



## **INDUSTRIAL HYGIENE MONITORING REPORT – Accommodation facilities**

**S1 2024**

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**Baffinland Iron Mines corp.**

**Mary River Mine and Milne Port inlet  
(Nunavut)**

**August 2024**

**File # : HDS-9048-1**



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## PREPARED FOR

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## 1 INTRODUCTION

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### 1.1 Mandate and Objectives

The services of Hudon Desbiens St-Germain Environnement inc. (HDS Environnement) were selected by Baffinland Iron Mines Corporation (BIM) to survey various physical contaminants in accommodation facilities at the Mary River Mine and the Milne Port, two mining sites located in the Qikiqtani Region (Baffin Island; Nunavut).

This study was carried out at the request of Wayne LeDrew, Sr. Health & Security Coordinator of BIM as part of the 2024 industrial hygiene monitoring program.

### 1.2 Scope and Approach

The scope of the study included the following:

- Mary River Mine site (MRM):
  - Sailivik camp (SC): indoor noise and whole-body vibration levels.
- Milne Port site (MP):
  - Port Site complex (PSC) camp and 380-person camp: indoor noise and whole-body vibration levels.

The present report includes, but is not limited to, a brief description of the implemented strategy, sampling methodology, results, conclusions and relevant recommendations.

### 1.3 Study Limitations

The conclusions and recommendations included in this report are based upon professional opinions expressed within the context of the mandate given to HDS Environment by Baffinland Iron Mines. HDS Environment accepts no responsibility for any use that is made of this report in any other context or by any other party, unless being expressly informed prior to such use and having explicitly agreed to the use of this report by others.

This study only reflects the observations and measurements made during the sampling campaign. HDS Environnement declines all responsibility for any variation in environmental conditions and the potential impacts on the conclusions of this study (detailed study limitation in Appendix A).

## **2 SITES DESCRIPTIONS & OPERATING CONDITIONS**

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### **2.1 Sites descriptions**

BIM operates two (2) sites in the Qikiqtani Region: the MRM site and the MP site. The crushed ore produced throughout the year by the mining operations at MRM is transported to MP by a fleet of Off-Highway Trucks (OHTs), where it is stockpiled until the sea lane is opened for a few weeks, at the end of the summer.

This study was conducted at different workers' accommodations, in August 2023 during shipping season.

### **2.2 Conditions during surveys**

SC and PSC are composed of modular prefabricated structures, while the 380-man camp is made of soft-wall structures. Rooms are standardised across each facility.

The indoor noise and whole-body vibration levels measured in accommodation facilities include contributions from various indoor sources (HVAC systems, opening/closing doors, cleaning, etc.) as well as outdoor sources (idling vehicles, machinery operations, etc.).

The various surveys in accommodations and offices were overall considered representative of regular operating, ventilation and occupancy conditions (please refer to section 5, *Results* for details).

## 3 GUIDELINE VALUES

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### 3.1 Indoor noise

Based on information collected during the mandate, the Nunavut Impact Review Board (NIRB) established a 75-dBA threshold for the average noise exposure of workers during rest periods. This limit is based on the 85-dBA exposure threshold established by the Mine Health and Safety Act R-125-95 for an 8-hr work shift (Part IX and Schedule 5).

Additional research allowed to pinpoint the World Health Organization (WHO) *Guidelines for Community Noise*<sup>1</sup> which recommends an 8-hr  $L_{Aeq}$ <sup>2</sup> of 30 dBA during night-time, inside a bedroom (continuous noises). This guideline is designed to minimize sleep disturbance for “sensitive groups [...] including shift workers [...] and other individuals who have difficulty sleeping”.

Thus, to take into account the requirements of NIRB as well as the ALARA (As Low As Reasonably Achievable) safety principle, we will therefore consider in this study a 8-hr  $L_{Aeq}$  comfort threshold of 30 dBA and a 8-hr  $L_{Aeq}$  exposure limit (EL) of 75 dBA to assess workers' exposure to indoor noise levels during rest periods.

### 3.2 Whole-body vibration

Based on information collected during the mandate, due to the absence of a vibration exposure threshold in the *Mine Health and Safety Act* R-125-95, the NIRB refers to the daily exposure limits defined by the European Physical Agents Vibration Directive 2002/44/EC.

For workers exposed to whole-body vibration, this directive defines an action limit (AL) of 0.5 m/s<sup>2</sup> and an EL of 1.15 m/s<sup>2</sup>, both standardized to an 8-hr reference period.

Additional research allowed to pinpoint a 5-part standard from the International Organization for Standardization (ISO) on human exposure to mechanical vibrations. In appendix C of part 1 of the standard<sup>3</sup>, it is stated that “fifty percent of alert, fit persons can just detect a weighted vibration with a peak magnitude of 0.015 m/s<sup>2</sup> [...] with a range of response [that] may extend from about 0.01 m/s<sup>2</sup> to 0.02 m/s<sup>2</sup> peak”.

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<sup>1</sup> *Guidelines for community noise*, World Health Organization, Geneva, Switzerland (1999).

<sup>2</sup> 8h- $L_{Aeq}$  is the energy average equivalent level of A-weighted sound over eight (8) hours.

<sup>3</sup> ISO 2631-1:1997 *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration – Part 1: General requirements*

In part 2<sup>4</sup> of the same standard, it is also stated that “*experience showed in numerous countries that residents expressed complaints linked to vibrations in residential buildings when the magnitude of vibrations are slightly above the perception threshold defined in part 1, appendix C*”.<sup>5</sup>

Thus, to take into account the requirements of NIRB as well as the ALARA safety principle, we will therefore consider in this study a comfort threshold of 0.015 m/s<sup>2</sup> (peak exposure), an 8-hr AL of 0.5 m/s<sup>2</sup> and an 8-hr EL of 1.15 m/s<sup>2</sup> to assess workers’ exposure to whole-body vibration levels during rest periods.

It should be noted that the AL should be considered as a threshold for increased vigilance in order to prevent reaching the EL.

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<sup>4</sup> ISO 2631-2:2003 *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)*

<sup>5</sup> Free translation from the French version of ISO 2631-2:2003

## 4 METHODOLOGY

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### 4.1 Sampling strategy

The sampling strategy was initially established by BIM representatives prior to the industrial hygiene campaign and adjusted on the field by the HDS representative based on availability of vacant or unoccupied rooms. The final sampling strategy is presented in table 1 below.

### 4.2 Indoor noise

Indoor noise levels were measured with a class 1 sound level meter (SLM) from Larson Davis, Spartan™ 821 (S/N 001009). The SLM was calibrated prior to sampling using an adapted acoustic calibrator (from Larson Davis, model Cal200) and the calibration drift was checked post-sampling with the same calibrator. These instruments were calibrated to manufacturer's specifications less than one (1) year prior to fieldwork (calibration certificates available in Appendix B).

Sound levels were logged at regular intervals (continuous readings integrated with a Q3 bisection factor, no integration threshold, SLOW response and a 40-110 range).

The SLM were set on a tripod in the center of the room.

Average noise levels ( $L_{avg}$ ) measured in the present study were considered representative of equivalent average noise levels time-weighted over an 8-hr period ( $8h-L_{Aeq}$ ) and were thus directly compared to the comfort threshold and the 8-hr EL considered in the present study.

### 4.3 Whole-body vibration

Whole-body vibration levels were measured with a HVM200 from Larson Davis, equipped with a seat pad triaxial accelerometer SEN027. These instruments were calibrated to manufacturer's specifications less than one (1) year prior to fieldwork (calibration certificates available in Appendix B).

The HVM200 was set on "Whole-body Mode" for proper frequency weighting and measurements were logged at 1-min intervals during sampling, unless stated otherwise.

Seat pads were positioned on the floor or on a bedside table, approximately in the center of targeted rooms.

Average accelerations ( $A_{eq}$  or  $A_{rms}$ ) measured during the present study were considered representative of equivalent average accelerations time-weighted on an 8-hr reference period and were thus directly compared to the 8-hr AL and the 8-hr EL considered in the present study.





**TABLE 1**  
**SAMPLING STRATEGY - Accommodations facilities**  
**Indoor noise and whole-body vibration - S1 2024**  
*Baffinland Iron Mines - Mary River Mine and Milne Port Sites (Nunavut)*

Date	Location		Indoor Noise	Whole-body vibration
Mary River Mine				
2024-04-07	Sailiviik camp	Room C2-23	1	1
Milne Port				
2024-04-01	380-person camp	Room H31 [NS]	1	1
2024-04-02	PSC camp	Room BC-12 [NS]	1	1

## 5 RESULTS

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### 5.1 Indoor noise

The indoor noise levels collected in accommodation facilities are compiled in table 2 below. The session reports are presented in Appendix C.

The notable facts are as follow:

- all the indoor noise measurements respect the 75-dBA exposure level considered by the NIRB:
  - MRM: average noise level 28 dBA.
  - MP: average noise levels ranged from 35 to 43 dBA.
- the comfort threshold of 30 dBA considered in this study was exceeded at each sampling station:
  - MRM, Sailiivik Camp, 6% of measurement is above the comfort threshold.
  - MP, 380-person camp, 100% of measurement is above the comfort threshold; exceedances are evenly spread during the sampling period.
  - MP, PSC, 100% of measurement is above the comfort threshold; the highest exceedance percentages are before 9 p.m.

The maximum level of 43 dBA was measured in the 380-person camp on April 1<sup>st</sup>, 2024 (Room H-31).



**TABLE 2**  
**RESULTS - Accommodation facilities**  
**Indoor noise levels - S1 2024**  
*Baffinland Iron Mines - Mary River and Milne Port Sites (Nunavut)*

<i>Starting Date</i>	<i>Location</i>	<i>Instrument</i>	<i>Sampling period</i>	<i>Leq<sup>1</sup> (dBA)</i>	<i>Remarks</i>
<b>Comfort threshold<sup>2</sup> (dBA)</b>				<b>30</b>	
<b>Exposure Level<sup>3</sup> (dBA)</b>				<b>75</b>	
<b>Mary River Mine</b>					
2024-04-07	Sailliivik Camp - Room C2-23	Spartan 821 S/N 30013	from 4 h 08 to 18 h 39	28,1	Vacant Room Regular conditions
<b>Milne Port</b>					
2023-04-01	380-person camp - Room H-31	Spartan 821 S/N 30013	from 17 h 15 to 6 h 48	43,0	Vacant Room Regular conditions
2024-04-02	Port site complex - Room BC-12	Spartan 821 S/N 30013	from 16 h 12 to 7 h 05	35,3	Vacant Room Regular condition

**General remarks:**

Measurements were taken with a Larson Davis SoundExpert 821 sound level meter (Q3 bisection factor, no integration threshold).  
Measurements were taken in vacant rooms.

**Notes :**

<sup>1</sup> Leq: equivalent noise level averaged over sampling time.

<sup>2</sup> Comfort threshold defined in the World Health Organization *Guidelines for Community Noise* and designed to minimize sleep disturbances for shift workers.

<sup>3</sup> Exposure level considered by the Nunavut Impact Review Board (NIRB) for exposure to noise during resting time.

## 5.2 Whole-body vibration

The vibration levels measured in accommodation facilities are compiled in table 3 below. The session reports are presented in Appendix D.

The notable facts are as follow:

- all the whole-body vibration measurements respect the limits of  $0.5 \text{ m/s}^2$  and  $1.15 \text{ m/s}^2$  considered by the NIRB:
  - MRM: average vibration levels of  $0,003 \text{ m/s}^2$ .
  - MP: average vibration levels range from  $0,003$  to  $0,004 \text{ m/s}^2$ .
- the comfort threshold (peak exposure) of  $0,015 \text{ m/s}^2$  considered in this study was exceeded at each sampling station:
  - SC: exceedances represent 12% of the sampling time (95% of the exceedances are before 9 a.m. and after 3 p.m.).
  - 380-person camp: exceedances represent 2% of the sampling time (70% of the exceedances are before 9 p.m. and after 3 a.m.).
  - PSC: exceedances represent 26% of the sampling time (95% of the exceedances are before 9 p.m. and after 3 a.m.).

