Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **OM2024-6**

Certificate of Calibration for G.R.A.S. IEC 60711 & 60318-4 Ear Simulator RA0045

This calibration is performed by comparison with measurement reference standard:

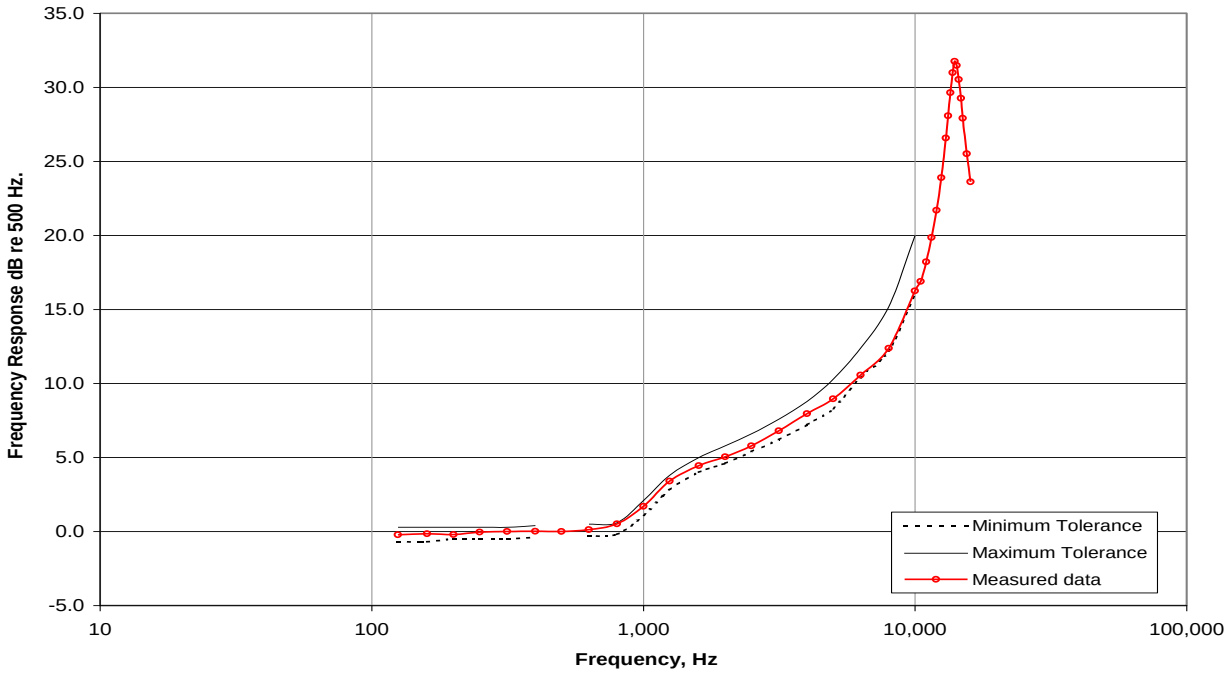
Reference Standards	
Type No.	4134/UA0825
Serial No.	1866524
Calibrated by	DANAK
Cal Date	05 SEP 2023
Due Date	05 SEP 2025

a) Estimated uncertainty of comparison: ± **0.065** dB
b) Estimated uncertainty of 4134: ± **0.04** dB
c) Total uncertainty: $\sqrt{a^2+b^2}$ = ± **0.076** dB
d) Expanded uncertainty (coverage factor *k* = 2 for 95% confidence level): = ± **0.15** dB

Type no.	**RA0045**
Serial no.	**234950**
With built in microphone	**40AG**
Microphone serial no.	**211410**
With preamplifier type no.	**N/A**
Preamplifier Serial no.	**N/A**
Submitted by	**Odin Metrology**
	Thousand Oaks, CA 91320
Purchase order no.	**N/A**
Asset no.	**N/A**

Performance Data		
Open circuit sensitivity at 1,013 hPa, 23°C, 50% RH, 251.2 Hz	**-37.29**	dB re 1 V/Pa
	13.67	mV/Pa
System sensitivity (with preamplifier) at 251.2 Hz	**N/A**	dB re 1 V/Pa
	N/A	mV/Pa

Ear Simulator Frequency Response: Type RA0045
S/N 234950 : Measured 18 Dec 2024



Calibration performed by

Harold Lynch, Service Manager

Condition of Test		
Ambient Pressure	**994.28**	hPa
Temperature	**23**	°C
Relative Humidity	**32**	%
Polarization Voltage	**200**	V
Frequency	**251.2**	Hz
Date of Calibration	**18 DEC 2024**	
Re-calibration due on	**18 DEC 2025**	

Odin Metrology, Inc.
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Thousand Oaks, CA 91320
Phone: (805) 375-0830; Fax: (805) 375-0405

The calibration data is both "as found" and "as final." At the time of calibration this microphone was found to be **within** the manufacturer's specifications.
Calibration Procedure: **OM-P-1008-Microphone Rev. 1.2 20130618 and OM-P-1017-IEC 711 Couplers Rev. 1.7 20170315.**

This calibration is traceable to DANAK/DPLA No**. M2.10-1597-2.1** and through inter-laboratory comparisons to NIST Test Number: **683/289533-17.** *See page 2 Traceability**.**

ODIN METROLOGY, INC.

