.0	94.9	94.9	94.9	95.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of pulse range is ± 0.23 dB

Measurement data - Sound exposure level

Background sig., dB	Reading 1, dB	Reading 2, dB	Reading 3, dB	Requirement, dB
28.0	65.9	65.8	65.9	66.0 ± 1.7
67.0	104.9	104.9	104.9	105.0 ± 1.7

The estimated expanded measurement uncertainty for measurements of SEL is ± 0.23 dB

Measurement data - Overload indicator (non-integrating)

Instrument reading, dB	Target, dB	Tolerance, dB
117.2	117.2	± 0.4

The estimated expanded measurement uncertainty for measurements of overload indicator response in non-integrating mode is ± 0.23 dB

Measurement data - Overload indicator (integrating)

Reading 1, dB	Reading 2, dB	Reading 3, dB	Target, dB	Tolerance, dB
86.0	86.0	85.9	86.0	± 2.2

The estimated expanded measurement uncertainty for measurements of overload indicator response in integrating mode is ± 0.23 dB

Measurement data - Electrostatic actuator tests at 125 Hz and 8 kHz. The following data include all corrections for microphone response, linearity errors, windshield and case reflections.

Frequency, Hz	Averaged reading, dB	Target, dB	Tolerance, dB
125	79.4	79.5	± 1.0
8000	78.7		+1.5, -3.0

The estimated expanded measurement uncertainty for electrostatic actuator measurements is ± 0.22 dB

The following data supplied by Rion are included for completeness:

Addendum to the NL-31 Instruction Manual

Errata (page 133):

- Total range: 23 to 137 dB(A).
- Linearity range (on 30 - 120 dB reference range): 99 dB (28 to 127).

Additional information

- Primary indicator range (on 30 - 120 dB reference range): 32 - 111 dB, allowing a crest factor of 10 for Impulse time weighting.
- Pulse range: > 63 dB
- Measurement range for various LEVEL settings: See table below.

Measurement ranges				
Measurement range for various "LEVEL" range settings (dB) * Frequency weighting A-, C- and Lin.				
"LEVEL" setting (dB)	Time weighting			Leq
	Fast/Slow	Impulse	Peak	
20 - 80	23 – 80 **	23 – 70 **	50 – 90	23 – 87 **
20 - 90	23 – 90 **	23 – 80 **	50 – 100	23 – 97 **
20 - 100	23 – 100**	23 – 90 **	50 – 110	23 – 107 **
20 - 110	23 – 110**	23 – 100 **	50 – 120	23 – 117 **
30 - 120	28 – 120**	28 – 110 **	50 – 130	28 – 127 **
40 - 130	38 – 130	38 – 120	50 – 140	38 – 137

*For time weighting Fast and Slow a crest factor 3, and for time weighting Impulse a crest factor 10, is taken into account.
**The lower limit of the measurement range is 30 dB(C) for C- weighting and 35 dB(Lin) for Lin- weighting.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 2 November 2011 Certificate N° 06180

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Approved Signatory
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CLIENT	Arcus Renewable Energy Consulting Ltd 2F Swinegate Court East 3 Swinegate York YO1 8AJ
F.A.O.	Neil Dodds
REF.	Order N° BM141011 (ANV) Job N° UKAS11/10233/01
DATE OF RECEIPT	17 October 2011
PROCEDURE	AV Calibration Engineer's Handbook, Section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter Rion type NL-31 [serial no. 01062688] connected via a preamplifier type NH-21 [serial no. 20326] to a half-inch microphone type UC-53A [serial no. 310533]. Associated calibrator Rion type NC-74 [serial no. 34372738] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	31 October 2011
PREVIOUS CALIBRATION	Calibrated on 13 October 2009 Certificate Nº 04844 issued by UKAS laboratory Nº 0653

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 8 August 2013 Certificate N° 07273

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Approved Signatory
G.Parry

CLIENT	Arcus Consultancy Services 7th Floor 145 St Vincent Street Glasgow G2 5JF
F.A.O.	Michel Baron
REF.	- Job N° UKAS13/07163/02
DATE OF RECEIPT	29 July 2013
PROCEDURE	AV Calibration Engineer's Handbook, Section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 Edition 2:June 2009
IDENTIFICATION	Sound level meter Rion type NL-52 [serial no. 00510130] connected via an extension lead type EC-04 and preamplifier type NH-25 [serial no. 10123] to a half-inch microphone type UC-59 [serial no. 02831] fitted with a foam windshield type WS-10. Associated calibrator Rion type NC-74 [serial no. 35105087] with one-inch housing and adapter type NC-74-002 for half-inch microphone.
CALIBRATED ON	6 August 2013
PREVIOUS CALIBRATION	None known