**TABLE 3**  
**RESULTS - Accommodation facilities**  
**Whole-body vibrations - S1 2024**  
*Baffinland Iron Mines - Mary River and Milne Port Sites (Nunavut)*

Starting Date	Location	Sampling duration	$A_{eq}^1$ ( $m/s^2$ )	$A_{peak}^2$ ( $m/s^2$ )	Remarks
Comfort threshold ( $m/s^2$ ) (peak) <sup>3</sup>			-	0,015	
8-hr action limit ( $m/s^2$ ) <sup>4</sup>			0,5	-	
8-hr exposure level ( $m/s^2$ ) <sup>5</sup>			1,15	-	
<b>Mary River Mine</b>					
2024-04-07	Sailiivik Camp - Room C2-23	from 4 h 08 to 18 h 38	0,003	<b>0,153</b>	Vacant Room Regular conditions Comfort threshold exceeded for ~12% of sampling time
<b>Milne Port</b>					
2024-04-01	380-person camp - Room H-31	from 17 h 15 to 6 h 48	0,003	<b>0,039</b>	Vacant Room Regular conditions Comfort threshold exceeded for ~2% of the sampling period
2024-04-02	Port site complex - Room BC-12	from 16 h 11 to 6 h 11	0,004	<b>0,115</b>	Vacant Room Regular conditions Comfort threshold exceeded for ~26% of the sampling period

**General remarks:**

All samples are taken with Larson Davis HVM200 with triaxial accelerometer in seatpad (Whole Body Vibration mode).

**Notes :**

<sup>1</sup>  $A_{eq}$  or  $A_{rms}$ : the frequency-weighted, time-weighted acceleration sum over the sampling period.

<sup>2</sup>  $A_{peak}$ : the frequency-weighted, peak acceleration sum measured during the sampling period.

<sup>3</sup> Comfort threshold defined by the 5-part standard ISO 2631 1:1997 (peak measurement)

<sup>4</sup> 8-hr Action limit considered by the Nunavut Impact Review Board (NIRB) for exposure to whole-body vibrations during resting time.

<sup>5</sup> 8-hr Exposure limit considered by the Nunavut Impact Review Board (NIRB) for exposure to whole-body vibrations during resting time.

## 6 CONCLUSIONS AND RECOMMENDATIONS

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The services of HDS Environnement were retained by BIM to survey noise and vibration levels in accommodation facilities of the Mary River Mine and Milne Inlet sites, located in the Qikiqtani Region (Baffin Island; Nunavut).

The surveys took place in April 2024 (see table 1 for sampling strategy). Overall, based on the data collected on site, the survey results were deemed representative of regular operating, ventilation and occupancy conditions expected at this time of year.

Conclusions and recommendations based on the data collected during this study are presented below.

### 6.1 Noise

All the indoor noise measurements taken in the accommodations respect the exposure limit of 75 dBA considered by the NIRB for exposure to noise during rest.

The comfort threshold of 30 dBA considered in this study was exceeded in all the facilities. The highest exceedance percentages are before 9 p.m.

Based on elements above, HDS Environnement recommends:

- further documenting indoor noise levels in the accommodation facilities, especially for night shift workers during peak activity.
- identifying stationary sources of constant noise above 30 dBA in accommodation facilities.

### 6.2 Whole-body vibration

All the whole-body vibration measurements taken in the accommodations respect the limits of 0.5 m/s<sup>2</sup> and 1.15 m/s<sup>2</sup> considered by the NIRB for exposure to whole-body vibration during rest.

The comfort threshold of 0.015 m/s<sup>2</sup> considered in this study was exceeded in all the facilities. More than 95% of the exceedances were measured before 9 p.m. or after 3 a.m.

Based on elements above, HDS Environnement recommends:

- further documenting whole-body vibration levels with a HVM200 in the accommodation facilities, especially during peak activity.
- identifying stationary sources of whole-body vibrations above 0.015 m/s<sup>2</sup> in accommodation facilities.

## REFERENCES

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- *Mine Health and Safety Act (mine health and safety regulations)* R-125-95.
- *Safety Act (occupational health and safety regulations)* R-003-2016;
- *Canada Occupational Health and Safety Regulations*, SOR/86-304
- American Conference of Governmental Industrial Hygienists, *TLVs and BEIs booklet*, 2024 edition.
- World Health Organization, *Guidelines for community noise*, 1999.
- ISO 2631 1:1997 *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration – Part 1: General requirements*.
- ISO 2631-2:2003 *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)*.



## APPENDIX A

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### Study limitations



## **LIMITATIONS AND DISCLAIMER OF LIABILITY**

This report (hereinafter the "Report") was prepared by Hudon Desbiens St-Germain Environnement inc. (hereinafter "HDS Environnement") at the request and for the sole benefit of the client for whom it is directly intended (hereinafter the "Client").

The use of the Report and its content by a third party is subject to the prior written authorization of HDS Environnement. In the event of use of the Report without the authorization of HDS Environnement, this third party undertakes to use it at its own risk and assumes full responsibility. Likewise, it expressly releases HDS Environnement from any liability resulting, directly or indirectly, from the elements, information, conclusions and/or recommendations contained in the Report. HDS Environnement has no obligation towards this third party and may under no circumstances be held liable for losses, fines, penalties, costs, damages and/or prejudices, of any nature whatsoever, suffered by this third party which would result, directly or indirectly, from the use of the Report, including in particular any decision-making process used by this third party on the basis of the information, recommendations and/or conclusions contained in the Report.

Without limiting the generality of the foregoing or certain specific considerations described later in this Report, the scope of the mandate entrusted to HDS Environnement is defined by the service offer emitted on March 20<sup>th</sup>, 2024, and its subsequent modifications, as accepted by the Client (hereinafter the "Mandate").

The purpose of the Report is to provide an overview of the premises specifically covered by the Mandate, on the dates indicated in the Report, according to the scope of the Mandate, and of the findings, comments, conclusions and/or recommendations arising of this Mandate. The interpretations provided in the Report consider the laws, regulations, standards, policies, directives and best practices listed in the Report and considered while carrying out the works related to the Mandate. Accordingly, the interpretations provided in the report are of a technical nature only and do not constitute legal advice.

The work described in the Report is based on information expressly brought to the attention of HDS Environnement prior to said work, either by the Client or following diligent and reasonable research. HDS Environnement cannot be held responsible for any erroneous or missing information during the execution of said work.

Similarly, the interpretations provided in the Report are based on the results obtained within the framework of the Mandate, following specific analyzes carried out on samples taken at determined depths and at given locations, while carrying out the works related to the Mandate. These interpretations may not reflect actual variations in concentrations of materials or substances outside the scope of work of the Mandate. HDS Environnement can in no way be held responsible for these possible variations, as well as for any loss, fine, penalty, damage and/or prejudice, of any nature whatsoever, resulting directly or indirectly from them.



## APPENDIX B

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### Calibration certificates

~ *Certificate of Calibration and Compliance* ~

Model : 377B02 Manufacturer : PCB  
Serial : 348790 Description : 1/2" Free-Field Microphone

**Calibration Environmental Conditions**

Environmental test conditions as printed on microphone calibration chart.

**Reference Equipment**

Manufacturer	Model #	Serial #	Control #	Cal Date	Due Date
National Instruments	PC1e-6351	01896F08	CA1918	04/20/2023	04/20/2024
Larson Davis	PRM915	0143	CA2000	02/07/2023	02/07/2024
Larson Davis	PRM902	4701	CA1450	12/07/2022	12/07/2023
Larson Davis	PRM916	129	CA1084	06/23/2022	06/23/2023
Larson Davis	CAL250	5569	CA2284	10/07/2022	10/06/2023
Larson Davis	2201	146	CA1686	12/20/2022	12/20/2023
Larson Davis	GPRM902	4163	CA1089	08/23/2022	08/23/2023
Larson Davis	PRM915	147	CA2179	08/15/2022	08/15/2023
Larson Davis	PRA951-4	0241	CA1449	06/23/2022	06/23/2023
Bruel & Kjaer	4192	3259547	CA3214	01/23/2023	01/23/2024
Newport	iTHX-SD/N	1080002	CA1511	02/07/2023	02/07/2024
PCB	68510-02	N/A	CA2672	02/08/2023	02/08/2024

Frequency sweep performed with B&K UA0033 electrostatic actuator.

**Condition of Unit**

As Found : n/a

As Left : New Unit, In Tolerance

**Notes**

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 10012-1, ANSI/NCSS Z540.3 and ISO 17025.
4. Measurement results relate only to the items tested. Refer to Manufacturer's Specification Sheet for performance details.
5. Open Circuit Sensitivity is measured using the voltage insertion method following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-20.
8. Product is compliant with specification if measured value is within or equal to the specification tolerance. Product is not compliant with specification if measured value falls outside of the specification tolerance.

Technician: Leonard Lukasik Date: 06/13/2023



**PCB PIEZOTRONICS**  
AN AMPHENOL COMPANY  
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TEL: +1 (888) 684-0013 - FAX: +1 (716) 685-3886 - www.pcb.com





# ~ Calibration Report ~

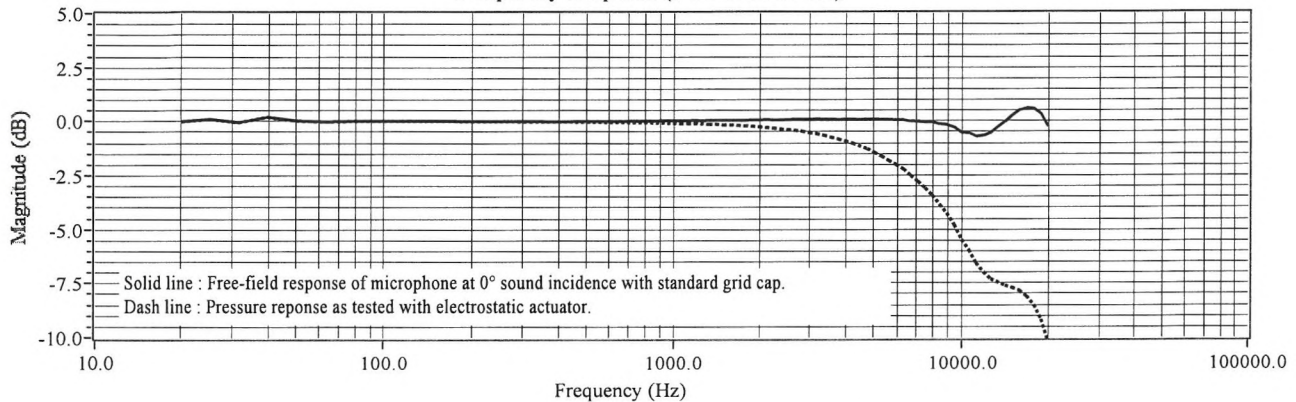
Model : 377B02 Manufacturer : PCB  
Serial : 348790 Description : 1/2" Free-Field Microphone

## Calibration Data

Open Circuit Sensitivity at 251.2 Hz : 56.68 mV/Pa Polarization Voltage, External : 0 V  
-24.93 dB re 1 V/Pa Capacitance : 12.98 pF

Temperature: 68 °F (20 °C) Ambient Pressure: 979 mbar Relative Humidity: 42 %

Frequency Response (0 dB at 251.2 Hz)



