Appendix 10A

Calibration Certificates

PERFORMANCE VERIFICATION CERTIFICATE

Functional tests & performance verification against golden reference lidar carried out at ZX Lidars premises in Hollybush, UK

Test Unit	**ZX859**
Golden Reference Unit*	**ZXGZ49**
Test Date Range	**05/02/2019-03/03/2019 (num. of 10 min data points > 600)**

*Golden reference unit was certified in February 2019 against a DNV-GL approved IEC compliant meteorological mast at the UK Remote Sensing Test Site. Verification report for the golden reference unit available upon request.

Factory Acceptance Tests:

Velocity testing and system integrity tests provide a check of several key components including wedge angle, wedge mounting, laser wavelength, and software configuration:

Test:	*Criteria:*	*Result:*
VELOCITY TEST	**VELOCITY ERROR < 0.5%**	**PASS**
DIRECTION TEST	**DIRECTION ERROR < 3°**	**PASS**
SENSITIVITY TEST	**BACKSCATTER RATIO* > 1.0**	**PASS**
FOCUS CALIBRATION	**RANGE ERROR < 1m**	**PASS**

Verification:

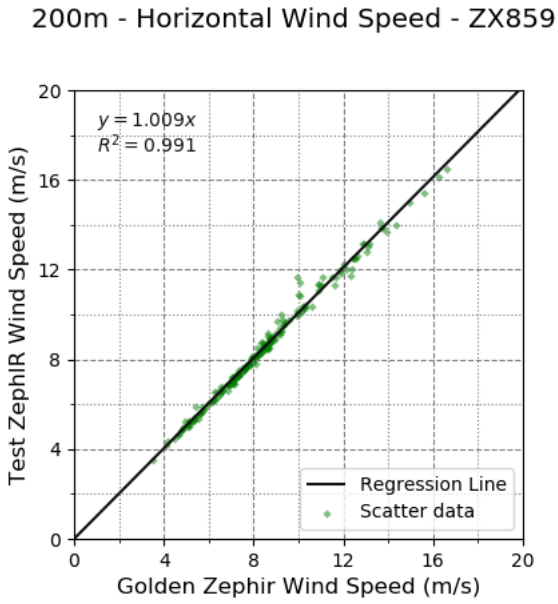
Wind speed statistics are returned from single variant regression with the regression analysis constrained to pass through the origin (y=mx+b and b=0). Analysis shall be applied to all wind speeds. Wind direction statistics are returned from single variant regression with no constraint on the origin (y=mx+b)

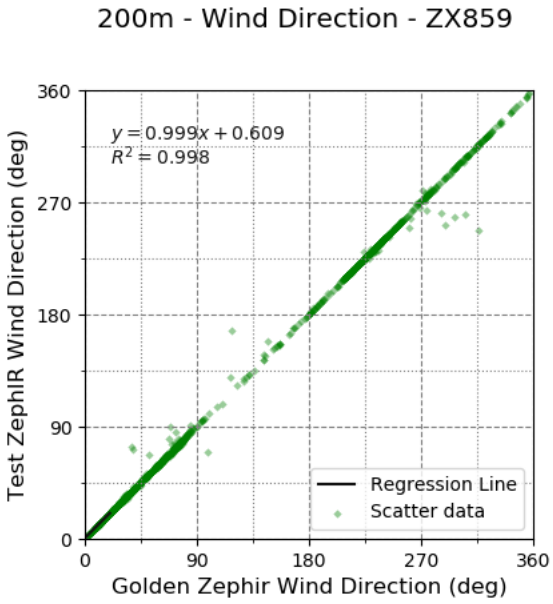
Horizontal Wind Speed:

Height	Acceptance Criteria	Result	PASS/FAIL
38m	**Slope is 0.985 - 1.010**	**1.002**	**PASS**
	R2 is > 0.990	**0.997**	**PASS**
100m	**Slope is 0.985 - 1.010**	**1.004**	**PASS**
	R2 is > 0.990	**0.997**	**PASS**
200m	**Slope is 0.985 - 1.010**	**1.000**	**PASS**
	R2 is > 0.990	**0.996**	**PASS**

Wind Direction:

Height	Acceptance Criteria	Result	PASS/FAIL
200m	**Slope is 0.990 - 1.010**	**0.999**	**PASS**
	Offset is 0 +/- 2.000	**0.450**	**PASS**
	R2 is > 0.990	**0.998**	**PASS**





Verification Outcome: Unit ZX859 has passed ZX Lidars' acceptance criteria. This document is for information only.

