AV CONSULTING B.V.
Calibration Laboratory

CERTIFICATE OF CALIBRATION AVC16097

CUSTOMER

Name:	AV-CONSULTING
Address:	Benedenberg 100A
Zip code & City :	2861 LH Bergambacht
Country:	Netherlands

CALIBRATION OF

Device:	Hand-held Analyzer	
Brand & type:	Bruel & Kjaer	2250
Serial number:	2567728	
Customers Instrument tag:		

SPECIFICATIONS

Calibrated in accordance with:	NEN-EN-IEC 61672-3:2013
Method used:	Electroacoustics - Sound level meters - Part 3: Periodic tests
Traceability:	The calibration assures the traceability to the international units system SI.

CALIBRATION CONDITIONS

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

Environmental conditions:

Pressure	Unit	Humidity	Unit	Temperature	Unit
1023,50	[hPa]	59,5	[%]	22,9	[°C]

UNCERTAINTY OF MEASUREMENT

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which for a normal distribution provides a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from standards, calibration method, effects of environmental conditions and any short time contribution from the device under calibration.

RESULT PASS

DATE

Date of calibration:		*Date of issue:*	
Calibration Engineer:		*Approved Signatory:*	
A.Vreeswijk	27-Sep-2017		27-Sep-2017

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CERTIFICATE OF CALIBRATION AVC16097

VISUAL INSPECTION

	Yes	No
The equipment / device is in serviceable condition.	x	
There is no visible damage.	x	
The appropriate documentation accompanied the equipment.	x	
Calibration tags / CE tags are present and correct.	x	
The equipment is suitable to use for official testing and/or calibration.	x	

COMMENTS

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-1, 2014, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1: 2013.

CALIBRATION EQUIPMENT

Device	Brand	Type	Serial no.
Digital Voltmeter 6½ digits	Keysight	34465A	MY54502281
Ultra Low Distortion Generator	Stanford RS	DS360	33264
Conditioning Amplifier	Bruel & Kjaer	2691	2079137
Electroacoustical Calibrator	Bruel & Kjaer	4231	1000577
Pistonphone	Bruel & Kjaer	4228	1570765
Mulifrequency Calibrator	Bruel & Kjaer	4226	1854566
Full Frequency Coupler	BSWA	CA-916	540002
Microphone replacement	NTI	K65-15	K65S
Audio analyzer	NTI	XL2	A2A-06359-E0
Puls FFT-Analyzing System	Bruel & Kjaer	3032A	2338570

CERTIFICATE OF CALIBRATION AVC16097

DEVICE UNDER TEST

Device	Type	Brand	Serial no.
Sound level meter	2250	Bruel & Kjaer	2567728
Microphone	4189	Bruel & Kjaer	2560557
Pre-amplifier	ZC-0032	Bruel & Kjaer	23906
Supplied calibrator	4231	Bruel & Kjaer	2517858
Software version	BZ-7223	Bruel & Kjaer	Version 4.5.2.
Instruction manual	BE1712-22	Bruel & Kjaer	N/A
Pattern approval	Approval Sign	PTB	DE-16-M-PTB-0038

MEASUREMENTS & TESTS IEC-61672-3

0. PRELIMINARY INSPECTION

3 § 5. Prior to any measurements the sound level meter and all accessories and controls etc. shall be visually checked. All relevant controls shall be operated to ensure proper working. If controls, display or other essential elements are not proper working no tests shall be performed.

	Microphone Protection Grid	Microphone Diaphragm	SLM Controls	SLM Display	SLM Accessories	Other elements
Visual inspection Proper working order	OK	OK	OK	OK	OK	OK

1. ENVIRONMENTAL CONDITIONS PRIOR TO CALIBRATION

3 § 7. Actual environmental conditions prior to calibration.

	Measured	Unit
Barometric pressure	1023,5	[hPa]
Relative humidity	59,5	[%]
Air temperature	22,9	[°C]

2. REFERENCE INFORMATION

3 § 22h + 22m Information about reference range, level and channel.

	Value
	[dB SPL]
Reference sound pressure level	94,00
Reference range	140,00
Channel number	1

3. INDICATION AT THE CALIBRATION CHECK FREQUENCY

3 § 10 + 22m Measure and adjust the sound level meter using the supplied calibrator.
3 § 9 An alternative equivalent calibrator from the lab can be used.