Frequency (Hz)	Pressure (dB)	Free-Field (dB)	Frequency (Hz)	Pressure (dB)	Free-Field (dB)	Frequency (Hz)	Pressure (dB)	Free-Field (dB)
20.00	0.00	0.00	1584.90	-0.17	0.04	6683.40	-2.52	0.00
25.10	0.10	0.10	1678.80	-0.19	0.04	7079.50	-2.80	-0.02
31.60	-0.04	-0.04	1778.30	-0.21	0.04	7498.90	-3.11	-0.04
39.80	0.21	0.21	1883.60	-0.23	0.05	7943.30	-3.44	-0.05
50.10	0.03	0.03	1995.30	-0.26	0.05	8414.00	-3.86	-0.13
63.10	-0.03	-0.03	2113.50	-0.27	0.07	8912.50	-4.27	-0.16
79.40	0.02	0.02	2238.70	-0.31	0.06	9440.60	-4.79	-0.27
100.00	0.02	0.02	2371.40	-0.35	0.06	10000.00	-5.49	-0.54
125.90	0.01	0.01	2511.90	-0.38	0.08	10592.50	-5.95	-0.55
158.50	0.01	0.01	2660.70	-0.42	0.09	11220.20	-6.56	-0.70
199.50	0.00	0.00	2818.40	-0.46	0.10	11885.00	-6.99	-0.67
251.20	0.00	0.00	2985.40	-0.53	0.09	12589.30	-7.31	-0.54
316.20	-0.01	-0.00	3162.30	-0.58	0.10	13335.20	-7.46	-0.27
398.10	-0.02	-0.02	3349.70	-0.66	0.08	14125.40	-7.61	-0.02
501.20	-0.03	0.01	3548.10	-0.73	0.09	14962.40	-7.71	0.26
631.00	-0.05	-0.01	3758.40	-0.83	0.07	15848.90	-7.84	0.51
794.30	-0.07	0.02	3981.10	-0.92	0.08	16788.00	-8.12	0.60
1000.00	-0.09	0.03	4217.00	-1.02	0.09	17782.80	-8.52	0.59
1059.30	-0.09	0.04	4466.80	-1.15	0.08	18836.50	-9.19	0.32
1122.00	-0.11	0.03	4731.50	-1.28	0.09	19952.60	-10.19	-0.26
1188.50	-0.11	0.04	5011.90	-1.44	0.09			
1258.90	-0.12	0.04	5308.80	-1.62	0.08			
1333.50	-0.14	0.04	5623.40	-1.81	0.07			
1412.50	-0.14	0.05	5956.60	-2.02	0.05			
1496.20	-0.16	0.04	6309.60	-2.23	0.06			

Technician: Leonard Lukasik Date: 06/13/2023



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# Calibration Certificate

**Certificate Number** 2023009282

**Customer:**

HDS Environment  
640 Rue Saint Paul O,Bur 100  
Montreal,QC H3C 1L9,Canada

<b>Model Number</b>	PRM821	<b>Procedure Number</b>	D0001.8383
<b>Serial Number</b>	001203	<b>Technician</b>	Jacob Cannon
<b>Test Results</b>	<b>Pass</b>	<b>Calibration Date</b>	24 Jul 2023
<b>Initial Condition</b>	As Manufactured	<b>Calibration Due</b>	
<b>Description</b>	Larson Davis 1/2" Preamplifier for 821 Class 1	<b>Temperature</b>	23.69 °C ± 0.01 °C
		<b>Humidity</b>	48.6 %RH ± 0.5 %RH
		<b>Static Pressure</b>	86.5 kPa ± 0.03 kPa

**Evaluation Method** Tested electrically using a 12.0 pF capacitor to simulate microphone capacitance.  
Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level. Tests are considered to pass when the measured value is within the acceptance limits, which are derived from industry standards.

Simple acceptance criteria is used with an expanded uncertainty not to exceed 0.20 dB for all measurements below 100 kHz and 0.50 dB for measurements above 100 kHz.

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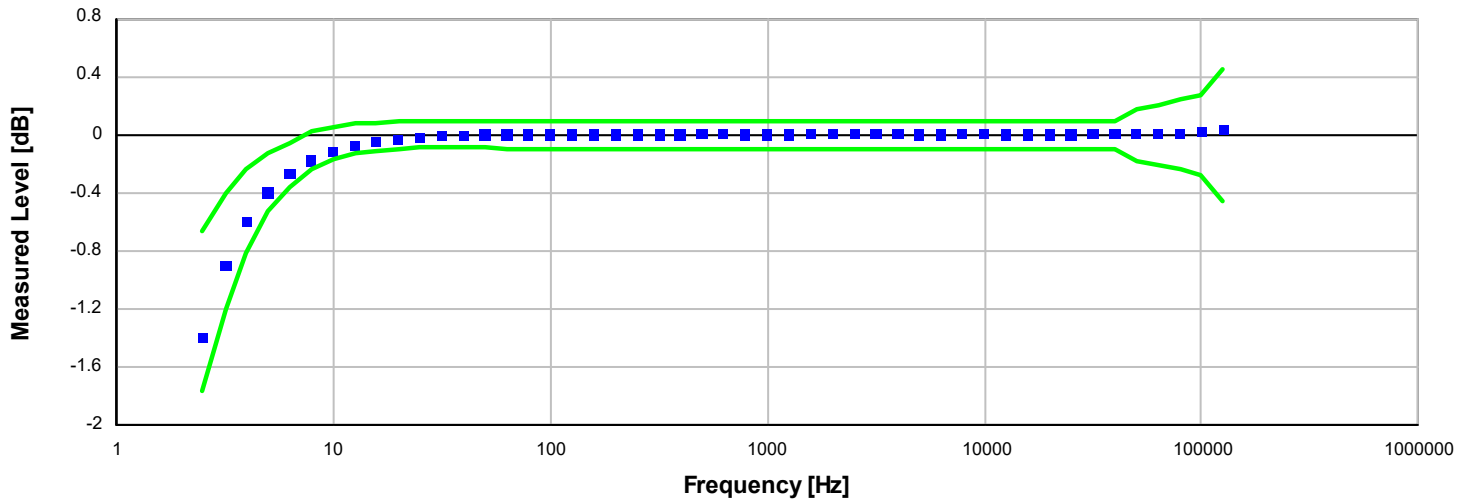
Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis Model 2900 Real Time Analyzer	10/31/2022	10/31/2023	001150
Hart Scientific 2626-S Humidity/Temperature Sensor	02/20/2023	08/20/2024	006946
Keysight 34401A DMM	06/14/2023	06/14/2024	007485
SRS DS360 Ultra Low Distortion Generator	03/30/2023	03/30/2024	007635

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## Frequency Response

Frequency response electrically tested at 120.0 dB re 1  $\mu$ V

Frequency [Hz]	Test Result [dB re 1 kHz]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
2.50	-1.40	-1.76	-0.66	0.12	Pass
3.20	-0.90	-1.20	-0.40	0.12	Pass
4.00	-0.60	-0.81	-0.23	0.12	Pass
5.00	-0.40	-0.53	-0.13	0.10	Pass
6.30	-0.27	-0.36	-0.05	0.07	Pass
7.90	-0.18	-0.24	0.03	0.07	Pass
10.00	-0.12	-0.17	0.06	0.07	Pass
12.60	-0.08	-0.13	0.08	0.04	Pass
15.80	-0.05	-0.11	0.09	0.04	Pass
20.00	-0.03	-0.10	0.10	0.04	Pass
25.10	-0.02	-0.08	0.10	0.04	Pass
31.60	-0.01	-0.08	0.10	0.04	Pass
39.80	-0.01	-0.09	0.10	0.04	Pass
50.10	0.00	-0.09	0.10	0.04	Pass
63.10	0.00	-0.10	0.10	0.04	Pass
79.40	0.00	-0.10	0.10	0.04	Pass
100.00	0.00	-0.10	0.10	0.04	Pass
125.90	0.00	-0.10	0.10	0.04	Pass
158.50	0.00	-0.10	0.10	0.04	Pass
199.50	0.00	-0.10	0.10	0.04	Pass
251.20	0.00	-0.10	0.10	0.04	Pass
316.20	0.00	-0.10	0.10	0.04	Pass
398.10	0.00	-0.10	0.10	0.04	Pass
501.20	0.01	-0.10	0.10	0.04	Pass
631.00	0.01	-0.10	0.10	0.04	Pass
794.30	0.00	-0.10	0.10	0.04	Pass
1,000.00	0.00	-0.10	0.10	0.04	Pass
1,258.90	0.00	-0.10	0.10	0.04	Pass
1,584.90	0.01	-0.10	0.10	0.04	Pass
1,995.30	0.01	-0.10	0.10	0.04	Pass
2,511.90	0.01	-0.10	0.10	0.04	Pass
3,162.30	0.01	-0.10	0.10	0.04	Pass

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Frequency [Hz]	Test Result [dB re 1 kHz]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
3,981.10	0.01	-0.10	0.10	0.04	Pass
5,011.90	0.00	-0.10	0.10	0.04	Pass
6,309.60	0.00	-0.10	0.10	0.04	Pass
7,943.30	0.01	-0.10	0.10	0.04	Pass
10,000.00	0.01	-0.10	0.10	0.04	Pass
12,589.30	0.00	-0.10	0.10	0.04	Pass
15,848.90	0.00	-0.10	0.10	0.04	Pass
19,952.60	0.00	-0.10	0.10	0.04	Pass
25,118.90	0.00	-0.10	0.10	0.05	Pass
31,622.80	0.01	-0.10	0.10	0.05	Pass
39,810.70	0.01	-0.10	0.10	0.05	Pass
50,118.70	0.01	-0.18	0.18	0.09	Pass
63,095.70	0.01	-0.21	0.21	0.09	Pass
79,432.80	0.01	-0.24	0.24	0.09	Pass
100,000.00	0.02	-0.27	0.27	0.09	Pass
125,892.50	0.03	-0.45	0.45	0.45	Pass

## Gain Measurement

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
Output Gain @ 1 kHz	-0.14	-0.45	-0.03	0.04	Pass

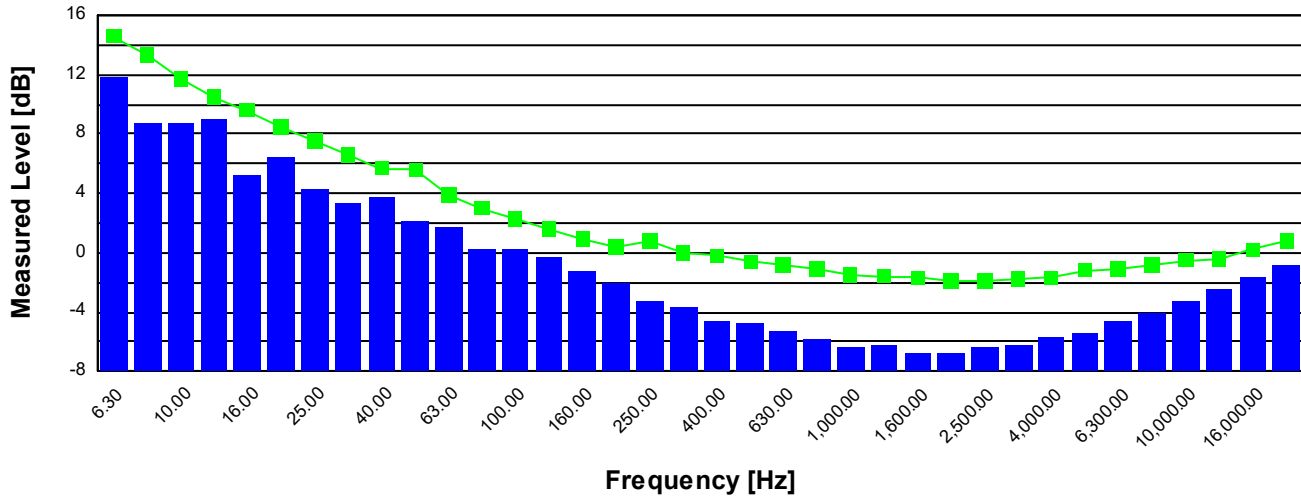
-- End of measurement results--

## DC Bias Measurement

Measurement	Test Result [V]	Lower limit [V]	Upper limit [V]	Expanded Uncertainty [V]	Result
DC Voltage	18.15	15.50	19.50	0.04	Pass

