Environmental Railway Vibration Study

25 Dundas Street West

Proposed Mixed-Use Development

Belleville, Ontario

July 14, 2025
Project: 113-0367010

Prepared for

MDM Developments

Prepared by

Adam Krawtschenko

Reviewed by

LICENSED PROFESSIONAL ENGINEER
7/14/2025
K. KATSIROUMPAS
90487216
PROVINCE OF ONTARIO

Kathy Katsiroumpas, B.Sc., P.Eng.

VALCOUSTICS
Canada Ltd.

Version History

Version #	Date	Comments
1.0	July 14, 2025	Prepared for Submission

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25 Dundas Street West

Proposed Mixed-Use Development

City of Belleville

EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) was retained to prepare a Railway Vibration Study to support the Zoning By-law Amendment (ZBA) amendment for the proposed mixed-use development located at 25 Dundas Street West in the City of Belleville.

The significant source of ground-borne vibration with potential for impact at the proposed development is rail traffic from the Canadian Pacific Kansas City (CPKC) Belleville Subdivision to the north of the subject site. The measured on-site ground-borne vibration velocity magnitudes due to regular movements of CPKC trains did not exceed the applicable vibration guideline limit at the location of the proposed buildings.

Therefore, vibration mitigation measures are not mandatory for the proposed development.

1.0 INTRODUCTION

VCL was retained to prepare a Railway Vibration Study to support the ZBA amendment to the City of Belleville.

The ground-borne vibration due to the train pass-bys was measured on site and compared with the applicable vibration guidelines to determine the need for mitigation. The results are outlined herein.

1.1 THE SITE AND THE SURROUNDING AREA

The subject site is located at 25 Dundas Street West in the City of Belleville, and is surrounded by:

- The CPKC Belleville Subdivision with Dundas Street West and existing commercial beyond, to the north and west;
- An existing marina, with Belleville Harbour beyond, to the east; and
- An existing hotel to the south.

A Key Plan is included as Figure 1.

1.2 THE PROPOSED DEVELOPMENT

The proposed development consists of 206 stacked townhouse units, a mixed-use commercial building that includes 7 residential condo units and an outdoor amenity area.

The assessment is based on the Site Plan prepared by Rosalie Dawson Architect Inc., dated April 27, 2025. See Appendix A.

1.3 SOURCES OF VIBRATION

The anticipated vibration source with potential to impact the development is rail traffic on the Canadian Pacific Kansas City (CPKC) Belleville Subdivision to the north and west of the site.

Ground-borne vibration due to vehicle movements on surrounding roadways is not expected to create significant impact on the proposed development and thus, has not been considered further in the assessment. There are no other sources of significant vibration in the vicinity of the site.

2.0 VIBRATION GUIDELINES

The Federation of Canadian Municipalities and the Railway Association of Canada jointly developed “Guidelines for New Development in Proximity to Railway Operations”, dated May 2013 (herein referred to as the FCM/RAC guidelines). For residential developments, the FCM/RAC Guideline recommends a maximum vibration threshold of 0.14 mm/s root mean square (RMS, using a 1 second averaging time) between 4 Hz and 200 Hz (Reference 1).

The FCM/RAC guideline limit has been used to complete this study.

3.0 METHOD

3.1 MEASUREMENT LOCATIONS

Vibration measurements were done at four locations on the subject site and are labelled as Locations A, B, C and D on Figure 2.

The locations were:

- Location A, representing the northwest façade of the townhouse units closest to the railway. This location was approximately 30 m from the rail right of way;
- Location B, representing the northwest façade of the townhouse units closest to the railway. This location was approximately 30 m from the rail right of way and west of Location A;

- Location C, representing the north façade of the townhouse units in the core of the site. This location was approximately 54 m from the rail right of way; and
- Location D, representing the north façade of the townhouse units at the south-west corner of the site. This location was approximately 45 m from the rail right of way;

3.2 TRANSDUCER PLACEMENT

Geophones were used to measure the vibration velocity produced by the train pass-bys. At each location, the geophone was placed into a small hole dug into the ground, approximately 300 mm below grade such that it was resting on compacted soil and was securely anchored with metal ground spikes.

3.3 DATA ACQUISITION

A total of twenty-three (23) freight train pass-bys were monitored between May 8, 2025 and May 10, 2025;

For each pass-by, the vibration signals were recorded simultaneously at all four locations. The vertical axis signal from each geophone was recorded digitally at each location, using a MetricPro Model MPV3C21 vibration data acquisition and analysis system. The monitors recorded vibration velocity, in millimeter per second (mm/s).

At each location the vibration data acquisition system recorded the ground-borne vibration continuously throughout the monitoring period. The system was set to monitor using a sampling rate of 1000 samples per second.

3.4 DATA ANALYSIS

Time histories of the vibration velocity produced by each train pass-by were plotted using a RMS (root-mean-square) averaging routine with a time constant of one second. The analysis procedure conforms with the FCM/RAC guidelines.

4.0 RESULTS

Table 1 summarizes the maximum measured overall vibration velocity (1-second RMS) for each train pass-by, as well as the train composition.

The maximum overall vibration velocity magnitudes at each location were measured to be:

- 0.07 mm/s at Location A;
- 0.09 mm/s at Location B;
- 0.03 mm/s at Location C; and
- 0.07 mm/s at Location D.

Appendix B contains the recorded time histories for the railway pass-bys at each measurement location.

The measured maximum vibration velocity magnitudes at the subject site, due to the rail movements are within the 0.14 mm/s FCM/RAC Guideline limit for residential uses.

5.0 CONCLUSIONS

The ground-borne vibration velocity magnitudes due to railway traffic on the adjacent CPKC Belleville Subdivision, measured at the closest building facades of the proposed development to the railway, were within the FCM/RAC vibration limits for residential uses. Thus, vibration mitigation is not required for the proposed development.

6.0 REFERENCES

1) "Guidelines for New Development in Proximity to Railway Operations", Prepared for The Federation of Canadian Municipalities and the Railway Association of Canada, May 2013.