	Expected	Measured	Uncertainty	Unit
Initial indication	93,91	93,85	0,20	[dB]
Calibration check frequency	1000,00	1000,00	1	[Hz]
Adjusted indication	93,91	93,90	0,20	[dB]

4. SELF-GENERATED NOISE LEVEL (SOUND)

3 § 11.1 For A-weighting, the noise is measured with the microphone installed in an acoustic chamber which eliminates ambient noise.
Averaging time is 30 seconds at the most sensitive level of the meter. The level of self-generated noise is reported for information only and is not used to assess conformance to a requirement.

	Max	Measured	Uncertainty
	[dB SPL]	[dB SPL]	[dB]
A-weighted	17,70	16,80	0,50

5. SELF-GENERATED NOISE LEVEL (ELECTRICAL)

3 § 11.2 Self-generated noise measured in most sensitive range, with electrical input-signal device terminated in the manner specified in the instruction manual or manufactures specifications. The level of self-generated noise is reported for information only and is not used to assess conformance to a requirement.

	Max.	Measured	Uncertainty
	[dB SPL]	[dB SPL]	[dB]
A-weighted	13,60	13,00	0,30
C-weighted	14,30	13,20	0,30
Z-weighted	19,40	18,60	0,30

6. ACOUSTICAL SIGNAL TEST FREQUENCY WEIGHTING, C-WEIGHTING

3 § 12 Frequency weighting is measured acoustical with a calibrated multi-frequency sound calibrator or coupler. Averaging time is 10 seconds and the result is the average of 2 measurements

	Coupler pressure Lc	Microphone correction freefield	Body influance	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB]	[dB]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
1000Hz, 1st.	93,98	0,10	-0,07	93,95	93,87	-0,70	0,70	-0,08	0,25
1000Hz, 2nd.	93,98	0,10	-0,07	93,95	93,88	-0,70	0,70	-0,07	0,25
1000Hz, Average	93,98	0,10	-0,07	93,95	93,88	-0,70	0,70	-0,07	0,25
125Hz, 1st.	93,96	0,00	0,00	93,76	93,85	-1,00	1,00	0,09	0,25
125Hz, 2nd.	93,96	0,00	0,00	93,76	93,85	-1,00	1,00	0,09	0,25
125Hz, Average	93,96	0,00	0,00	93,76	93,85	-1,00	1,00	0,09	0,25
8000Hz, 1st.	93,60	2,80	-0,08	87,88	87,64	-2,50	1,50	-0,24	0,52
8000Hz, 2nd.	93,59	2,80	-0,08	87,87	87,64	-2,50	1,50	-0,23	0,52
8000Hz, Average	93,59	2,80	-0,08	87,87	87,64	-2,50	1,50	-0,23	0,52

7. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, A-WEIGHTING

3 § 13. Frequency response measured with electrical signal relative to level at 1 kHz in reference range.

Normal frequency	Input level	Expected	Measured	El.+ Acc. Response	Body Influence	Corrected Measured	Accept -Limit	Accept +Limit	Deviation	Uncertainty
[Hz}	[dBV]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
1000 (Ref.)	-24,57	95,00	95,00	0,01	-0,07	94,94	-0,20	0,20	-0,06	0,12
63,096	1,63	95,00	95,01	0,00	0,00	95,01	-1,00	1,00	0,01	0,12
125,89	-8,47	95,00	95,00	0,00	0,00	95,00	-1,00	1,00	0,00	0,12
251,19	-15,97	95,00	95,00	0,00	0,07	95,07	-1,00	1,00	0,07	0,12
501,2	-21,37	95,00	95,10	-0,01	0,22	95,31	-1,00	1,00	0,31	0,12
1995,3	-25,77	95,00	95,01	0,04	-0,09	94,96	-1,00	1,00	-0,04	0,12
3981,1	-25,57	95,00	95,00	0,04	-0,09	94,95	-1,00	1,00	-0,05	0,12
7943,3	-23,47	95,00	95,00	-0,03	-0,08	94,89	-2,50	1,50	-0,11	0,12
15849,0	-17,97	95,00	94,08	0,87	0,11	95,06	-16,00	2,50	0,06	0,12

8. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, C-WEIGHTING

3 § 13. Frequency response measured with electrical signal relative to level at 1 kHz in reference range.