-- End of measurement results--

## 1/3-Octave Self-Generated Noise



Frequency [Hz]	Test Result [dB re 1 $\mu$ V]	Upper limit [dB re 1 $\mu$ V]	Result
6.30	11.90	14.60	Pass
8.00	8.70	13.30	Pass
10.00	8.80	11.70	Pass
12.50	9.00	10.50	Pass
16.00	5.30	9.60	Pass
20.00	6.50	8.50	Pass
25.00	4.30	7.50	Pass
31.50	3.30	6.60	Pass
40.00	3.70	5.70	Pass
50.00	2.20	5.60	Pass
63.00	1.70	3.90	Pass
80.00	0.30	3.00	Pass
100.00	0.20	2.30	Pass
125.00	-0.30	1.60	Pass
160.00	-1.30	0.90	Pass
200.00	-2.00	0.40	Pass
250.00	-3.20	0.80	Pass
315.00	-3.60	0.00	Pass
400.00	-4.60	-0.20	Pass
500.00	-4.70	-0.60	Pass
630.00	-5.30	-0.80	Pass
800.00	-5.80	-1.10	Pass
1,000.00	-6.30	-1.50	Pass
1,250.00	-6.20	-1.60	Pass
1,600.00	-6.70	-1.70	Pass
2,000.00	-6.70	-1.90	Pass
2,500.00	-6.40	-1.90	Pass
3,150.00	-6.20	-1.80	Pass
4,000.00	-5.70	-1.70	Pass
5,000.00	-5.40	-1.20	Pass
6,300.00	-4.60	-1.10	Pass
8,000.00	-4.10	-0.80	Pass
10,000.00	-3.30	-0.50	Pass
12,500.00	-2.50	-0.40	Pass
16,000.00	-1.60	0.20	Pass
20,000.00	-0.80	0.80	Pass

-- End of measurement results--

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## Self-generated Noise

Bandwidth	Test Result [ $\mu\text{V}$ ]	Test Result [dB re 1 $\mu\text{V}$ ]	Upper limit [dB re 1 $\mu\text{V}$ ]	Result
Broadband (20 Hz - 20 kHz)	4.68	13.40	15.50	Pass
A-weighted (20 Hz - 20 kHz)	2.16	6.70	9.00	Pass
-- End of measurement results--				

Signatory: Jacob Cannon

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# Calibration Certificate

**Certificate Number 2023009836**

**Customer:**

HDS Environment  
640 Rue Saint Paul O,Bur 100  
Montreal,QC H3C 1L9,Canada

**Model Number** CAL200

**Serial Number** 21489

**Test Results** Pass

**Initial Condition** As Manufactured

**Description** Larson Davis CAL200 Acoustic Calibrator

**Procedure Number** D0001.8386

**Technician** Scott Montgomery

**Calibration Date** 2 Aug 2023

**Calibration Due**

**Temperature** 25 °C ± 0.3 °C

**Humidity** 38 %RH ± 3 %RH

**Static Pressure** 101.2 kPa ± 1 kPa

**Evaluation Method** The data is acquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 µPa.

**Compliance Standards** Compliant to Manufacturer Specifications per D0001.8190 and the following standards:  
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	06/21/2023	06/21/2024	001021
Larson Davis Model 2900 Real Time Analyzer	03/31/2023	03/31/2024	001051
Microphone Calibration System	02/22/2023	02/22/2024	005446
1/2" Preamplifier	08/23/2022	08/23/2023	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/08/2022	08/08/2023	006507
1/2 inch Microphone - RI - 200V	10/05/2022	10/05/2023	006510
Hart Scientific 2626-S Humidity/Temperature Sensor	11/14/2022	05/14/2024	006943
Pressure Sensor	11/02/2022	11/02/2023	007827

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## Output Level

Nominal Level [dB]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
94	101.2	93.98	93.80	94.20	0.15	Pass
114	101.2	114.00	113.80	114.20	0.14	Pass

-- End of measurement results--

## Frequency

Nominal Level [dB]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
94	101.2	1,000.34	993.00	1,007.00	0.20	Pass
114	101.2	1,000.34	993.00	1,007.00	0.20	Pass

-- End of measurement results--

## Total Harmonic Distortion + Noise (THD+N)

Nominal Level [dB]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
94	101.2	0.46	0.00	2.00	0.25 ‡	Pass
114	101.2	0.33	0.00	2.00	0.25 ‡	Pass

-- End of measurement results--

## Level Change Over Pressure

Tested at: 114 dB, 25 °C, 32 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
108.0	108.0	-0.03	-0.25	0.25	0.04 ‡	Pass
101.3	101.3	0.00	-0.25	0.25	0.04 ‡	Pass
92.0	91.9	0.02	-0.25	0.25	0.04 ‡	Pass
83.0	82.8	0.01	-0.25	0.25	0.04 ‡	Pass
74.0	73.9	-0.03	-0.25	0.25	0.04 ‡	Pass
65.0	65.0	-0.12	-0.25	0.25	0.04 ‡	Pass

-- End of measurement results--

## Frequency Change Over Pressure

Tested at: 114 dB, 25 °C, 32 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
108.0	108.0	0.00	-7.00	7.00	0.20 ‡	Pass
101.3	101.3	0.00	-7.00	7.00	0.20 ‡	Pass
92.0	91.9	0.00	-7.00	7.00	0.20 ‡	Pass
83.0	82.8	-0.01	-7.00	7.00	0.20 ‡	Pass
74.0	73.9	-0.01	-7.00	7.00	0.20 ‡	Pass
65.0	65.0	-0.02	-7.00	7.00	0.20 ‡	Pass

-- End of measurement results--

## Total Harmonic Distortion + Noise (THD+N) Over Pressure

Tested at: 114 dB, 25 °C, 32 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
108.0	108.0	0.32	0.00	2.00	0.25 ‡	Pass
101.3	101.3	0.32	0.00	2.00	0.25 ‡	Pass
92.0	91.9	0.32	0.00	2.00	0.25 ‡	Pass
83.0	82.8	0.32	0.00	2.00	0.25 ‡	Pass
74.0	73.9	0.33	0.00	2.00	0.25 ‡	Pass
65.0	65.0	0.34	0.00	2.00	0.25 ‡	Pass

-- End of measurement results--

Signatory: Scott Montgomery

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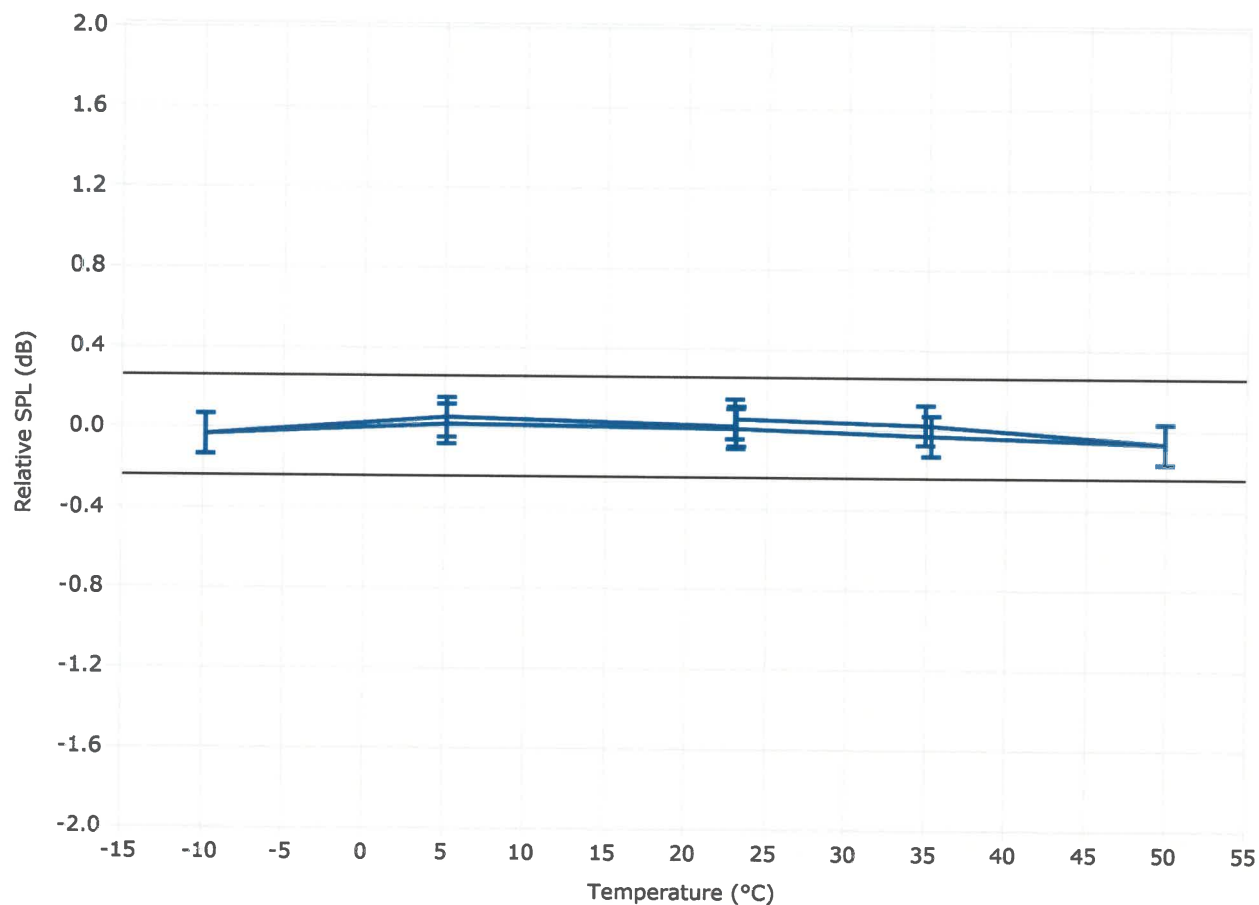


## Model CAL200 Relative SPL vs. Temperature

Larson Davis Model CAL200 Serial Number: 21489

Model CAL200 Relative SPL vs. Temperature at 50% RH.  
A 2559 Mic (SN: 2992) with a PRM901 Preamp (SN: 0175), station 16 was used to check the levels.