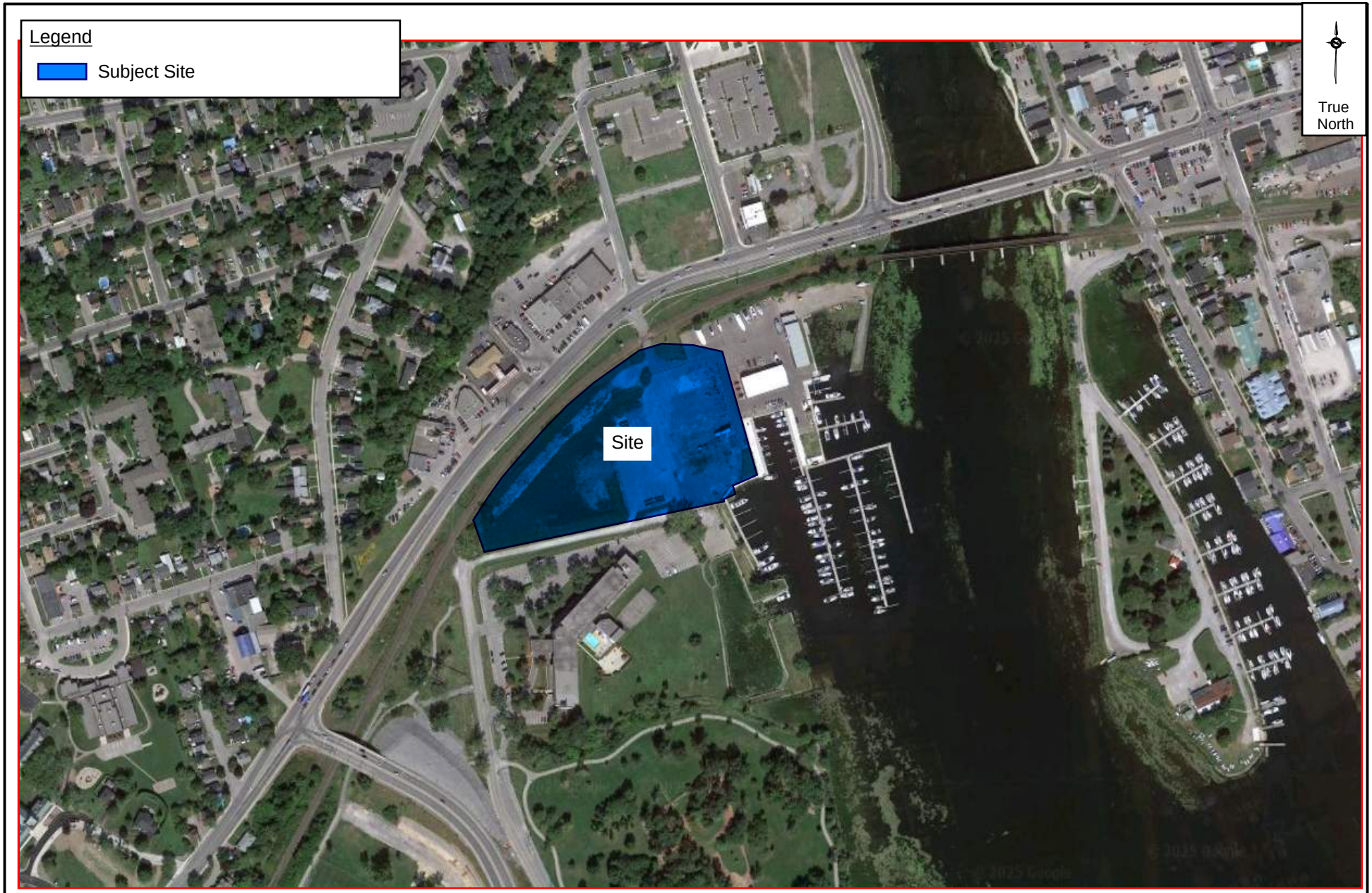
AK\KK\sk
Dundas Street and Mary Street - Vibration v1_0.docx

TABLE 1: MEASURED MAXIMUM VIBRATION VELOCITY DUE TO TRAIN PASS-BYS

Pass -by #	Date	Time/Period	Direction	Number of Loco-motives[3]	Number of Rail Cars[3]	Maximum Vibration Velocity[1] (mm/s)			
						Location A[2]	Location B[2]	Location C[2]	Location D[2]
1	2025-05-08	15:42–15:47	East	3	116	0.07	0.03	0.02	0.03
2	2025-05-08	18:15–18:21	West	3	139	0.03	0.03	0.01	0.02
3	2025-05-08	23:20–23:27	West	2	189	0.02	0.03	0.01	0.02
4	2025-05-09	00:10–00:16	West	3	159	0.03	0.04	0.02	0.03
5	2025-05-09	00:48–00:53	East	3	149	0.05	0.04	0.03	0.03
6	2025-05-09	06:36–06:41	West	3	154	0.02	0.04	0.01	0.01
7	2025-05-09	07:14–07:19	East	2	132	0.04	0.04	0.02	0.02
8	2025-05-09	11:10–11:14	West	2	120	0.07	0.06	0.03	0.07
9	2025-05-09	14:09–14:14	East	2	145	0.03	0.04	0.01	0.02
10	2025-05-09	18:54–18:58	West	2	142	0.05	0.04	0.03	0.04
11	2025-05-09	19:47–19:50	West	2	153	0.04	0.05	0.02	0.04
12	2025-05-09	20:00–20:02	West	2	98	0.06	0.05	0.03	0.05
13	2025-05-09	22:12–22:16	East	2	125	0.02	0.04	0.01	0.02
14	2025-05-10	00:39–00:43	West	2	153	0.04	0.05	0.02	0.03
15	2025-05-10	01:19–01:22	East	3	137	0.03	0.05	0.03	0.04
16	2025-05-10	02:32–02:36	East	2	141	0.02	0.05	0.01	0.03
17	2025-05-10	06:36–06:39	West	2	149	0.05	0.03	0.03	0.05
18	2025-05-10	10:33–10:34	East	1	9	0.03	0.04	0.01	0.04
19	2025-05-10	13:54–13:58	East	4	174	0.03	0.06	0.02	0.04
20	2025-05-10	15:55–15:59	West	2	126	0.03	0.04	0.02	0.03
21	2025-05-10	17:15–17:19	West	2	153	0.07	0.05	0.03	0.04
22	2025-05-10	20:34–20:37	West	2	155	0.03	0.04	0.01	0.02
23	2025-05-10	23:38–23:42	East	2	170	0.03	0.09	0.02	0.02

Notes:

(1) Maximum overall vibration velocity occurring for the entire pass-by, one second RMS averaging.
(2) See Figure 2.
(3) Approximate values



VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Key Plan**	Date: **June 22, 2025**	Figure: **1**
	Project Name: **25 Dundas Street West, Belleville**	Project No.: **113-0367-010**	

Original plan sketch by Rosalie Dawson Architect Inc.