Normal frequency	Input level	Expected	Measured	El.+ Acc. Response	Body Influence	Corrected Measured	Accept -Limit	Accept +Limit	Deviation	Uncertainty
[Hz]	[dBV]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
1000 (Ref.)	-24,57	95,00	95,00	0,01	-0,07	94,94	-0,20	0,20	-0,06	0,12
63,096	-23,77	95,00	95,00	0,00	0,00	95,00	-1,00	1,00	0,00	0,12
125,89	-24,37	95,00	95,00	0,00	0,00	95,00	-1,00	1,00	0,00	0,12
251,19	-24,57	95,00	95,00	0,00	0,07	95,07	-1,00	1,00	0,07	0,12
501,19	-24,57	95,00	95,02	-0,01	0,22	95,23	-1,00	1,00	0,23	0,12
1995,3	-24,37	95,00	95,03	0,04	-0,09	94,98	-1,00	1,00	-0,02	0,12
3981,1	-23,77	95,00	95,00	0,04	-0,09	94,95	-1,00	1,00	-0,05	0,12
7943,3	-21,57	95,00	95,00	-0,03	-0,08	94,89	-2,50	1,50	-0,11	0,12
15849	-16,07	95,00	94,08	0,87	0,11	95,06	-16,00	2,50	0,06	0,12

9. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, Z-WEIGHTING

3 § 13. Frequency response measured with electrical signal relative to level at 1 kHz in reference range.

Normal frequency	Input level	Expected	Measured	El.+ Acc. Response	Body Influence	Corrected Measured	Accept -Limit	Accept +Limit	Deviation	Uncertainty
[Hz}	[dBV]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
1000 (Ref.)	-24,57	95,00	95,00	0,01	-0,07	94,94	-0,20	0,20	-0,06	0,12
63,10	-24,57	95,00	95,00	0,00	0,00	95,00	-1,00	1,00	0,00	0,12
125,89	-24,57	95,00	95,01	0,00	0,00	95,01	-1,00	1,00	0,01	0,12
251,19	-24,57	95,00	95,02	0,00	0,07	95,09	-1,00	1,00	0,09	0,12
501,19	-24,57	95,00	95,02	-0,01	0,22	95,23	-1,00	1,00	0,23	0,12
1995,3	-24,57	95,00	95,02	0,04	-0,09	94,97	-1,00	1,00	-0,03	0,12
3981,1	-24,57	95,00	95,00	0,04	-0,09	94,95	-1,00	1,00	-0,05	0,12
7943,3	-24,57	95,00	95,00	-0,03	-0,08	94,89	-2,50	1,50	-0,11	0,12
15849,0	-24,57	95,00	94,10	0,87	0,11	95,08	-16,00	2,50	0,08	0,12

10. FREQUENCY AND TIME WEIGHTINGS AT 1 kHz

3 § 14. Frequency and time weighting measured at 1 kHz with electrical signal in reference range.
Measured relative to A-weighted and Fast response.

	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
LAF, Ref.	94,00	94,00	-0,20	0,20	0,00	0,12
LCF	94,00	94,00	-0,20	0,20	0,00	0,12
LZF	94,00	94,00	-0,20	0,20	0,00	0,12
LAS	94,00	93,95	-0,10	0,10	-0,05	0,12
LAeq	94,00	94,00	-0,10	0,10	0,00	0,12

11. LONG-TERM STABILITY

3 § 15. Long-term stability over 25 to 35 minutes, with steady 1 kHz signal at reference level.

	Measured	Accept -Limit	Accept +limit	Deviation	Time-stamp	Uncertainty
	[dB SPL]	[dB]	[dB]	[dB]	09-27-17	[dB]
Reference	94	-0,2	0,2	0	9:06	0,1

12. LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE, UPPER

3 § 16. Level linearity in reference range, measured at 8 kHz until overload indication.