Test Date: 09 Jun 2023 11:26:09 AM



0.1dB expanded uncertainty at ~95% confidence level (k=2)

Sequence File: CAL250w200s.SEQ

Test Location: Larson Davis – A PCB Division  
1681 West 820 North, Provo, Utah 84601  
Tel: 716 684-0001 [www.LarsonDavis.com](http://www.LarsonDavis.com)

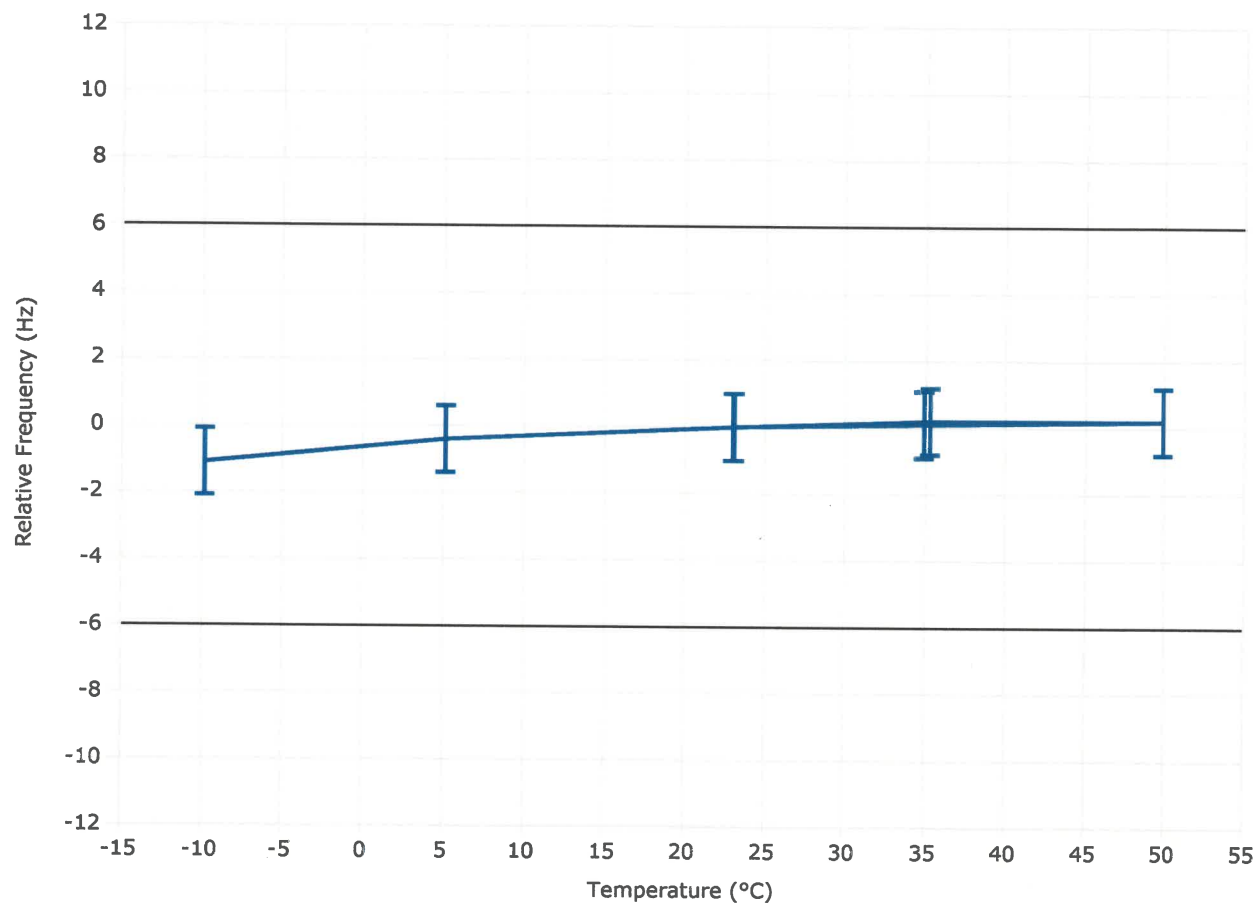


## Model CAL200 Relative Frequency vs. Temperature

Larson Davis Model CAL200 Serial Number: 21489

Model CAL200 Relative Frequency vs. Temperature at 50% RH.  
A 2559 Mic (SN: 2992) with a PRM901 Preamp (SN: 0175), station 16 was used to check the levels.

Test Date: 09 Jun 2023 11:26:09 AM



1.0 Hz expanded uncertainty at ~95% confidence level ( $k=2$ )

Sequence File: CAL250w200s.SEQ

Test Location: Larson Davis – A PCB Division  
1681 West 820 North, Provo, Utah 84601  
Tel: 716 684-0001 [www.LarsonDavis.com](http://www.LarsonDavis.com)

# Calibration Certificate

**Certificate Number** 2023010140

**Customer:**

HDS Environment

640 Rue Saint Paul O, Bur 100

Montreal, QC H3C 1L9, Canada

**Model Number** Spartan 821

**Serial Number** 30013

**Test Results** Pass

**Initial Condition** As Manufactured

**Description** Spartan 821  
Class 1 Sound Level Meter  
Firmware Revision: 1.002R02

**Procedure Number**

**Technician** Jacob Cannon

**Calibration Date** 8 Aug 2023

**Calibration Due**

**Temperature** 23.88 °C ± 0.25 °C

**Humidity** 49.8 %RH ± 2.0 %RH

**Static Pressure** 86.27 kPa ± 0.13 kPa

**Evaluation Method**

**Tested with:**

**Data reported in dB re 20 µPa.**

Larson Davis CAL200. S/N 9079

TMS 9917C. S/N 219

Larson Davis PRM821. S/N 001203

PCB 377B02. S/N 348790

**Compliance Standards**

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8467:

IEC 60651:2001 Type 1

IEC 60804:2000 Type 1

IEC 61260:2014 Class 1

IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.11-2014 Class 1

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis Spartan 721/821 Manual, I821.03 Rev A

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, 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 specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2023-02-20	2024-08-20	006946
Larson Davis CAL200 Acoustic Calibrator	2023-07-17	2024-07-17	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-30	2024-03-30	007635
TMS 9917C-LD Microphone Comparison Calibrator	2023-03-14	2024-03-14	007649
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

### Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

### Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-24.77	-27.50	-24.50	0.14	Pass

-- End of measurement results--

### Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.40	Pass
1000	0.20	0.00	-0.70	0.70	0.40	Pass
8000	-3.70	-3.00	-5.50	-1.50	0.50	Pass

-- End of measurement results--



## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	26.12

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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# Calibration Certificate

**Certificate Number** 2023010134

**Customer:**

HDS Environment  
640 Rue Saint Paul O, Bur 100  
Montreal, QC H3C 1L9, Canada

**Model Number** Spartan 821  
**Serial Number** 30013  
**Test Results** **Pass**  
**Initial Condition** As Manufactured  
**Description** Spartan 821  
Class 1 Sound Level Meter  
Firmware Revision: 1.002R02

**Procedure Number** D0001.8465  
**Technician** Jacob Cannon  
**Calibration Date** 8 Aug 2023  
**Calibration Due**  
**Temperature** 23.87 °C ± 0.25 °C  
**Humidity** 48.6 %RH ± 2.0 %RH  
**Static Pressure** 86.29 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRM821 S/N 001203 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8468:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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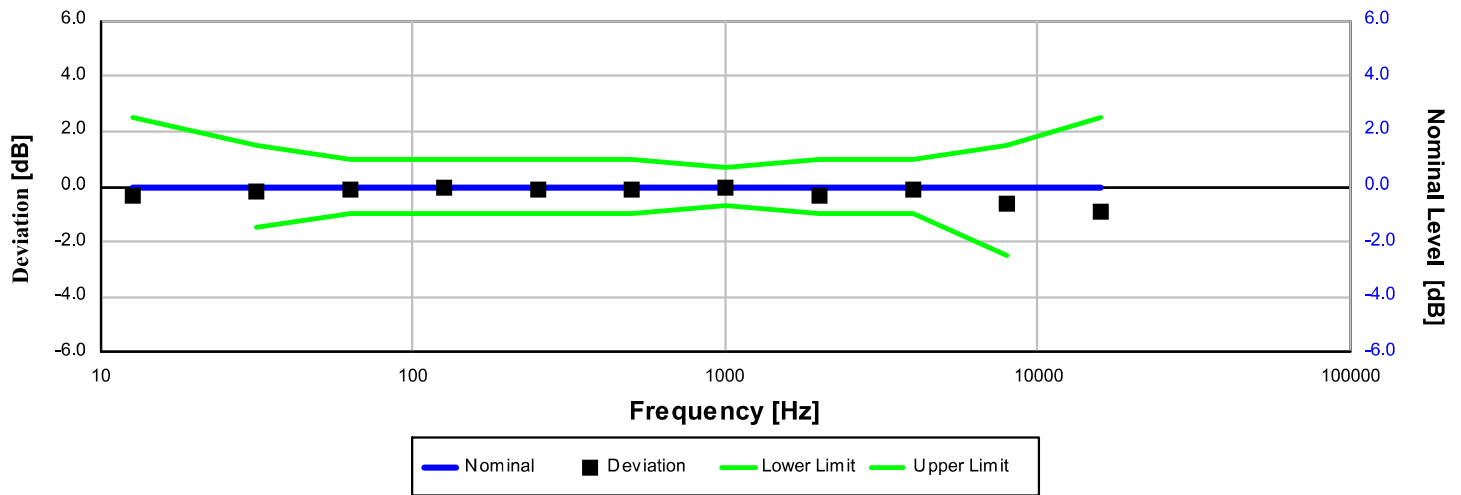
Correction data from Larson Davis Spartan 721/821 Manual, I821.03 Rev A

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2023-02-20	2024-08-20	006946
SRS DS360 Ultra Low Distortion Generator	2022-09-02	2023-09-02	007167



## Z-weight Filter Response

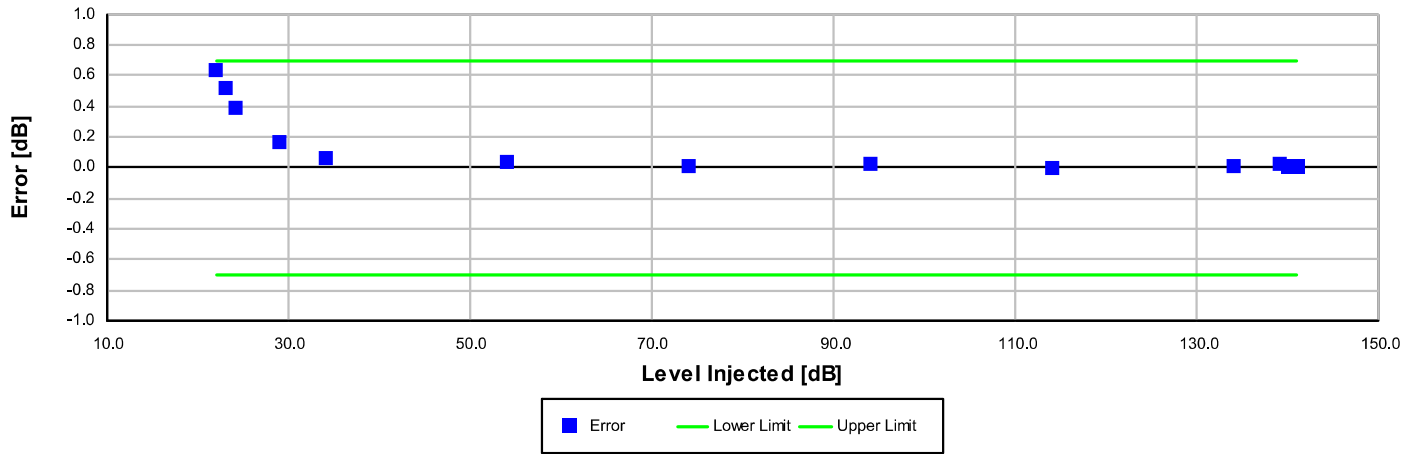


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
12.59	-0.30	-0.30	-inf	2.50	0.15	Pass
31.62	-0.20	-0.20	-1.50	1.50	0.15	Pass
63.10	-0.10	-0.10	-1.00	1.00	0.15	Pass
125.89	0.00	0.00	-1.00	1.00	0.15	Pass
251.19	-0.10	-0.10	-1.00	1.00	0.15	Pass
501.19	-0.10	-0.10	-1.00	1.00	0.15	Pass
1,000.00	0.00	0.00	-0.70	0.70	0.15	Pass
1,995.26	-0.30	-0.30	-1.00	1.00	0.15	Pass
3,981.07	-0.10	-0.10	-1.00	1.00	0.15	Pass
7,943.28	-0.60	-0.60	-2.50	1.50	0.15	Pass
15,848.93	-0.90	-0.90	-16.00	2.50	0.15	Pass

-- End of measurement results--

## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
22.00	0.64	-0.70	0.70	0.16	Pass
23.00	0.52	-0.70	0.70	0.16	Pass
24.00	0.39	-0.70	0.70	0.16	Pass
29.00	0.17	-0.70	0.70	0.16	Pass
34.00	0.06	-0.70	0.70	0.16	Pass
54.00	0.04	-0.70	0.70	0.16	Pass
74.00	0.01	-0.70	0.70	0.16	Pass
94.00	0.03	-0.70	0.70	0.16	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
134.00	0.02	-0.70	0.70	0.15	Pass
139.00	0.02	-0.70	0.70	0.15	Pass
140.00	0.01	-0.70	0.70	0.15	Pass
141.00	0.01	-0.70	0.70	0.15	Pass