The sound level meter was set up using the type NC-74 sound calibrator supplied; it was set to frequency weighting A, and initially read 94.2 dB. It was then adjusted to read 93.9 dB (corresponding to 93.9 dB at standard atmospheric pressure). This reading was derived from Calibration Certificate no. 07262 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The calibration check frequency was 1 kHz.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 Edition 2:June 2009 were used to perform the periodic tests.

RESULTS

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

The self-generated noise recorded with the microphone replaced by the electrical input device was:

11.5 dB (A) ; 16.2 dB (C) ; 21.7 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 22 to 23 °C, 31 to 41 %RH and 100.9 to 101.0 kPa
End: 22 to 23 °C, 32 to 42 %RH and 100.9 to 101.0 kPa

All measurement data are held at AV Calibration for a period of at least six years.

Technical information including adjustment data specified in the *Technical Notes* 55750 (11-03), *Instruction Manual* 55530 (11-03), *Description for IEC 61672-1* 56030 (11-04) and additional data supplied by Rion has been used to carry out this verification. No information on the uncertainty of measurement, required by 11.7 of IEC 61672-3:2006 (BS EN 61672-3:2006), of some of the adjustment data given in the technical notes was made available by the manufacturer. The uncertainty of measurement of these 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 (BS EN 61672-1:2003).

Publicly-available evidence has been found that the Rion NL-52 sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

LABORATORY MEASUREMENT UNCERTAINTIES

The measured errors obtained during testing have been extended by the laboratory's expanded measurement uncertainty before assessing conformance to the standard, and it is these extended errors which are quoted in the following pages. In accordance with convention, positive measured errors have been extended by the positive value of expanded uncertainty, and negative measured errors by the negative value. Where a bilateral extended error (± n.n dB) is given, this implies that the measured error was numerically zero.

The laboratory's expanded measurement uncertainties, including contributions from manufacturer-specified corrections where appropriate, are as follows:

Test ①: ± 0.33 dB @ 125 Hz; ± 0.47 dB @ 8 kHz
Test ②: (± dB) 0.33 @ 63 Hz; 0.33 @ 125 Hz; 0.33 @ 250 Hz; 0.33 @ 500 Hz; 0.33 @ 1kHz; 0.33 @ 2 kHz; 0.36 @ 4 kHz; 0.47 @ 8kHz; 0.61 @ 16kHz
Test ③: ± 0.13 dB
Tests ④⑤: ± 0.20 dB
Test ⑥: ± 0.27 dB
Test ⑦: ± 0.23 dB
Sound calibrator: ± 0.22 dB

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.

Measurement data - Test ① : Acoustical signal test of frequency weighting C (electrostatic actuator method)

Frequency, Hz	Extended error, dB	Tolerance, dB
125	0.51	± 1.5
8000	-1.02	+2.1, -3.1

The above data include manufacturer-specified corrections for case reflections

Measurement data - Test ② : Electrical signal tests of frequency weightings

Frequency, Hz	Extended error in A-weighting, dB		Extended error in C-weighting, dB		Extended error in Z-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
63	0.33	-0.33	0.43	-0.23	0.43	-0.23	± 1.5
125	0.23	-0.43	0.43	-0.23	0.33	-0.33	± 1.5
250	0.13	-0.53	0.23	-0.43	0.23	-0.43	± 1.4
500	0.33	-0.33	0.33	-0.33	0.33	-0.33	± 1.4
1000	REF	REF	REF	REF	REF	REF	REF
2000	0.43	-0.23	0.43	-0.23	0.43	-0.23	± 1.6
4000	0.36	-0.36	0.36	-0.36	0.36	-0.36	± 1.6
8000	0.27	-0.67	0.27	-0.67	0.27	-0.67	+2.1, -3.1
16000	-3.99	-5.21	-3.99	-5.21	-2.69	-3.91	+3.5, -17.0

The above data include manufacturer-specified corrections for the **measured** microphone response and windshield

Measurement data - Test ③ : Frequency and time weightings at 1 kHz

Parameter measured	Extended error, dB	Tolerance, dB
LAF	REF	REF
LCF	± 0.13	± 0.4
LZF	± 0.13	± 0.4
LAS	± 0.13	± 0.3
LAeq	± 0.13	± 0.3

Measurement data - Test ④: Level linearity on the reference level range (at 8 kHz, ref 94.0 dB).