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consulting acoustical engineers

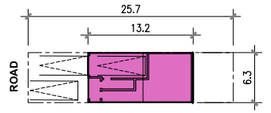
Title: **Vibration Monitoring Locations**		Date: **June 22, 2025**	Figure: **2**
Project Name: **25 Dundas Street West, Belleville**		Project No.: **113-0367-010**	

APPENDIX A

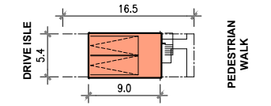
SITE PLAN

Total 213 Residential Units

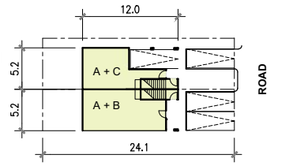
TYPE A
2 Units Stacked
Unit A: 2200sf
Unit B: 1430
Total Units = 22



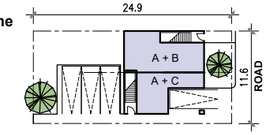
TYPE B
2 Units Stacked
Unit A: 1385sf
Unit B: 550sf
Total Units = 88



TYPE C
2 @ 2 Units Stkd
Unit A: 900sf
Unit B: 750sf
Unit C: 650sf
Total Units = 48



TYPE D - Rail Line
2 @ 2 Units Stkd
Unit A: 800sf
Unit B: 700sf
Unit C: 600sf
Total Units = 48



TYPE E
Condo
850sf
Total Units = 7

Statistics to come:

Per Unit type (A,B,C,D E):
1. Bedrooms / w/c's (estimate)
2. max height
3. lot area
4. frontage
5. lot coverage percentage
6. min. landscaped area
7. min front, side, rear yard setbacks
8. parking spaces per unit

General:
1. site dimensions
2. parking count visitor
3. commercial area
4. amenity area (building)
5. other...

416.209.4424
rosalie@RDArchitect.ca
RDArchitect.ca
169 Shoreline Drive,
Oro-Medonte, ON L0L 1T0
ROSALIE DAWSON ARCHITECT INC.

Porta - Townhome Study

25 Dundas Street West, Belleville Ontario

Client: MDM Developments

drawing: Low Rise Site Plan Sketch - V3,
Towns along rail line shifted down to meet 30m setback from tracks

issued for: Consultant Coordination

scale:	1:750	plot date:	2025.04.27
job number:	21009		
drawn by:	RD		
dwg. ref. no:	N/A	drawing no:	1

APPENDIX B

VIBRATION VELOCITY TIME HISTORIES DUE TO RAILWAY TRAIN PASS-BYS

Pass-By #1

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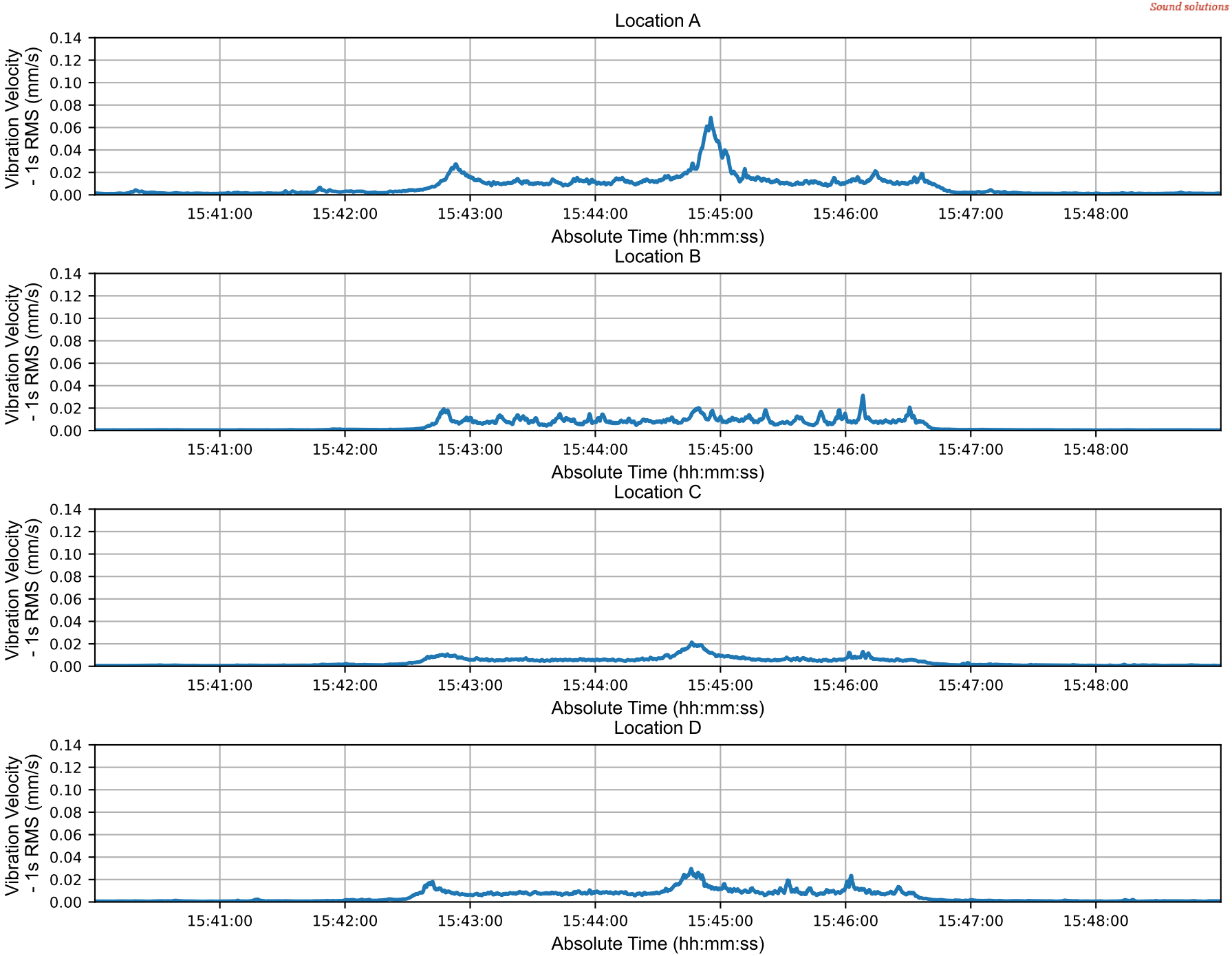