-- End of measurement results--

## Overload Detector

Overload indication performed according to IEC 61672-3:2013 20 and ANSI S1.4-2014 Part 3: 20 for compliance to IEC 61672-1:2013 5.11, IEC 60804:2000 9.3.5, IEC 61252:2002 11, ANSI S1.4 (R2006) 5.8, and ANSI S1.4-2014 Part 1: 5.11, ANSI S1.25 (R2007) 7.6, ANSI S1.43 (R2007) 7

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
Positive	141.90	140.50	142.50	0.15	Pass
Negative	141.90	140.50	142.50	0.15	Pass
Comparison	0.00	-1.50	1.50	0.15	Pass

-- End of measurement results--

## Range

Measured in A-weight at 8000 Hz for compliance to IEC 61672-1:2013 5.6.4, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6.4, ANSI S1.43 (R2007) 6.2

Measurement	Measured Level [dB]	Lower limit [dB]	Expanded Uncertainty [dB]	Result
Primary Indicator Range	120.00	106.00	0.15	Pass
Dynamic Range	129.95	118.00	0.15	Pass

-- End of measurement results--

**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.90	93.20	94.80	0.15	Pass
0 dB Gain, Linearity	27.07	26.20	27.60	0.16	Pass

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	12.05	14.50	Pass
Z-weight Noise Floor	22.88	25.00	Pass

-- End of measurement results--

**Total Harmonic Distortion**

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
20 Hz Signal	137.85	137.20	138.80	0.15	Pass
THD	-75.63		-60.00	0.01 ‡	Pass
THD+N	-64.94		-60.00	0.01 ‡	Pass

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

LARSON DAVIS – A PCB DIVISION  
 1681 West 820 North  
 Provo, UT 84601, United States  
 716-684-0001



# Calibration Certificate

Certificate Number 2024004342

Customer:

The Modal Shop  
10310 AeroHub Boulevard  
Cincinnati, OH 45215, United States

Model Number	HVM200	Procedure Number	D0001.8391
Serial Number	0001930	Technician	Tina Brezinski
Test Results	Pass	Calibration Date	20 Mar 2024
Initial Condition	Found / Left	Calibration Due	20 Mar 2025
Description	Larson Davis Model HVM200	Temperature	23.7 °C ± 0.01 °C
		Humidity	21.9 %RH ± 0.5 %RH
		Static Pressure	99.16 kPa ± 0.03 kPa

**Evaluation Method** Tested electrically using ADSIT.99 test fixture. Data reported in m/s<sup>2</sup> with equivalent sensor sensitivity of 1 mV/m/s<sup>2</sup>.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards:  
ISO 8041-1:2017 IEC 61260:2014  
ISO 8041-2:2021 ANSI S1.11  
ANSI S2.70

The Modal Shop certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances will be made by the customer as needed.

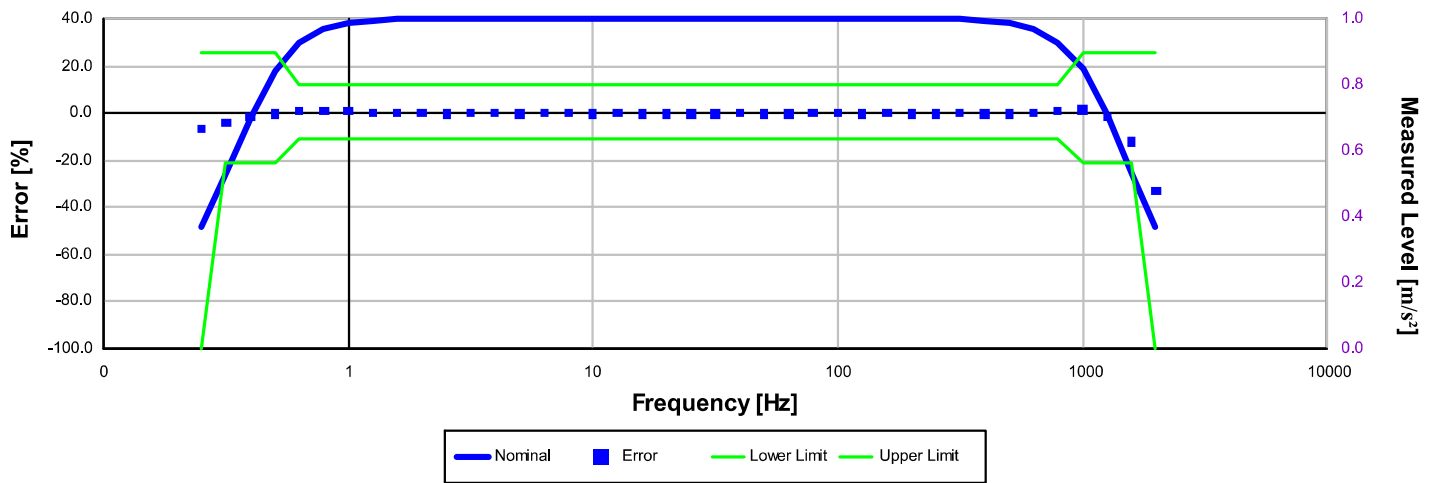
The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	04/19/2023	04/19/2024	TMS123270

## X-Axis, Fb-weighting



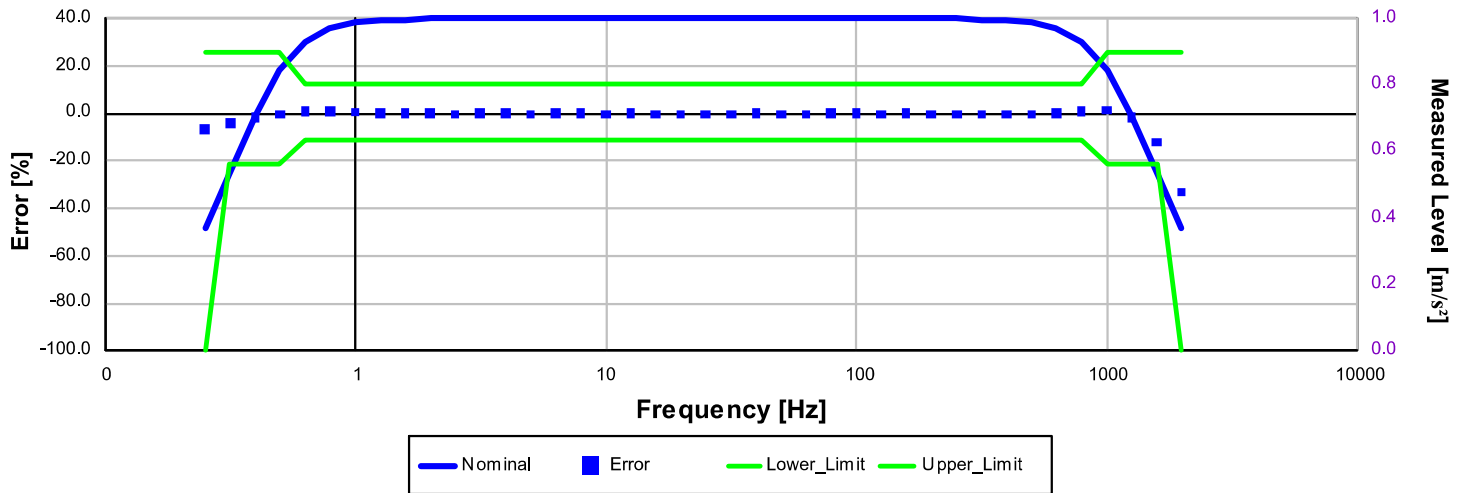
Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s²]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
0.25	0.3422	-6.72	-100	26	1.70	Pass
0.32	0.5077	-4.22	-21	26	1.70	Pass
0.40	0.6918	-1.69	-21	26	1.70	Pass
0.50	0.8415	-0.23	-21	26	1.70	Pass
0.63	0.9359	0.86	-11	12	1.70	Pass
0.79	0.9772	0.82	-11	12	1.70	Pass
1.00	0.9951	0.78	-11	12	1.70	Pass
1.26	0.9960	0.11	-11	12	1.70	Pass
1.58	0.9977	-0.03	-11	12	1.70	Pass
2.00	0.9997	0.05	-11	12	1.70	Pass
2.51	0.9962	-0.35	-11	12	1.70	Pass
3.16	1.0009	0.10	-11	12	1.70	Pass
3.98	0.9993	-0.06	-11	12	1.70	Pass
5.01	0.9975	-0.25	-11	12	1.70	Pass
6.31	1.0008	0.08	-11	12	1.70	Pass
7.94	0.9997	-0.03	-11	12	1.70	Pass
10.00	0.9984	-0.16	-11	12	1.70	Pass
12.59	0.9997	-0.03	-11	12	1.70	Pass
15.85	0.9959	-0.41	-11	12	1.70	Pass
19.95	0.9962	-0.38	-11	12	1.70	Pass
25.12	0.9967	-0.33	-11	12	1.70	Pass
31.62	0.9985	-0.15	-11	12	1.70	Pass
39.81	0.9997	-0.03	-11	12	1.70	Pass
50.12	0.9964	-0.36	-11	12	1.70	Pass
63.10	0.9961	-0.39	-11	12	1.70	Pass
79.43	1.0004	0.04	-11	12	1.70	Pass
100.00	0.9997	-0.03	-11	12	1.70	Pass
125.89	0.9965	-0.34	-11	12	1.70	Pass
158.49	0.9995	-0.04	-11	12	1.70	Pass
199.53	0.9966	-0.31	-11	12	1.70	Pass
251.19	0.9955	-0.37	-11	12	1.70	Pass
316.23	0.9970	-0.10	-11	12	1.70	Pass
398.11	0.9929	-0.21	-11	12	1.70	Pass
501.19	0.9861	-0.16	-11	12	1.70	Pass
630.96	0.9706	0.07	-11	12	1.70	Pass
794.33	0.9386	1.02	-11	12	1.70	Pass



Frequency [Hz]	Test Result [m/s²]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
1,000.00	0.8568	1.32	-21	26	1.70	Pass
1,258.90	0.6954	-1.66	-21	26	1.70	Pass
1,584.90	0.4694	-12.03	-21	26	1.70	Pass
1,995.30	0.2472	-33.16	-100	26	1.70	Pass
-- End of measurement results--						