Level	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
[dB]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
94	94,00	94,00	-0,20	0,20	0,00	0,13
99	99,00	99,00	-0,80	0,80	0,00	0,13
104	104,00	104,00	-0,80	0,80	0,00	0,13
109	109,00	109,00	-0,80	0,80	0,00	0,13
114	114,00	114,01	-0,80	0,80	0,01	0,13
119	119,00	119,01	-0,80	0,80	0,01	0,13
124	124,00	124,01	-0,80	0,80	0,01	0,13
134	134,00	134,10	-0,80	0,80	0,10	0,13
135	135,00	135,00	-0,80	0,80	0,00	0,13
136	136,00	136,00	-0,80	0,80	0,00	0,13
137	137,00	137,01	-0,80	0,80	0,01	0,13
138	138,00	138,01	-0,80	0,80	0,01	0,13
139	139,00	139,00	-0,80	0,80	0,00	0,13
140	140,00	140,00	-0,80	0,80	0,00	0,13

13. LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE, LOWER

3 § 16. Level linearity in reference range, measured at 8 kHz until under range indication

Level	Expected	Measured	Accept - Limit	Accept +limit	Deviation	Uncertainty
[dB]	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
94	94,00	94,00	-0,20	0,20	0,00	0,13
89	89,00	89,00	-0,80	0,80	0,00	0,13
84	84,00	84,00	-0,80	0,80	0,00	0,13
79	79,00	79,00	-0,80	0,80	0,00	0,13
74	74,00	74,00	-0,80	0,80	0,00	0,13
69	69,00	69,00	-0,80	0,80	0,00	0,13
64	64,00	64,00	-0,80	0,80	0,00	0,13
59	59,00	59,01	-0,80	0,80	0,01	0,13
54	54,00	54,00	-0,80	0,80	0,00	0,13
49	49,00	49,01	-0,80	0,80	0,01	0,13
44	44,00	44,02	-0,80	0,80	0,02	0,13
39	39,00	39,03	-0,80	0,80	0,03	0,24
34	34,00	34,05	-0,80	0,80	0,05	0,24
30	30,00	30,10	-0,80	0,80	0,10	0,24
29	29,00	29,00	-0,80	0,80	0,00	0,24
28	28,00	28,10	-0,80	0,80	0,10	0,24
27	27,00	27,15	-0,80	0,80	0,15	0,24
26	26,00	26,22	-0,80	0,80	0,22	0,24
25	25,00	25,25	-0,80	0,80	0,25	0,24
24	24,00	24,24	-0,80	0,80	0,24	0,24

14. TONEBURST RESPONSE, TIME-WEIGHTED FAST

3 § 18. Response to 4 kHz tone burst measured in reference range, relative to continuous signal.

Signal	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
200 [ms] burst	136,00	136,00	-0,50	0,50	0,00	0,12
2 [ms] burst	119,00	118,95	-1,50	1,00	-0,05	0,12
0,25 [ms] burst	110,00	109,84	-3,00	1,00	-0,16	0,12

15. TONEBURST RESPONSE, TIME-WEIGHTED SLOW

3 § 18. Response to 4 kHz tone burst measured in reference range, relative to continuous signal.

Signal	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
Continuous. Ref.	137,00	137,01	-0,20	0,20	0,01	0,12
200 [ms] burst	129,61	129,66	-0,50	0,50	0,05	0,12
2 [ms] burst	110,01	110,00	-3,00	1,00	-0,01	0,12

16. TONEBURST RESPONSE, TIME-WEIGHTED LAE

3 § 18. Response to 4 kHz tone burst measured in reference range, relative to continuous signal.

Signal	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
Continuous. Ref.	137,00	137,00	-0,20	0,20	0,00	0,12
200 [ms] burst	130,00	130,00	-0,50	0,50	0,00	0,12
2 [ms] burst	110,00	109,95	-1,50	1,00	-0,05	0,12
0,25 [ms] burst	101,00	100,87	-3,00	1,00	-0,13	0,12

17. C-WEIGHTED PEAK SOUND LEVEL AT 8 kHz

3 §19. Peak response to 8 kHz single-cycle sine measured in least sensitive range, relative to continuous signal.

Signal	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
Continuous. Ref.	135,00	135,00	-0,20	0,20	0,00	0,09
Single Sine	136,40	138,40	-2,00	2,00	2,00	0,12

18. C-WEIGHTED PEAK SOUND LEVEL AT 500 Hz

3 § 19. Response to 500 Hz half-cycle sine measured in least sensitive range, relative to continuous signal.