Pass-By #2

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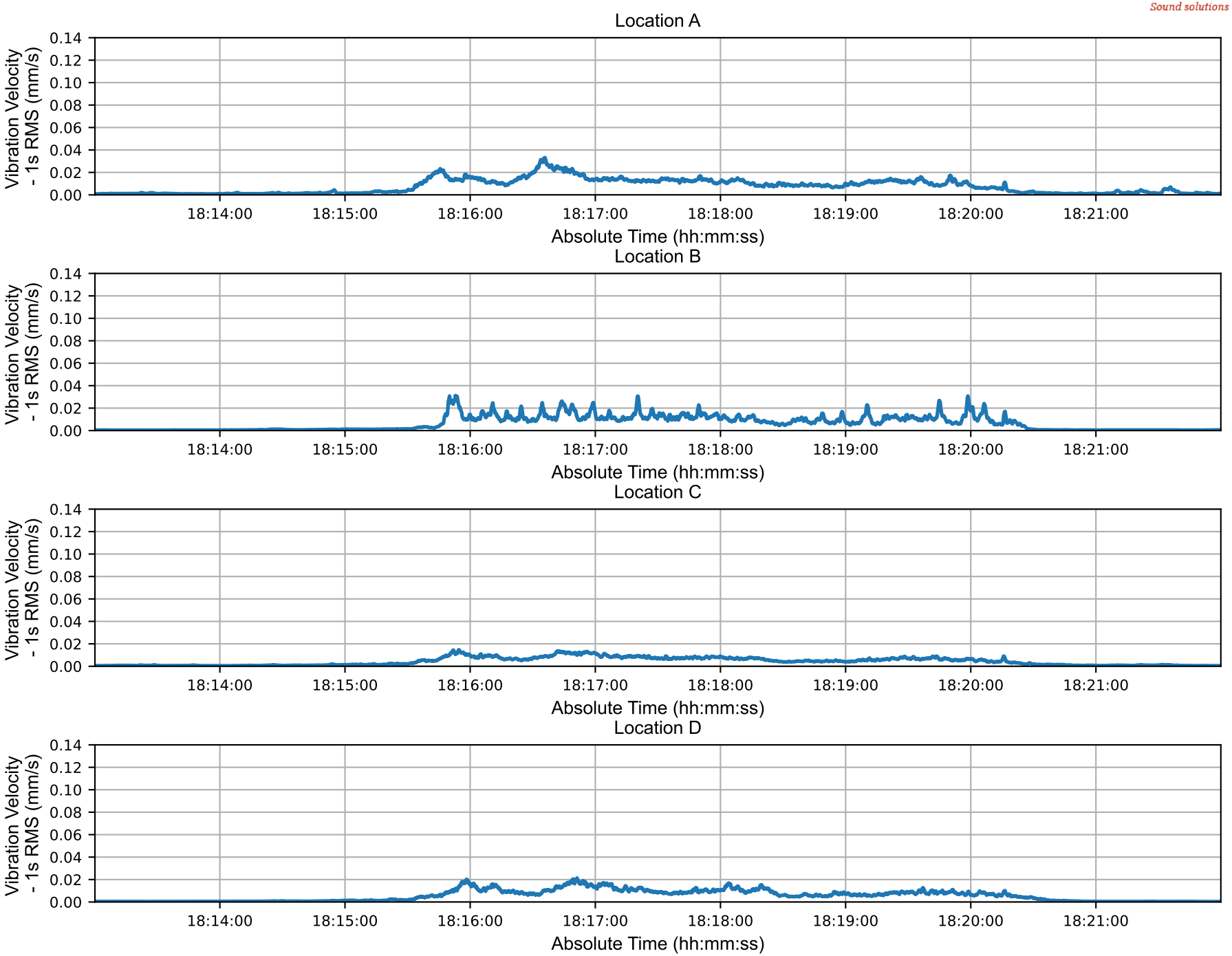

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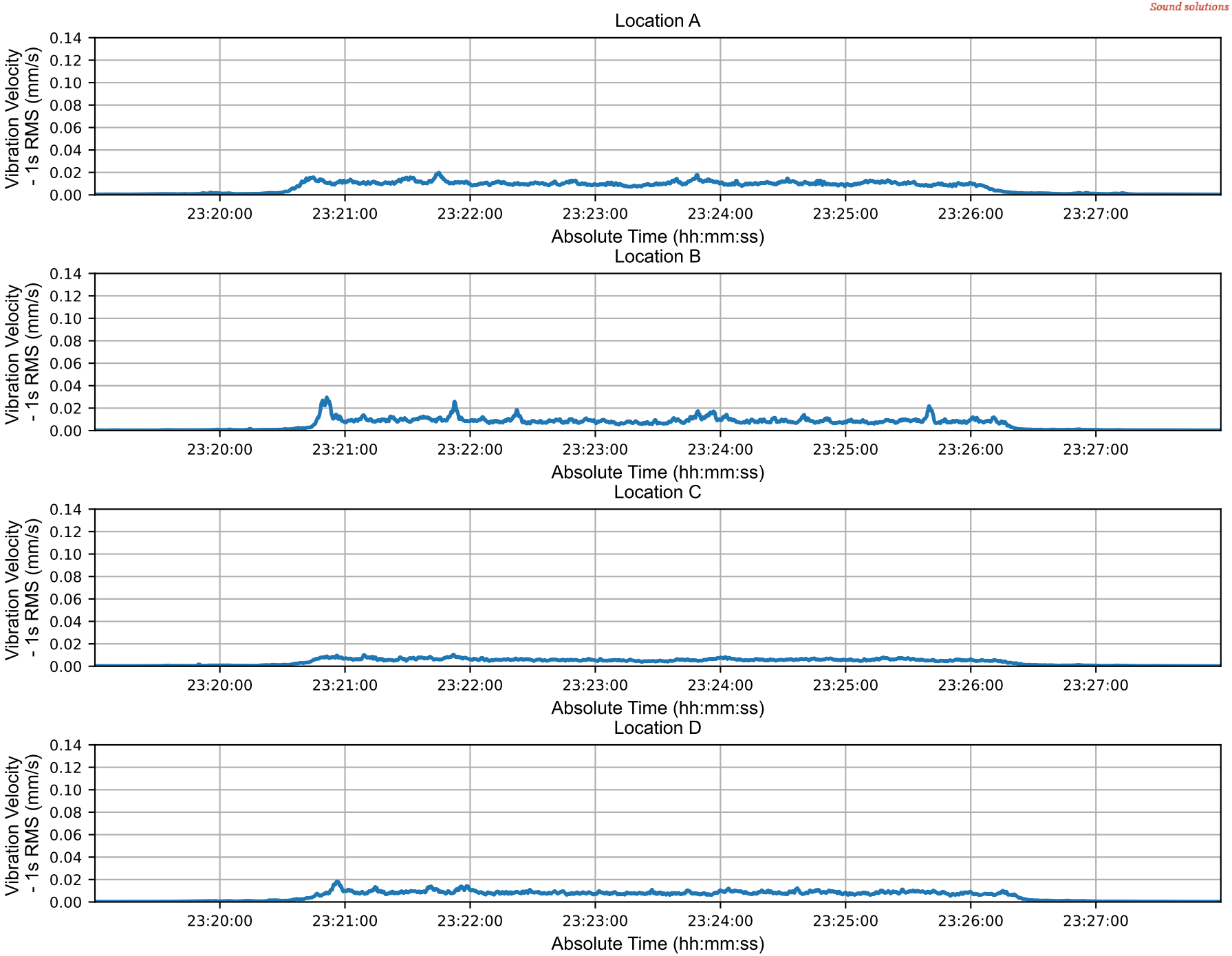