## Y-Axis, Fb-weighting

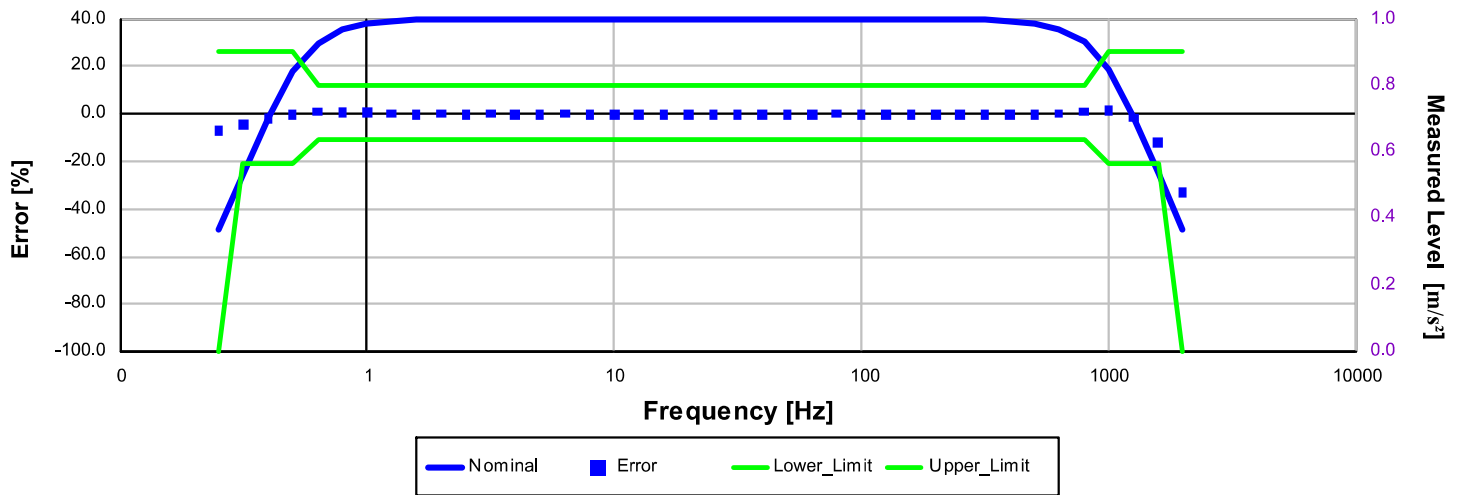


Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
0.25	0.3421	-6.75	-100	26	1.70	Pass
0.32	0.5075	-4.24	-21	26	1.70	Pass
0.40	0.6917	-1.71	-21	26	1.70	Pass
0.50	0.8413	-0.25	-21	26	1.70	Pass
0.63	0.9358	0.85	-11	12	1.70	Pass
0.79	0.9771	0.81	-11	12	1.70	Pass
1.00	0.9950	0.77	-11	12	1.70	Pass
1.26	0.9960	0.11	-11	12	1.70	Pass
1.58	0.9976	-0.04	-11	12	1.70	Pass
2.00	0.9996	0.04	-11	12	1.70	Pass
2.51	0.9962	-0.35	-11	12	1.70	Pass
3.16	1.0008	0.09	-11	12	1.70	Pass
3.98	0.9993	-0.06	-11	12	1.70	Pass
5.01	0.9975	-0.25	-11	12	1.70	Pass
6.31	1.0008	0.08	-11	12	1.70	Pass
7.94	0.9997	-0.03	-11	12	1.70	Pass
10.00	0.9984	-0.16	-11	12	1.70	Pass
12.59	0.9997	-0.03	-11	12	1.70	Pass
15.85	0.9959	-0.41	-11	12	1.70	Pass
19.95	0.9962	-0.38	-11	12	1.70	Pass
25.12	0.9967	-0.33	-11	12	1.70	Pass
31.62	0.9985	-0.15	-11	12	1.70	Pass
39.81	0.9997	-0.03	-11	12	1.70	Pass
50.12	0.9964	-0.36	-11	12	1.70	Pass
63.10	0.9961	-0.39	-11	12	1.70	Pass
79.43	1.0004	0.04	-11	12	1.70	Pass
100.00	0.9997	-0.03	-11	12	1.70	Pass
125.89	0.9965	-0.34	-11	12	1.70	Pass
158.49	0.9995	-0.04	-11	12	1.70	Pass
199.53	0.9966	-0.31	-11	12	1.70	Pass
251.19	0.9955	-0.37	-11	12	1.70	Pass
316.23	0.9970	-0.10	-11	12	1.70	Pass
398.11	0.9929	-0.21	-11	12	1.70	Pass
501.19	0.9861	-0.16	-11	12	1.70	Pass
630.96	0.9706	0.08	-11	12	1.70	Pass
794.33	0.9387	1.03	-11	12	1.70	Pass

Frequency [Hz]	Test Result [m/s²]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
1,000.00	0.8570	1.34	-21	26	1.70	Pass
1,258.90	0.6956	-1.63	-21	26	1.70	Pass
1,584.90	0.4696	-11.99	-21	26	1.70	Pass
1,995.30	0.2474	-33.11	-100	26	1.70	Pass
-- End of measurement results--						

## Z-Axis, Fb-weighting



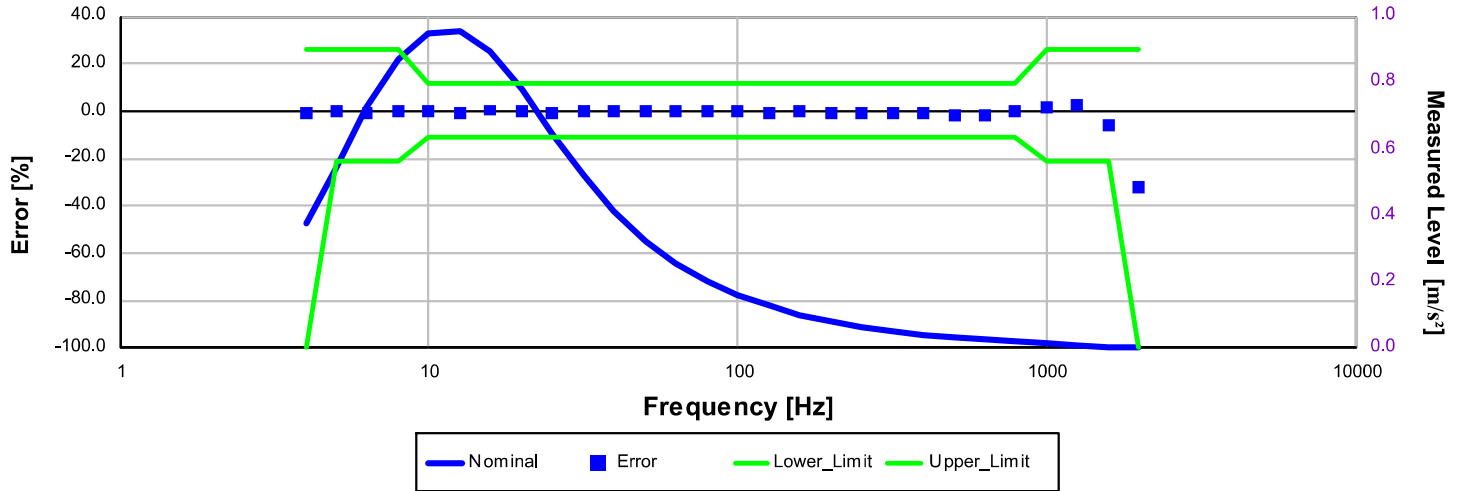
Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
0.25	0.3422	-6.73	-100	26	1.70	Pass
0.32	0.5076	-4.22	-21	26	1.70	Pass
0.40	0.6918	-1.69	-21	26	1.70	Pass
0.50	0.8415	-0.23	-21	26	1.70	Pass
0.63	0.9359	0.86	-11	12	1.70	Pass
0.79	0.9772	0.82	-11	12	1.70	Pass
1.00	0.9951	0.78	-11	12	1.70	Pass
1.26	0.9960	0.11	-11	12	1.70	Pass
1.58	0.9977	-0.03	-11	12	1.70	Pass
2.00	0.9996	0.04	-11	12	1.70	Pass
2.51	0.9962	-0.35	-11	12	1.70	Pass
3.16	1.0009	0.10	-11	12	1.70	Pass
3.98	0.9994	-0.05	-11	12	1.70	Pass
5.01	0.9976	-0.24	-11	12	1.70	Pass
6.31	1.0008	0.08	-11	12	1.70	Pass
7.94	0.9998	-0.02	-11	12	1.70	Pass
10.00	0.9985	-0.15	-11	12	1.70	Pass
12.59	0.9998	-0.02	-11	12	1.70	Pass
15.85	0.9959	-0.41	-11	12	1.70	Pass
19.95	0.9962	-0.38	-11	12	1.70	Pass
25.12	0.9967	-0.33	-11	12	1.70	Pass
31.62	0.9985	-0.15	-11	12	1.70	Pass
39.81	0.9997	-0.03	-11	12	1.70	Pass
50.12	0.9965	-0.35	-11	12	1.70	Pass
63.10	0.9961	-0.39	-11	12	1.70	Pass
79.43	1.0005	0.05	-11	12	1.70	Pass
100.00	0.9997	-0.03	-11	12	1.70	Pass
125.89	0.9965	-0.34	-11	12	1.70	Pass
158.49	0.9996	-0.03	-11	12	1.70	Pass
199.53	0.9966	-0.31	-11	12	1.70	Pass
251.19	0.9955	-0.37	-11	12	1.70	Pass
316.23	0.9971	-0.09	-11	12	1.70	Pass
398.11	0.9930	-0.20	-11	12	1.70	Pass
501.19	0.9862	-0.15	-11	12	1.70	Pass
630.96	0.9707	0.09	-11	12	1.70	Pass
794.33	0.9388	1.04	-11	12	1.70	Pass
1,000.00	0.8572	1.36	-21	26	1.70	Pass

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
1,258.90	0.6958	-1.60	-21	26	1.70	Pass
1,584.90	0.4698	-11.95	-21	26	1.70	Pass
1,995.30	0.2476	-33.06	-100	26	1.70	Pass

-- End of measurement results--

## X-Axis, Wh-weighting

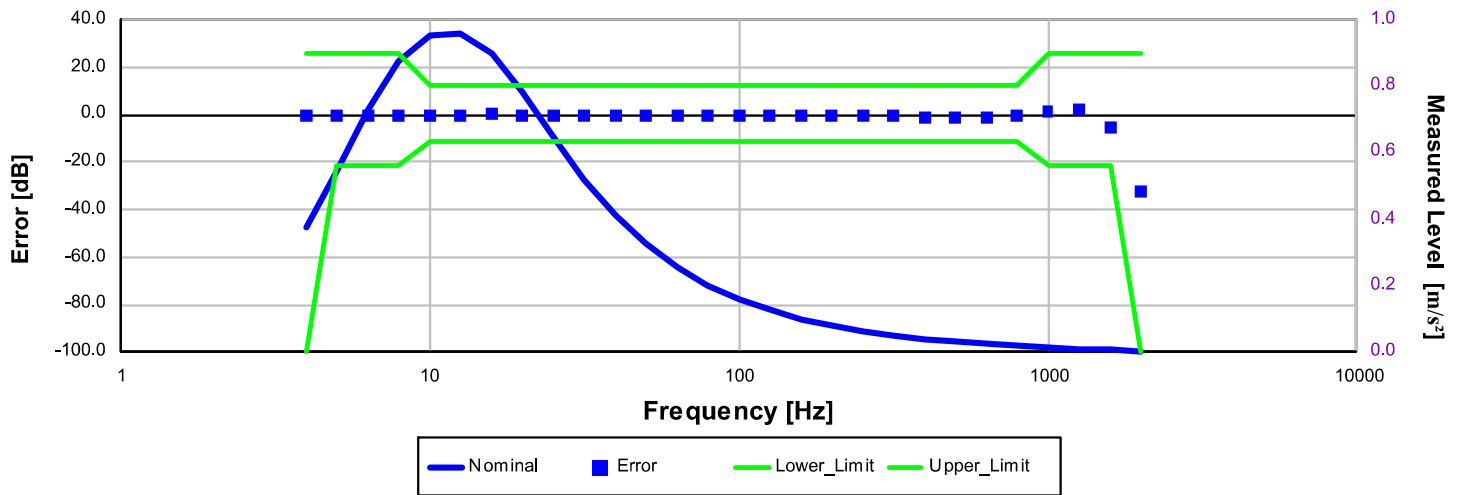


Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
3.98	0.3738	-0.44	-100	26	1.70	Pass
5.01	0.5431	-0.35	-21	26	1.70	Pass
6.31	0.7234	-0.52	-21	26	1.70	Pass
7.94	0.8734	0.04	-21	26	1.70	Pass
10.00	0.9503	-0.12	-11	12	1.70	Pass
12.59	0.9534	-0.44	-11	12	1.70	Pass
15.85	0.9000	0.47	-11	12	1.70	Pass
19.95	0.7805	-0.19	-11	12	1.70	Pass
25.12	0.6440	-0.48	-11	12	1.70	Pass
31.62	0.5186	-0.11	-11	12	1.70	Pass
39.81	0.4111	0.00	-11	12	1.70	Pass
50.12	0.3239	-0.15	-11	12	1.70	Pass
63.10	0.2552	-0.30	-11	12	1.70	Pass
79.43	0.2026	0.08	-11	12	1.70	Pass
100.00	0.1602	-0.01	-11	12	1.70	Pass
125.89	0.1265	-0.40	-11	12	1.70	Pass
158.49	0.1006	-0.13	-11	12	1.70	Pass
199.53	0.0795	-0.48	-11	12	1.70	Pass
251.19	0.0629	-0.68	-11	12	1.70	Pass
316.23	0.0500	-0.59	-11	12	1.70	Pass
398.11	0.0394	-0.99	-11	12	1.70	Pass
501.19	0.0310	-1.27	-11	12	1.70	Pass
630.96	0.0241	-1.33	-11	12	1.70	Pass
794.33	0.0186	-0.24	-11	12	1.70	Pass
1,000.00	0.0137	1.57	-21	26	1.70	Pass
1,258.90	0.0091	2.26	-21	26	1.70	Pass
1,584.90	0.0051	-5.67	-21	26	1.70	Pass
1,995.30	0.0020	-32.24	-100	26	1.70	Pass

