

**CERTIFICATE OF CALIBRATION**

No: CDK1607701

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**CALIBRATION OF**

Sound Level Meter:	Brüel & Kjær Type 3050-A-040	No: 3050-100751	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 2621142	
Preamplifier:	Brüel & Kjær Type 2669	No: 2803547	
Supplied Calibrator:	None		
Software version:	LabShop 21.0.0.567	Pattern Approval:	PENDING
Instruction manual:	BE1631		

**CUSTOMER**

Brüel & Kjær Sound & Vibration Measurement A/S  
Skodsborgvej 307  
DK-2850 Nærum  
Denmark

**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 3050-A-040 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 6.0 - DB: 6.01) by using procedure B&K proc LAN-XI-4189 (IEC61672).

**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: 2016-11-16

Date of issue: 2016-11-16



Jonas Johannessen  
Calibration Technician



Muhammad Farhan Azeem  
Approved Signatory

**1. Calibration Note**

n/a

**2. Summary**

4.1. Preliminary inspection	Passed
4.2. Environmental conditions, Prior to calibration	Passed
4.3. Channel information	Passed
4.4. Reference information	Passed
4.5. Indication at the calibration check frequency	Passed
4.6. Self-generated noise, Microphone installed	Passed
4.7. Acoustical signal tests of a frequency weighting, C weighting	Passed
4.8. Self-generated noise, Electrical	Passed
4.9. Electrical signal tests of frequency weightings, A weighting	Passed
4.10. Electrical signal tests of frequency weightings, C weighting	Passed
4.11. Electrical signal tests of frequency weightings, Z weighting	Passed
4.12. Frequency and time weightings at 1 kHz	Passed
4.13. Level linearity on the reference level range, Upper	Passed
4.14. Level linearity on the reference level range, Lower	Passed
4.15. Toneburst response, Time-weighting Fast	Passed
4.16. Toneburst response, Time-weighting Slow	Passed
4.17. Toneburst response, Leq	Passed
4.18. Peak C sound level, 8 kHz	Passed
4.19. Peak C sound level, 500 Hz	Passed
4.20. Overload indication	Passed
4.21. Environmental conditions, Following calibration	Passed

Conformance to the requirements of IEC 61672-3:2006, is demonstrated when the measured deviations extended by the actual expanded uncertainties of measurement, do not exceed the applicable tolerance limits given in IEC 61672-1:2002. (as specified in IEC 61672-3:2006 § 4.1)

The sound level meter submitted for periodic testing successfully completed the class 1 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 organization responsible 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 test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

**3. Instruments**

	<b>Instrument</b>	<b>Inventory No.</b>
Amplifier/Divider	Brüel & Kjær, Type 3111	123111003
Calibrator	Brüel & Kjær, Type 4226	124226018
Generator	Brüel & Kjær, Type 3560	123560017
Adaptor	Brüel & Kjær, Type WA-0302-B 15 pF	150503013
Voltmeter	Agilent, Type 34970A	142101027

## 4. Measurements

### 4.1. Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

	Result	
Visual inspection	OK	

### 4.2. Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured	
	[Deg C/ kPa / % RH]	
Air temperature	22.90	
Air pressure	100.80	
Relative humidity	40.00	

### 4.3. Channel information

Number of channel being calibrated.

Signal number	1	
Channel information	0	

### 4.4. Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value	
	[dB]	
Reference sound pressure level	94	
Reference level range	135	
Channel number	0	

### 4.5. Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured	Uncertainty	
	[dB / Hz]	[dB / Hz]	
Initial indication (in-house calibrator)	93.63	0.20	
Calibration check frequency (in-house calibrator)	1000.00	1.00	
Adjusted indication (in-house calibrator)	94.35	0.20	

#### 4.6. Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	
A weighted	17.20	15.48	-1.72	0.50	
Monitor Level	20.20	6.94	-13.26	0.50	

#### 4.7. Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
1000Hz, Ref. (1st)	94.44	0.10	0.00	94.34	94.36	-1.1	1.1	0.02	0.20	
1000Hz, Ref. (2nd)	94.44	0.10	0.00	94.34	94.36	-1.1	1.1	0.02	0.20	
1000Hz, Ref. (Average)	94.44	0.10	0.00	94.34	94.36	-1.1	1.1	0.02	0.20	
125.89Hz (1st)	94.40	0.00	0.00	94.22	94.27	-1.5	1.5	0.05	0.20	
125.89Hz (2nd)	94.40	0.00	0.00	94.22	94.27	-1.5	1.5	0.05	0.20	
125.89Hz (Average)	94.40	0.00	0.00	94.22	94.27	-1.5	1.5	0.05	0.20	
3981.1Hz (1st)	94.32	0.90	0.00	92.64	92.54	-1.6	1.6	-0.10	0.30	
3981.1Hz (2nd)	94.32	0.90	0.00	92.64	92.54	-1.6	1.6	-0.10	0.30	
3981.1Hz (Average)	94.32	0.90	0.00	92.64	92.54	-1.6	1.6	-0.10	0.30	
7943.3Hz (1st)	94.13	2.80	0.00	88.35	87.88	-3.1	2.1	-0.47	0.40	
7943.3Hz (2nd)	94.13	2.80	0.00	88.35	87.88	-3.1	2.1	-0.47	0.40	
7943.3Hz (Average)	94.13	2.80	0.00	88.35	87.88	-3.1	2.1	-0.47	0.40	