Signal	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
Continuous. Ref.	135,00	135,00	-0,20	0,20	0,00	0,09
Half-Sine Positive	137,40	137,20	-1,00	1,00	-0,20	0,12
Half-Sine Negative	137,40	137,20	-1,00	1,00	-0,20	0,12

19. OVERLOAD INDICATION

3 § 20. Overload indication, least sensitive range determined with a 4 kHz positive /negative one halfcycle sinus signal.

Signal	Difference half sine pos.-neg.	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB SPL]	[dB]	[dB]	[dB]	[dB]
Continuous. Ref.		140,00	-0,20	0,20	0,00	0,20
Half-Sine positive	0,00	141,20	-1,50	1,50	0,00	0,20
Half-Sine negative	0,00	141,20	-1,50	1,50	0,00	0,24

20. HIGH-LEVEL STABILITY

3 § 21. High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Signal	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
	[dB SPL]	[dB]	[dB]	[dB]	[dB]
High-level. Ref.	139,00	-0,20	0,20	0,00	0,10
High-level, after 5 min.	139,00	-0,10	0,10	0,00	0,10

21. LONG-TERM STABILITY

3 § 15. Long-term stability over 25 to 35 minutes, with steady 1 kHz signal at reference level.

	Measured	Accept - Limit	Accept +limit	Deviation	Uncertainty	Time stamp
	[dB SPL]	[dB]	[dB]	[dB]	[dB]	27-Sep-17
After time passed	94,00	-0,20	0,20	0,00	0,10	
Time passed	0:33:00	25 min.	35 min.			9:39

22. ENVIRONMENTAL CONDITIONS FOLLOWING CALIBRATION

3 § 7. Actual environmental conditions following calibration.

	Measured	Unit
Barometric pressure	1024,1	[hPa]
Relative humidity	60,0	[%]
Air temperature	22,6	[°C]

23. SUMMARY

0. PRELIMINARY INSPECTION	☑ PASS	☐ FAIL
1. ENVIRONMENTAL CONDITIONS PRIOR TO CALIBRATION	☑ PASS	☐ FAIL
2. REFERENCE INFORMATION	☑ PASS	☐ FAIL
3. INDICATION AT THE CALIBRATION CHECK FREQUENCY	☑ PASS	☐ FAIL
4. SELF-GENERATED NOISE LEVEL (SOUND)	☑ PASS	☐ FAIL
5. SELF-GENERATED NOISE LEVEL (ELECTRICAL)	☑ PASS	☐ FAIL
6. ACOUSTICAL SIGNAL TEST OF FREQUENCY WEIGHTING, C-WEIGHTING	☑ PASS	☐ FAIL
7. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, A-WEIGHTING	☑ PASS	☐ FAIL
8. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, C-WEIGHTING	☑ PASS	☐ FAIL
9. ELECTRICAL SIGNAL TEST OF FREQUENCY WEIGHTING, Z-WEIGHTING	☑ PASS	☐ FAIL
10. FREQUENCY AND TIME WEIGHTINGS AT 1 kHz	☑ PASS	☐ FAIL
11. LONG-TERM STABILITY	☑ PASS	☐ FAIL
12. LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE, UPPER	☑ PASS	☐ FAIL
13. LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE, LOWER	☑ PASS	☐ FAIL
14. TONEBURST RESPONSE, TIME-WEIGHTED FAST	☑ PASS	☐ FAIL
15. TONEBURST RESPONSE, TIME-WEIGHTED SLOW	☑ PASS	☐ FAIL
16. TONEBURST RESPONSE, TIME-WEIGHTED LAE	☑ PASS	☐ FAIL
17. C-WEIGHTED PEAK SOUND LEVEL AT 8 kHz	☑ PASS	☐ FAIL
18. C-WEIGHTED PEAK SOUND LEVEL AT 500 Hz	☑ PASS	☐ FAIL
19. OVERLOAD INDICATION	☑ PASS	☐ FAIL
20. HIGH -LEVEL STABILITY	☑ PASS	☐ FAIL
21. LONG-TERM STABILITY	☑ PASS	☐ FAIL
22. ENVIRONMENTAL CONDITIONS FOLLOWING CALIBRATION	☑ PASS	☐ FAIL