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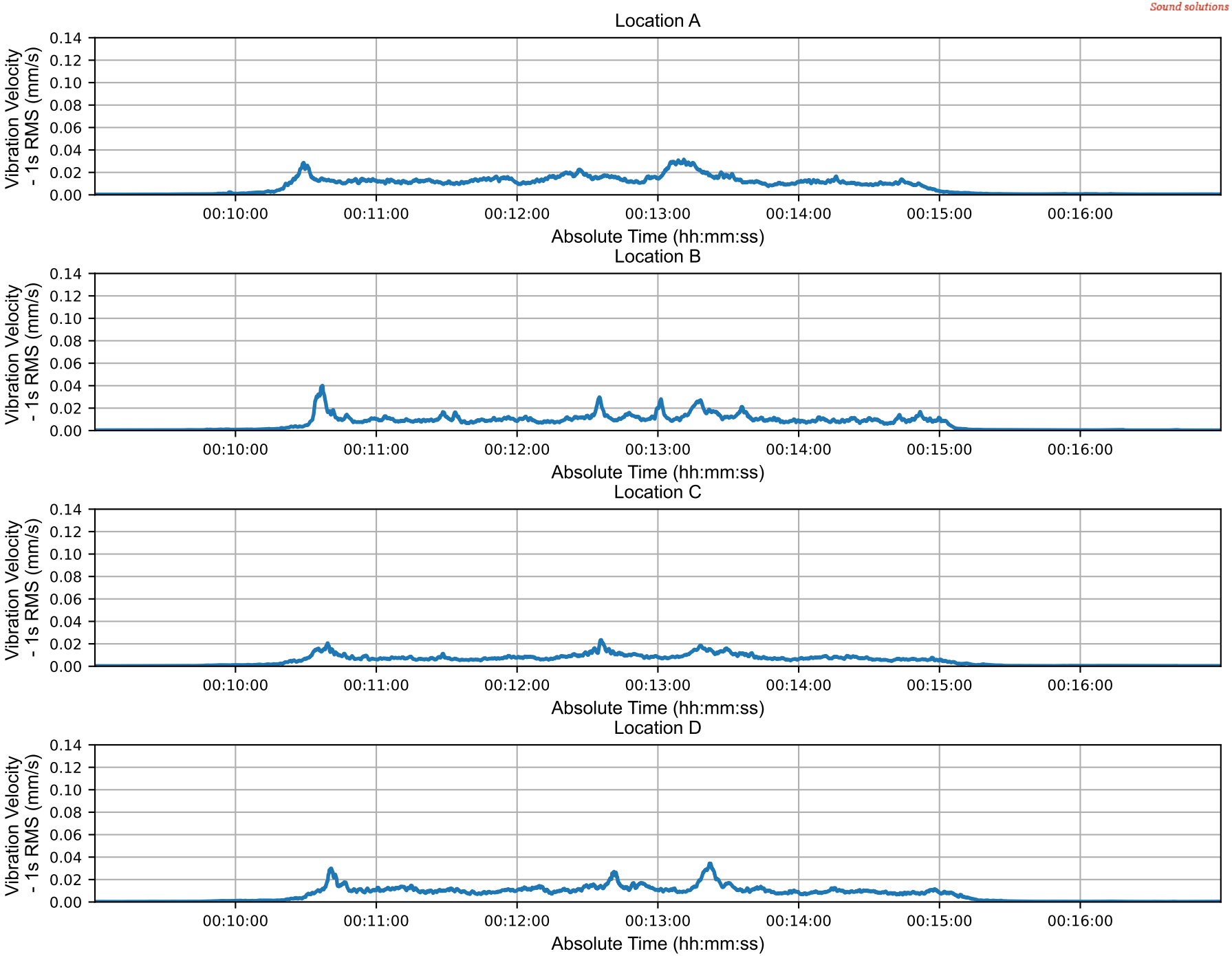

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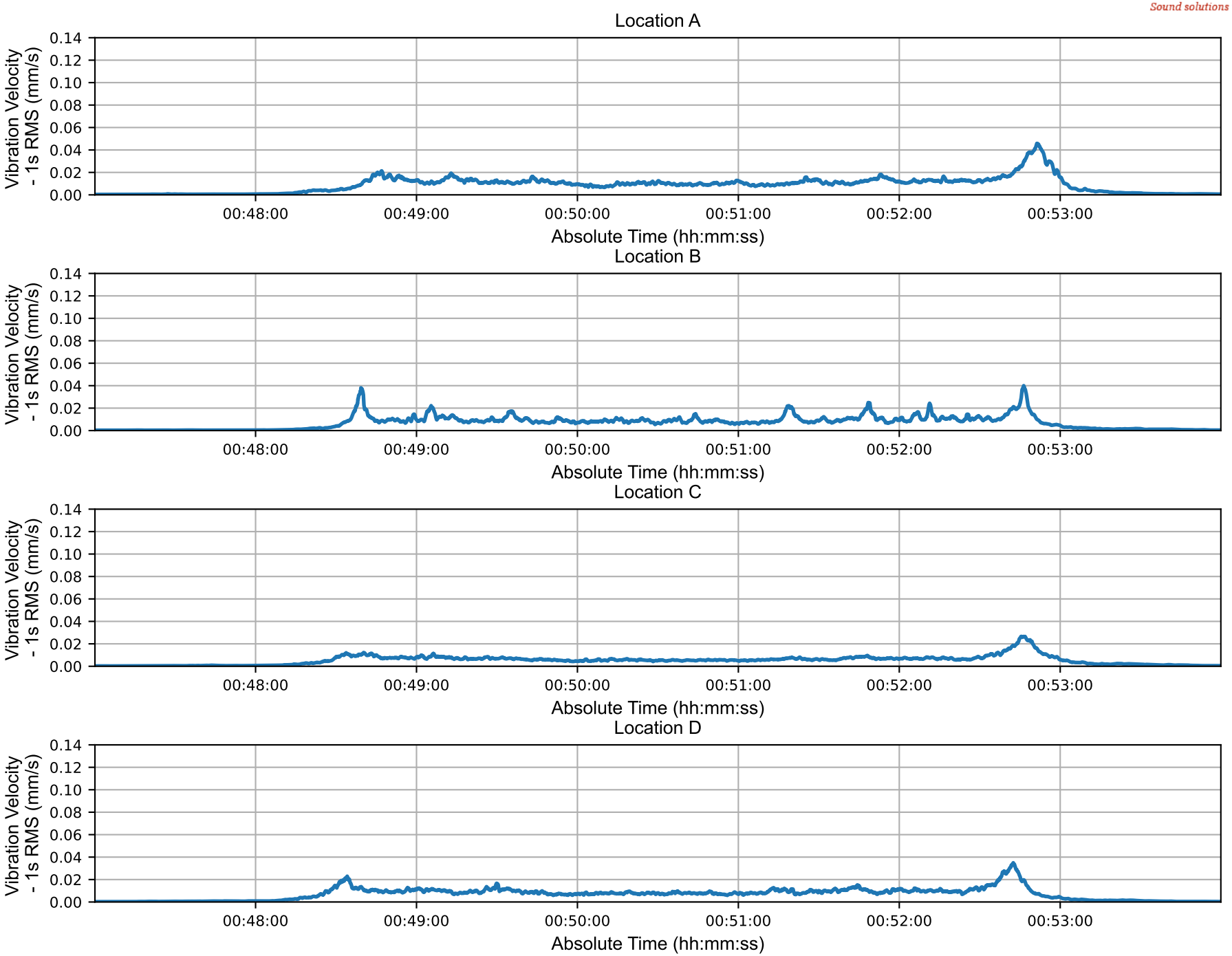