Instrumentation used for calibration of microphones

Instrument Type	Type no.	Serial no.	Cal. Date	Cal. Due	Cal. by
Precision Barometer	Druck 141	299/95-10	11 DEC 2024	11 DEC 2025	CMI
B&K Sine/Random Generator	1051	1777523	25 SEP 2024	25 SEP 2025	HL
Measuring Amplifier	2636	1087741	02 JUL 2024	02 JUL 2025	HL
Preamplifier	2645	1146891	02 APR 2024	02 APR 2025	HL
Preamplifier	2669	2145792	02 DEC 2024	02 DEC 2025	HL
Microphone	4134/UA0825	1866524	05 SEP 2023	05 SEP 2025	DANAK
Pistonphone	4220	1404269	02 DEC 2024	02 DEC 2025	HL
Multitone Calibrator	4226	3274134	27 NOV 2024	27 NOV 2025	HL
Precision Attenuator	5936	1637820	03 SEP 2024	03 SEP 2025	HL
Polarization Voltmeter	WB0781	21	03 SEP 2024	03 SEP 2025	HL
HP Multimeter	34401A	US36009807	05 SEP 2024	05 SEP 2025	PI
HP Multimeter	34401A	MY41031678	10 JAN 2024	10 JAN 2025	PI

Calibration of reference microphones 4160 serial numbers 991820 and 991821, and standard pistonphones 4228 serial number 1570748, 4220 serial numbers 1404269, 1510240, 4220 serial number 1048747 with 40 cm^3 volume are calibrated traceable to NIST with NIST test number **683/289533-17.**

The verification/calibration listed on page 1 of this document was performed on a test system which conforms to and operates under the requirements of **ANSI/NCSL Z540-1** which also covers the requirements for **MIL STD 45662A**, **ISO 17025**, and ISO 9001:2015 NQA certification no.: **11252**.

*Traceability to NIST by NIST calibration of Transfer Standard Microphone is used to verify consistency between DANAK/DPLA and NIST calibrations.

This page revised: Rev. 30.12, 20241218

Odin Metrology Inc.
Calibration of Brüel & Kjær Instruments
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IEC 60711 Ear Simulator Type RA0045

Serial# 234950
ID# N/A
Certificate# OM2024-6

Measured with
Microphone 40AG# 211410 Preamplifier 2669# 2145792

See Below for Frequency Response Tabulation including tolerances

Frequency (Hz)	Nominal Value (dB)	IEC 60711 Tolerance (dB) Minimum	IEC 60711 Tolerance (dB) Maximum	Data Found (dB) Re. 500 Hz	Pass/Fail	Data Found (dB) Re. 1000 Hz
100	-0.2	-0.8	0.2	-0.31	Pass	-2.01
125	-0.2	-0.7	0.3	-0.22	Pass	-1.92
160	-0.1	-0.7	0.3	-0.15	Pass	-1.85
200	-0.1	-0.5	0.3	-0.20	Pass	-1.90
250	-0.1	-0.5	0.3	-0.05	Pass	-1.74
315	0.0	-0.5	0.3	0.00	Pass	-1.70
400	0.1	-0.4	0.4	0.02	Pass	-1.68
500	REF			0.00	Pass	-1.70
630	0.1	-0.3	0.5	0.12	Pass	-1.58
800	0.2	-0.2	0.6	0.51	Pass	-1.19
1,000	1.6	1.1	2.1	1.70	Pass	0.00
1,250	3.3	2.8	3.8	3.41	Pass	1.71
1,600	4.5	4.0	5.0	4.45	Pass	2.75
2,000	5.2	4.6	5.8	5.04	Pass	3.34
2,500	6.0	5.4	6.6	5.79	Pass	4.09
3,150	6.9	6.2	7.6	6.80	Pass	5.10
4,000	8.0	7.2	8.8	7.96	Pass	6.26
5,000	9.3	8.3	10.3	8.95	Pass	7.26
6,300	11.4	10.4	12.4	10.56	Pass	8.49
8,000	13.7	12.2	15.2	12.38	Pass	10.68
10,000	18.0	16.0	20.0	16.25	Pass	14.09
10,500				16.89		15.19
11,000				18.22		16.52
11,500				19.85		18.15
12,000				21.69		19.99
12,500				23.89		22.20
13,000				26.57		24.87
13,250				28.08		26.38
13,500				29.63		27.93
13,750				30.99		29.29
14,000				31.75		30.05
14,250				31.47		29.78
14,500				30.53		28.83
14,750				29.26		27.56
15,000				27.91		26.21
15,500				25.51		23.81
16,000				23.62		21.92

Measurements were also made at these additional frequencies as requested. Note however that no tolerances are defined for these frequencies and these data are provided for reference only.

750				0.35		-1.35
1,500				4.26		2.56
2,250				5.40		3.70
3,000				6.59		4.89
4,500				8.49		6.79
6,000				9.90		8.20
9,000				14.06		12.36

Customer Odin Metrology, Inc.
Purchase Order# N/A
Date 18-Dec-24 Performed by: HL
Environmental Conditions:
Temperature 23 deg C
Pressure 994.28 hPa
Relative Humidity 32%