	Wind Data Analyst	**Wind and Verifications Engineer**	**Date**
PRINT:	Nathan Smith	S Wylie	04/03/2019
SIGN:			

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2108523

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 2611593	Id: -
Microphone:	Brüel & Kjær Type 4231	No: 2730389	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 12941	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.7.5	Pattern Approval:	PTB1.63-40478500 / 1.63-4078502
Instruction manual:	BE1712-22		

CUSTOMER

Enfonic Ltd
Unit 2A, Century Business Park
Dublin
D11 T0HV
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC6162-1:2013 class 1. Proceedures from IEC 61672-3:2013 were used perform the periodic tests. The accreditation assures the traceability of the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 7.3 - DB: 7.30) by using procedure B&K proc 2250, 4189 (IEC61672:2013)

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-08-18

Date of issue: 2021-08-18

M. Önder

Mikail Önder
Calibration Technician

Susanne Jørgensen

Susanne Jørgensen
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK
CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2101110

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250 - Light	No: 2602763	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2697054	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 12941	
Supplied Calibrator:	None		
Software version:	BZ7130 Version 4.7.2	Pattern Approval:	PTB1.63-40478500 / 1.63-4078502
Instruction manual:	BE1712-22		

CUSTOMER

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Unit 2A, Century Business Park
Dublin
D11 T0HV
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC6162-1:2013 class 1. Proceedures from IEC 61672-3:2013 were used perform the periodic tests. The accreditation assures the traceability of the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 7.3 - DB: 7.30) by using procedure B&K proc 2250, 4189 (IEC61672:2013)

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-06-24

Date of issue: 2021-06-24

M. Önder

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Susanne Jørgensen

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CERTIFICATE OF CALIBRATION

No: CDK2000408 Page 1 of 10

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 2654662	Id: - 2654662
Microphone:	Brüel & Kjær Type 4950	No: 2626990	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6822	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2460008	
Software version:	BZ7222 Version 2.1	Pattern Approval:	PTB1.63-4046158
Instruction manual:	BE1712-18		

CUSTOMER

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Century Business Park
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Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.9 - DB: 4.90) by using procedure 2250-4189.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2020-02-13

Date of issue: 2020-02-13

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Mikail Önder
Calibration Technician

Susanne Jørgensen
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DANAK
CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2100066

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250-Light	No: 3001456	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2788950	

Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.5.2	Pattern Approval:	PTB1.63-40478500 / 1.63-4078502
Instruction manual:	BE1712-22		

CUSTOMER

Enfonic Ltd
Unit 2A, Century Business Park
Dublin
D11 T0HV
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC6162-1:2013 class 1. Proceedures from IEC 61672-3:2013 were used perform the periodic tests. The accreditation assures the traceability of the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 7.3 - DB: 7.30) by using procedure B&K proc 2250, 4189 (IEC61672:2013)

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-01-21

Date of issue: 2021-01-22

M. Önder

Mikail Önder
Calibration Technician

Susanne Jørgensen

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ilac-MRA DANAK
CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2056586

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2270	No: 3001952	Id: - 2837952
Microphone:	Brüel & Kjær Type 4950	No: 2819925	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 8014	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2343370	
Software version:	BZ7222 Version 2.1	Pattern Approval:	PTB1.63-4046158
Instruction manual:	BE1712-18		

CUSTOMER

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CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2270 has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.9 - DB: 4.90) by using procedure 2270-4189.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-01-17

Date of issue: 2021-01-17

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Mikail Önder
Calibration Technician

Susanne Jørgensen
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CERTIFICATE OF CALIBRATION

No: CDK2103317

CALIBRATION OF

Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2460008 Id: -
½ Inch adaptor:	Brüel & Kjær Type UC-0210	
Pattern Approval:	PTB-1.61-4057176	

CUSTOMER

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CALIBRATION CONDITIONS

Preconditioning:	4 hours at 23°C ± 3°C
Environment conditions:	Pressure: 99.81 kPa. Humidity: 42 % RH. Temperature: 23.1 °C.

SPECIFICATIONS

The Supplied Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B Class 1. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application software Type 7794 (version 2.5) by using procedure P_4231_D07.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the 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 EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-05-17

Date of issue: 2021-05-17

Morten Høngård Hansen
Calibration Technician

Susanne Jørgensen
Approved Signatory