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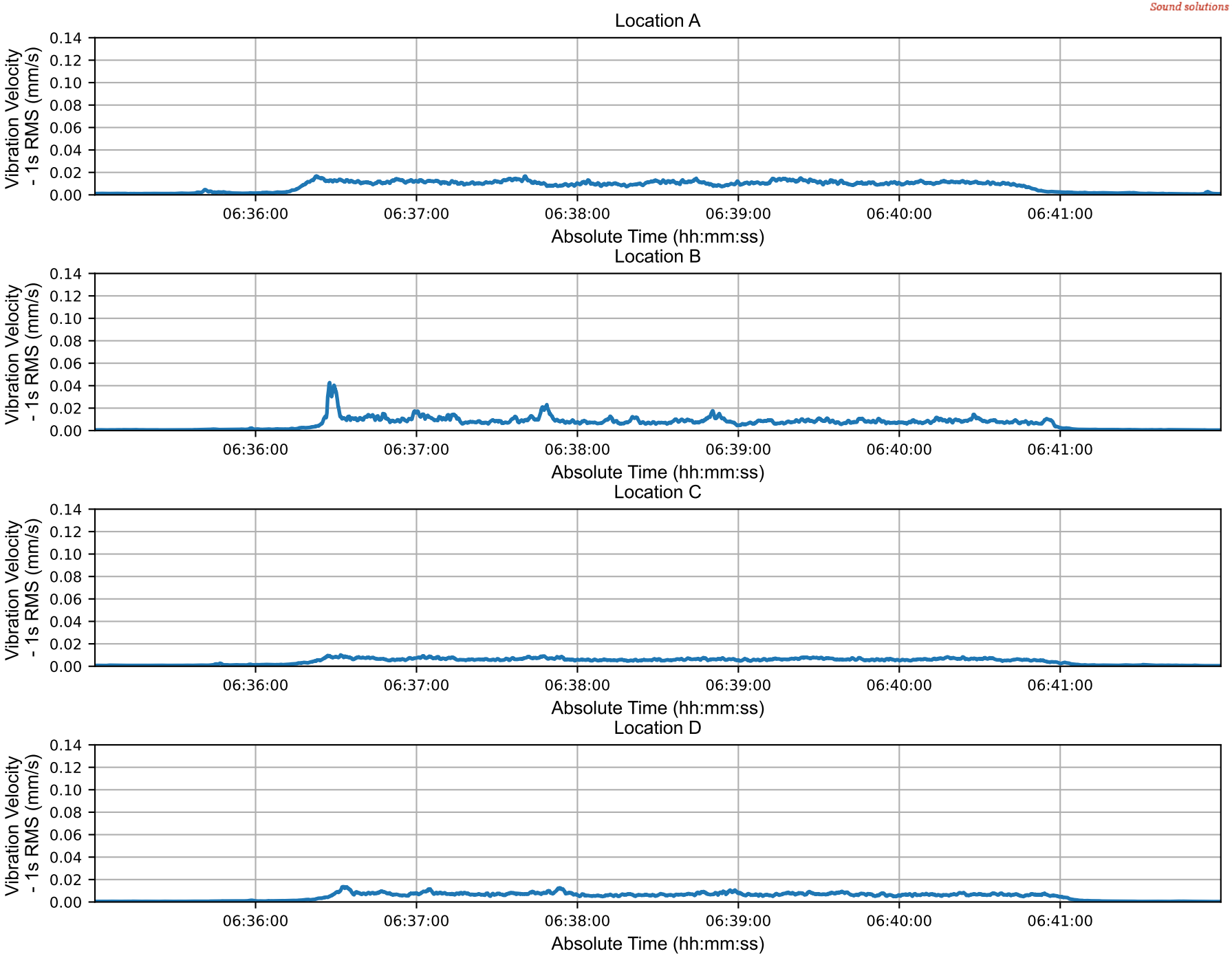