-- End of measurement results--

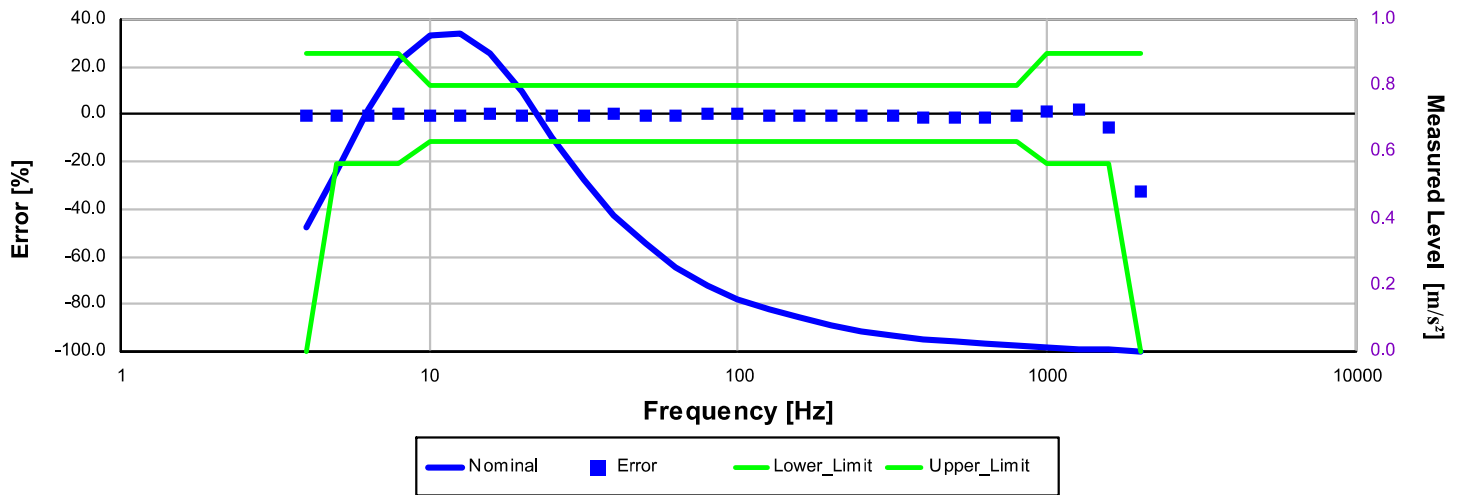
## Y-Axis, Wh-weighting



Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
3.98	0.3738	-0.44	-100	26	1.70	Pass
5.01	0.5431	-0.35	-21	26	1.70	Pass
6.31	0.7234	-0.52	-21	26	1.70	Pass
7.94	0.8734	0.04	-21	26	1.70	Pass
10.00	0.9503	-0.12	-11	12	1.70	Pass
12.59	0.9534	-0.44	-11	12	1.70	Pass
15.85	0.9000	0.47	-11	12	1.70	Pass
19.95	0.7805	-0.19	-11	12	1.70	Pass
25.12	0.6440	-0.48	-11	12	1.70	Pass
31.62	0.5186	-0.11	-11	12	1.70	Pass
39.81	0.4111	0.00	-11	12	1.70	Pass
50.12	0.3239	-0.15	-11	12	1.70	Pass
63.10	0.2552	-0.30	-11	12	1.70	Pass
79.43	0.2026	0.08	-11	12	1.70	Pass
100.00	0.1602	-0.01	-11	12	1.70	Pass
125.89	0.1265	-0.40	-11	12	1.70	Pass
158.49	0.1006	-0.13	-11	12	1.70	Pass
199.53	0.0795	-0.48	-11	12	1.70	Pass
251.19	0.0630	-0.68	-11	12	1.70	Pass
316.23	0.0500	-0.59	-11	12	1.70	Pass
398.11	0.0394	-0.99	-11	12	1.70	Pass
501.19	0.0310	-1.26	-11	12	1.70	Pass
630.96	0.0241	-1.32	-11	12	1.70	Pass
794.33	0.0186	-0.23	-11	12	1.70	Pass
1,000.00	0.0137	1.59	-21	26	1.70	Pass
1,258.90	0.0091	2.29	-21	26	1.70	Pass
1,584.90	0.0051	-5.63	-21	26	1.70	Pass
1,995.30	0.0020	-32.20	-100	26	1.70	Pass
-- End of measurement results--						

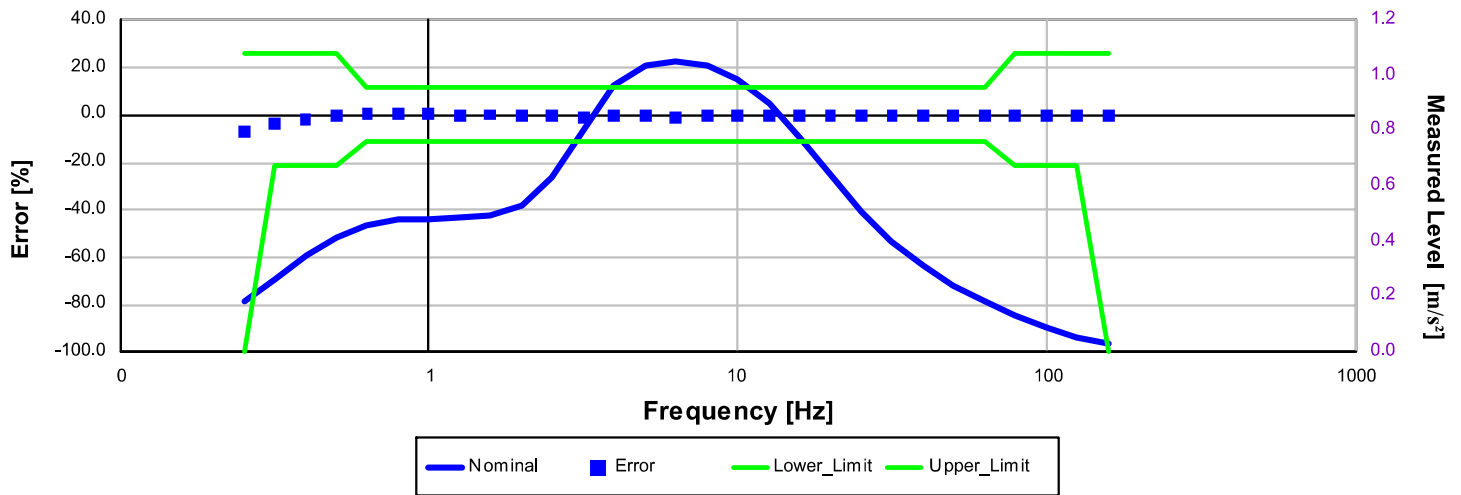
## Z-Axis, Wh-weighting



Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
3.98	0.3738	-0.44	-100	26	1.70	Pass
5.01	0.5431	-0.35	-21	26	1.70	Pass
6.31	0.7234	-0.52	-21	26	1.70	Pass
7.94	0.8734	0.04	-21	26	1.70	Pass
10.00	0.9503	-0.12	-11	12	1.70	Pass
12.59	0.9534	-0.44	-11	12	1.70	Pass
15.85	0.9000	0.47	-11	12	1.70	Pass
19.95	0.7805	-0.19	-11	12	1.70	Pass
25.12	0.6440	-0.48	-11	12	1.70	Pass
31.62	0.5186	-0.11	-11	12	1.70	Pass
39.81	0.4111	0.00	-11	12	1.70	Pass
50.12	0.3239	-0.14	-11	12	1.70	Pass
63.10	0.2552	-0.30	-11	12	1.70	Pass
79.43	0.2026	0.08	-11	12	1.70	Pass
100.00	0.1602	-0.01	-11	12	1.70	Pass
125.89	0.1265	-0.40	-11	12	1.70	Pass
158.49	0.1006	-0.13	-11	12	1.70	Pass
199.53	0.0795	-0.48	-11	12	1.70	Pass
251.19	0.0630	-0.68	-11	12	1.70	Pass
316.23	0.0500	-0.59	-11	12	1.70	Pass
398.11	0.0394	-0.99	-11	12	1.70	Pass
501.19	0.0310	-1.26	-11	12	1.70	Pass
630.96	0.0241	-1.31	-11	12	1.70	Pass
794.33	0.0186	-0.22	-11	12	1.70	Pass
1,000.00	0.0137	1.61	-21	26	1.70	Pass
1,258.90	0.0091	2.32	-21	26	1.70	Pass
1,584.90	0.0051	-5.58	-21	26	1.70	Pass
1,995.30	0.0020	-32.15	-100	26	1.70	Pass
-- End of measurement results--						

## X-Axis, Wk-weighting



Electrical signal test of frequency weighting performed according to ISO 8041-1:2017 12.11.3 and ISO 8042-1:2021 12.11.3

Frequency [Hz]	Test Result [m/s <sup>2</sup> ]	Error [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
0.25	0.1708	-6.75	-100	26	1.70	Pass
0.32	0.2554	-3.40	-21	26	1.70	Pass
0.40	0.3444	-1.71	-21	26	1.70	Pass
0.50	0.4186	-0.05	-21	26	1.70	Pass
0.63	0.4617	0.63	-11	12	1.70	Pass
0.79	0.4797	0.64	-11	12	1.70	Pass
1.00	0.4864	0.81	-11	12	1.70	Pass
1.26	0.4849	0.06	-11	12	1.70	Pass
1.58	0.4949	0.28	-11	12	1.70	Pass
2.00	0.5310	0.03	-11	12	1.70	Pass
2.51	0.6322	-0.20	-11	12	1.70	Pass
3.16	0.8019	-0.64	-11	12	1.70	Pass
3.98	0.9606	-0.44	-11	12	1.70	Pass
5.01	1.0372	-0.17	-11	12	1.70	Pass
6.31	1.0473	-0.64	-11	12	1.70	Pass
7.94	1.0340	-0.28	-11	12	1.70	Pass
10.00	0.9872	-0.12	-11	12	1.70	Pass
12.59	0.8992	0.03	-11	12	1.70	Pass
15.85	0.7748	0.06	-11	12	1.70	Pass
19.95	0.6353	-0.31	-11	12	1.70	Pass
25.12	0.5081	-0.42	-11	12	1.70	Pass
31.62	0.4029	-0.05	-11	12	1.70	Pass
39.81	0.3153	-0.24	-11	12	1.70	Pass
50.12	0.2442	-0.35	-11	12	1.70	Pass
63.10	0.1852	-0.29	-11	12	1.70	Pass
79.43	0.1339	-0.02	-21	26	1.70	Pass
100.00	0.0887	-0.06	-21	26	1.70	Pass
125.89	0.0529	-0.40	-21	26	1.70	Pass
158.49	0.0291	-0.33	-100	26	1.70	Pass

-- End of measurement results--