#### 4.8. Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.

Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the performance of the sound level meter is no longer acceptable for many practical applications. (section 10.2)

	Max	Measured	Uncertainty	
	[dB]	[dB]	[dB]	
A weighted	13.20	8.64	0.30	
C weighted	20.60	11.12	0.30	
Z weighted	20.60	15.11	0.30	

#### 4.9. Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	El.+Acous. Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-30.24	90.00	90.00	0.00	0.00	90.00	-1.1	1.1	0.00	0.12
63.096Hz	-4.04	90.00	90.05	0.00	0.00	90.05	-1.5	1.5	0.05	0.12
125.89Hz	-14.14	90.00	90.02	0.00	0.00	90.02	-1.5	1.5	0.02	0.12
251.19Hz	-21.64	90.00	89.98	0.00	0.00	89.98	-1.4	1.4	-0.02	0.12
501.19Hz	-27.04	90.00	89.98	0.00	0.00	89.98	-1.4	1.4	-0.02	0.12
1995.3Hz	-31.44	90.00	90.00	0.00	0.00	90.00	-1.6	1.6	0.00	0.12
3981.1Hz	-31.24	90.00	89.95	0.00	0.00	89.95	-1.6	1.6	-0.05	0.12
7943.3Hz	-29.14	90.00	89.96	0.00	0.00	89.96	-3.1	2.1	-0.04	0.12
15849Hz	-23.64	90.00	89.98	0.00	0.00	89.98	-17.0	3.5	-0.02	0.12

#### 4.10. Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	El.+Acous. Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-30.24	90.00	90.00	0.00	0.00	90.00	-1.1	1.1	0.00	0.12
63.096Hz	-29.44	90.00	90.01	0.00	0.00	90.01	-1.5	1.5	0.01	0.12
125.89Hz	-30.04	90.00	90.04	0.00	0.00	90.04	-1.5	1.5	0.04	0.12
251.19Hz	-30.24	90.00	90.00	0.00	0.00	90.00	-1.4	1.4	0.00	0.12
501.19Hz	-30.24	90.00	90.03	0.00	0.00	90.03	-1.4	1.4	0.03	0.12
1995.3Hz	-30.04	90.00	90.02	0.00	0.00	90.02	-1.6	1.6	0.02	0.12
3981.1Hz	-29.44	90.00	89.96	0.00	0.00	89.96	-1.6	1.6	-0.04	0.12
7943.3Hz	-27.24	90.00	89.96	0.00	0.00	89.96	-3.1	2.1	-0.04	0.12
15849Hz	-21.74	90.00	89.95	0.00	0.00	89.95	-17.0	3.5	-0.05	0.12

#### 4.11. Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	El.+Acous. Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-30.24	90.00	90.00	0.00	0.00	90.00	-1.1	1.1	0.00	0.12
63.096Hz	-30.24	90.00	90.00	0.00	0.00	90.00	-1.5	1.5	0.00	0.12
125.89Hz	-30.24	90.00	90.00	0.00	0.00	90.00	-1.5	1.5	0.00	0.12
251.19Hz	-30.24	90.00	90.00	0.00	0.00	90.00	-1.4	1.4	0.00	0.12
501.19Hz	-30.24	90.00	90.00	0.00	0.00	90.00	-1.4	1.4	0.00	0.12
1995.3Hz	-30.24	90.00	89.99	0.00	0.00	89.99	-1.6	1.6	-0.01	0.12
3981.1Hz	-30.24	90.00	89.98	0.00	0.00	89.98	-1.6	1.6	-0.02	0.12
7943.3Hz	-30.24	90.00	89.97	0.00	0.00	89.97	-3.1	2.1	-0.03	0.12
15849Hz	-30.24	90.00	89.97	0.00	0.00	89.97	-17.0	3.5	-0.03	0.12

#### 4.12. Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12	
LCF	94.00	94.00	-0.4	0.4	0.00	0.12	
LZF	94.00	94.00	-0.4	0.4	0.00	0.12	
LAS	94.00	93.99	-0.3	0.3	-0.01	0.12	
LAeq	94.00	93.99	-0.3	0.3	-0.01	0.12	