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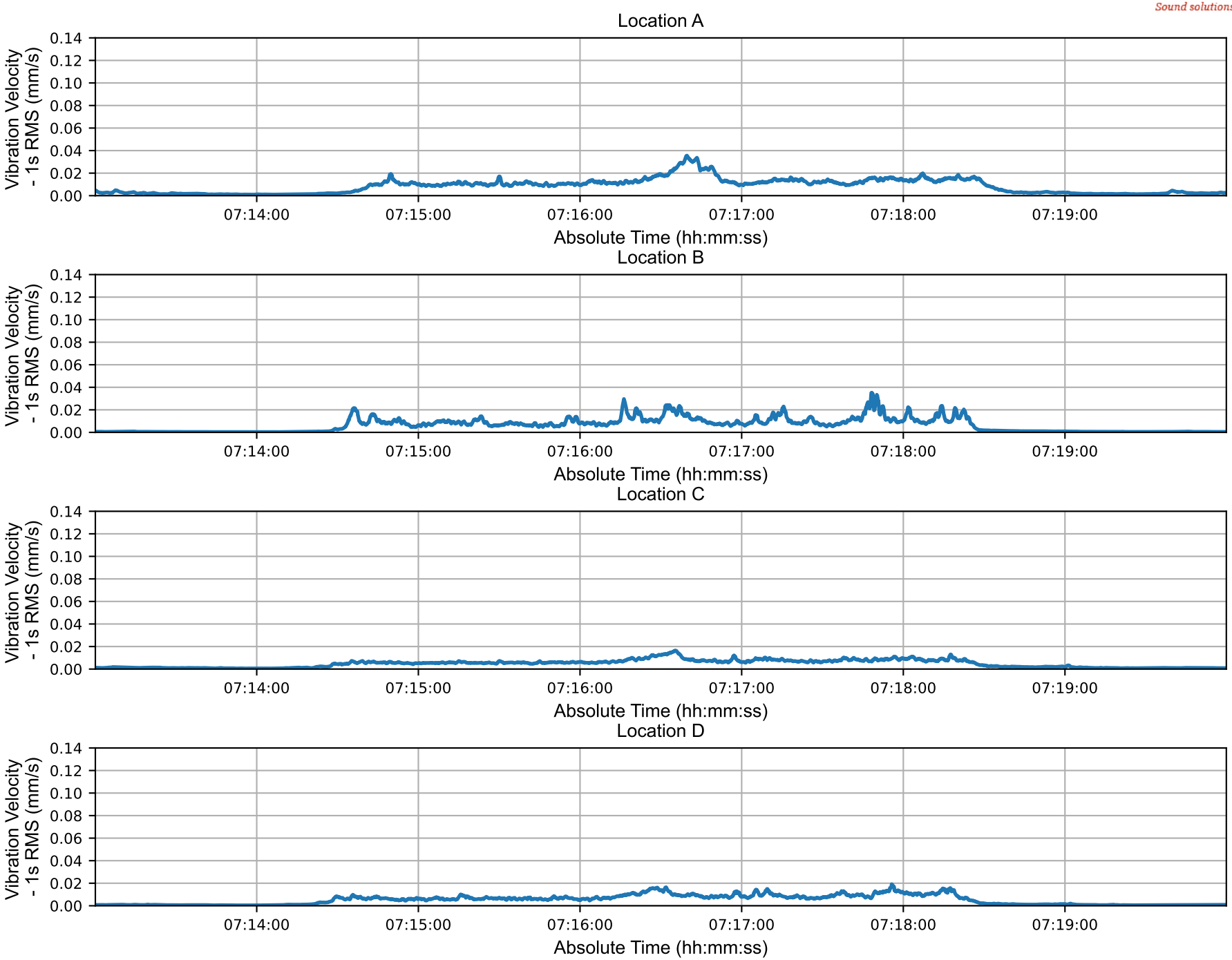
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07:16:00
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07:18:00
07:19:00
Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
Vibration Velocity - 1s RMS (mm/s)
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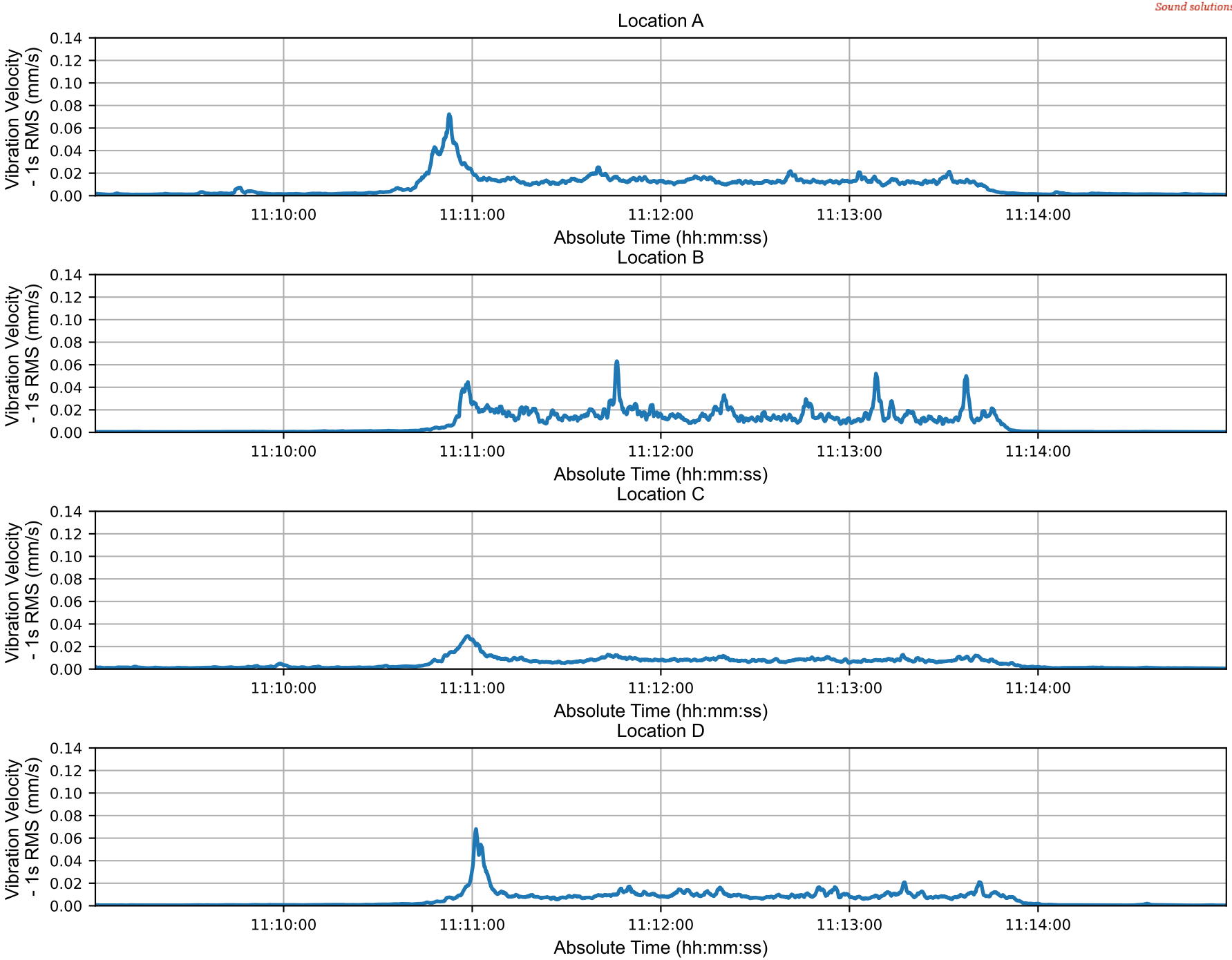
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Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
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Vibration Velocity - 1s RMS (mm/s)
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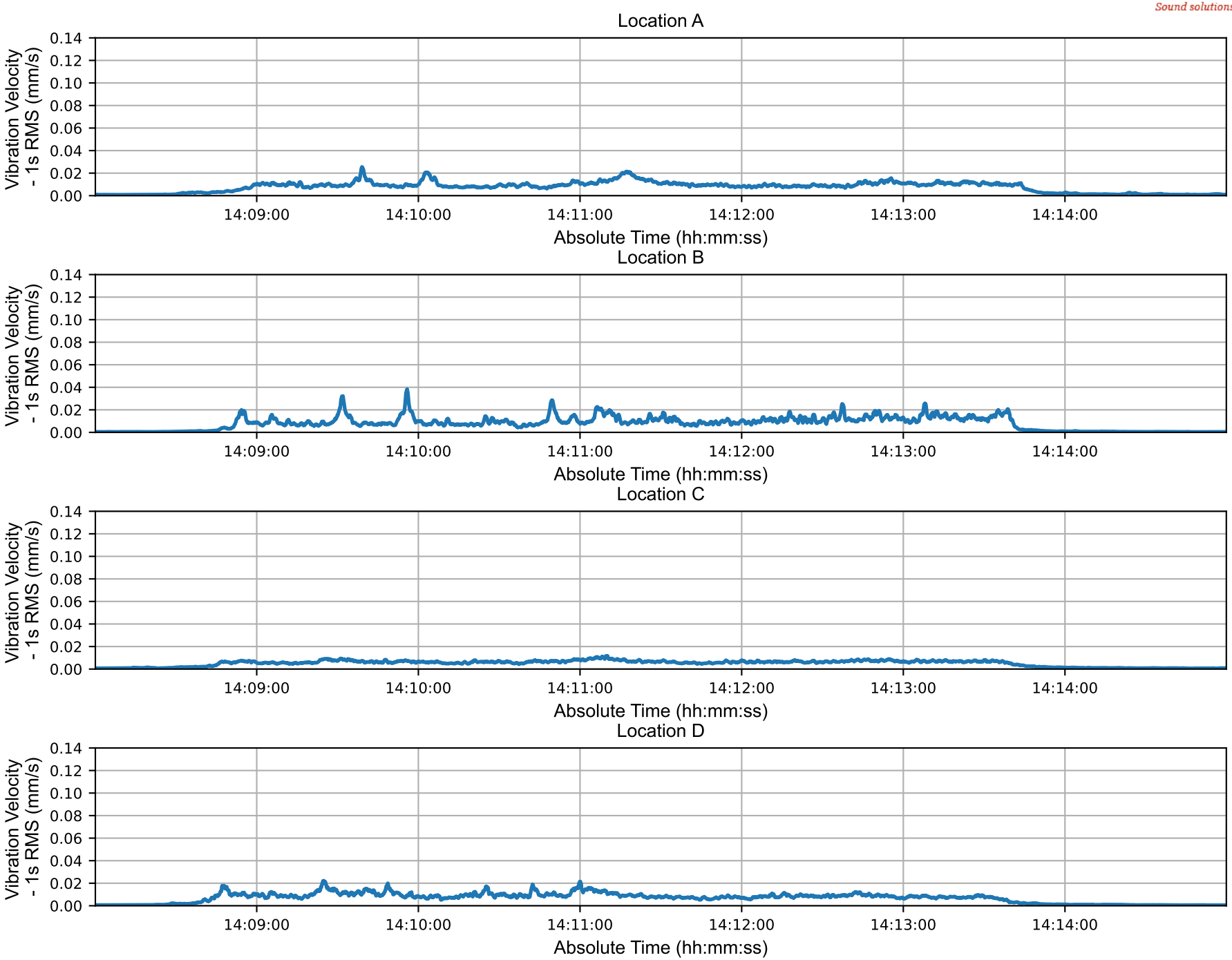
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Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
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Pass-By #10