Reference (only) range		
Nominal reading, dB	Extended error, dB	Warning flags
24.0	U/R	U/R
25.0	0.30	¤
26.0	0.30	¤
27.0	0.30	¤
28.0	0.30	¤
29.0	0.30	¤
30.0	± 0.20	¤
34.0	± 0.20	¤
39.0	± 0.20	¤
44.0	± 0.20	¤
49.0	± 0.20	¤
54.0	± 0.20	¤
59.0	± 0.20	¤
64.0	± 0.20	¤
69.0	± 0.20	¤
74.0	± 0.20	¤
79.0	± 0.20	¤
84.0	± 0.20	¤
89.0	± 0.20	¤
94.0	Ref	¤
99.0	± 0.20	¤
104.0	± 0.20	¤
109.0	± 0.20	¤
114.0	± 0.20	¤
119.0	± 0.20	¤
124.0	± 0.20	¤
129.0	± 0.20	¤

Reference (only) range		
Nominal reading, dB	Extended error, dB	Warning flags
131.0	± 0.20	¤
132.0	± 0.20	¤
133.0	± 0.20	¤
134.0	± 0.20	¤
135.0	± 0.20	¤
136.0	± 0.20	¤
137.0	± 0.20	¤
138.0	O/L	O/L
139.0	O/L	O/L

¤ denotes no warning flag

Linearity tolerances, dB	± 1.1

Measurement data - Test ⑤ Toneburst response

Parameter	Burst length ms	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
LAFmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	-0.30	-0.30	-0.30	+1.3, -1.8
	0.25	-0.30	-0.30	-0.30	+1.3, -3.3
LASmax	200	-0.30	-0.30	-0.30	± 0.8
	2	-0.30	-0.30	-0.30	+1.3, -3.3
LAE	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	-0.30	-0.30	-0.30	+1.3, -1.8
	0.25	-0.30	-0.30	-0.30	+1.3, -3.3

Measurement data - Test ⑥ : Peak C sound level

Frequency, Hz	Burst length cycles	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
8000	1	-0.37	-0.57	-0.87	± 2.4
500	+ ½	-0.47	-0.47	-0.47	± 1.4
	- ½	-0.47	-0.47	-0.47	± 1.4

Measurement data - Test ⑦ : Overload indication

Extended error in level of negative pulse required to trigger overload, relative to level of positive pulse required: -0.33 dB (tolerance ± 1.8 dB)

NOTES

1 The windscreen correction filter was set to *WS-10* and the diffuse field correction filter to *off.*

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

3 The instrument was running firmware version 1.2

4 All tests were carried out on the main measurement channel, with the exception of that for Peak C sound level which is available only on the sub-channel.

5 It was noted that in order to obtain the correct A-weighted response to the sound calibrator on the reference range, the meter had to be set 0.1 dB higher in calibration mode.

6 The following adjustment data, to be added to the electrostatic actuator response, have been issued by Rion. The uncertainties are for a coverage factor $k = 2$.

Frequency, Hz	Correction, dB	Uncertainty, dB
63	-0.02	± 0.23
125	-0.02	± 0.23
250	-0.02	± 0.23
500	-0.04	± 0.23
1000	0.00	± 0.23

Frequency, Hz	Correction, dB	Uncertainty, dB
2000	0.25	± 0.23
4000	1.04	± 0.28
8000	3.55	± 0.41
16000	9.25	± 0.57

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**14th September 2011**
Customer	**Arcus Renewable Energy Consulting Ltd**
Certificate Number	**CONF071107**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00510132
Preamplifier	Rion	NH-25	10125
Microphone	Rion	UC-59	02834

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2002 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

ANV Measurement Systems recommend that the instrument is calibrated at an interval of 12 months.

Signed..... Position..Director..... Date..15/9/11.....

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