#### 4.13. Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.13	
99 dB	99.00	99.00	-1.1	1.1	0.00	0.13	
104 dB	104.00	104.00	-1.1	1.1	0.00	0.13	
109 dB	109.00	109.00	-1.1	1.1	0.00	0.13	
114 dB	114.00	114.01	-1.1	1.1	0.01	0.13	
119 dB	119.00	119.01	-1.1	1.1	0.01	0.13	
124 dB	124.00	124.01	-1.1	1.1	0.01	0.13	
129 dB	129.00	129.02	-1.1	1.1	0.02	0.13	
130 dB	130.00	130.02	-1.1	1.1	0.02	0.13	
131 dB	131.00	131.02	-1.1	1.1	0.02	0.13	
132 dB	132.00	132.02	-1.1	1.1	0.02	0.13	
133 dB	133.00	133.02	-1.1	1.1	0.02	0.13	
134 dB	134.00	134.02	-1.1	1.1	0.02	0.13	
135 dB	135.00	135.02	-1.1	1.1	0.02	0.13	
136 dB	136.00	136.02	-1.1	1.1	0.02	0.13	
137 dB	137.00	137.01	-1.1	1.1	0.01	0.13	

**4.14. Level linearity on the reference level range, Lower**

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.13	
89 dB	89.00	89.00	-1.1	1.1	0.00	0.13	
84 dB	84.00	83.99	-1.1	1.1	-0.01	0.13	
79 dB	79.00	78.93	-1.1	1.1	-0.07	0.13	
74 dB	74.00	73.93	-1.1	1.1	-0.07	0.13	
69 dB	69.00	68.93	-1.1	1.1	-0.07	0.13	
64 dB	64.00	63.93	-1.1	1.1	-0.07	0.13	
59 dB	59.00	58.93	-1.1	1.1	-0.07	0.13	
54 dB	54.00	53.93	-1.1	1.1	-0.07	0.13	
49 dB	49.00	48.93	-1.1	1.1	-0.07	0.13	
44 dB	44.00	43.91	-1.1	1.1	-0.09	0.13	
39 dB	39.00	38.92	-1.1	1.1	-0.08	0.24	
35 dB	35.00	34.92	-1.1	1.1	-0.08	0.24	
34 dB	34.00	33.93	-1.1	1.1	-0.07	0.24	
33 dB	33.00	32.94	-1.1	1.1	-0.06	0.24	
32 dB	32.00	31.94	-1.1	1.1	-0.06	0.24	
31 dB	31.00	30.95	-1.1	1.1	-0.05	0.24	
30 dB	30.00	29.96	-1.1	1.1	-0.04	0.24	

**4.15. Toneburst response, Time-weighting Fast**

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	132.00	132.00	-0.8	0.8	0.00	0.12	
200 ms Burst	131.00	131.02	-0.8	0.8	0.02	0.12	
2 ms Burst	114.00	113.96	-1.8	1.3	-0.04	0.12	
0.25 ms Burst	105.00	104.89	-3.3	1.3	-0.11	0.12	

**4.16. Toneburst response, Time-weighting Slow**

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	132.00	132.00	-0.8	0.8	0.00	0.12	
200 ms Burst	124.60	124.58	-0.8	0.8	-0.02	0.12	
2 ms Burst	105.00	104.97	-3.3	1.3	-0.03	0.12	



#### 4.17. Toneburst response, Leq

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	132.00	132.00	-0.8	0.8	0.00	0.11	
200 ms Burst	115.00	115.01	-0.8	0.8	0.01	0.11	
2 ms Burst	95.00	94.98	-1.8	1.3	-0.02	0.11	
0.25 ms Burst	86.00	85.88	-3.3	1.3	-0.12	0.11	

#### 4.18. Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	130.00	130.00	-0.4	0.4	0.00	0.09	
Single Sine	133.40	134.46	-2.4	2.4	1.06	0.12	

#### 4.19. Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	130.00	130.00	-0.4	0.4	0.00	0.09	
Half-sine, Positive	132.40	131.93	-1.4	1.4	-0.47	0.12	
Half-sine, Negative	132.40	131.93	-1.4	1.4	-0.47	0.12	

#### 4.20. Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous	135.00	-0.4	0.4	0.00	0.20	
Half-sine, Positive	138.81	-10.0	10.0	3.81	0.20	
Half-sine, Negative	138.81	-10.0	10.0	3.81	0.20	
Difference	138.81	-1.8	1.8	0.00	0.30	

#### 4.21. Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured	
	[Deg C / kPa / % RH]	
Air temperature	22.90	
Air pressure	100.73	
Relative humidity	40.00	

**DANAK**

*DANAK is the national accreditation body in Denmark in compliance with EU regulation No. 765/2008. DANAK participates in the multilateral agreements for testing and calibration under European co-operation for Accreditation (EA) and under International Laboratory Accreditation Cooperation (ILAC) based on peerevaluation. Accredited test reports and calibration certificates issued by laboratories accredited by DANAK are recognized cross border by members of EA and ILAC equal to test reports and calibration certificates issued by these members' accredited laboratories.*

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