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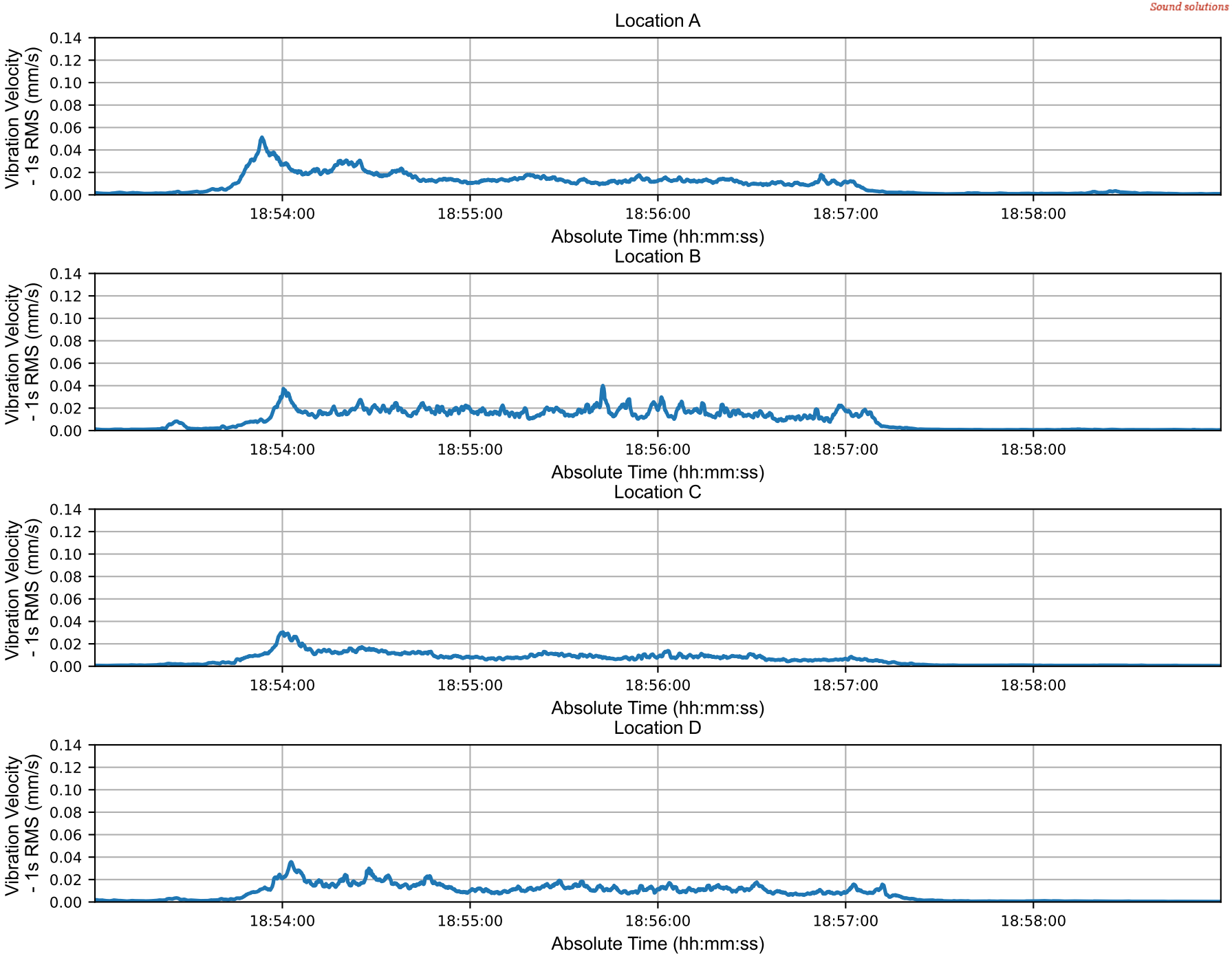

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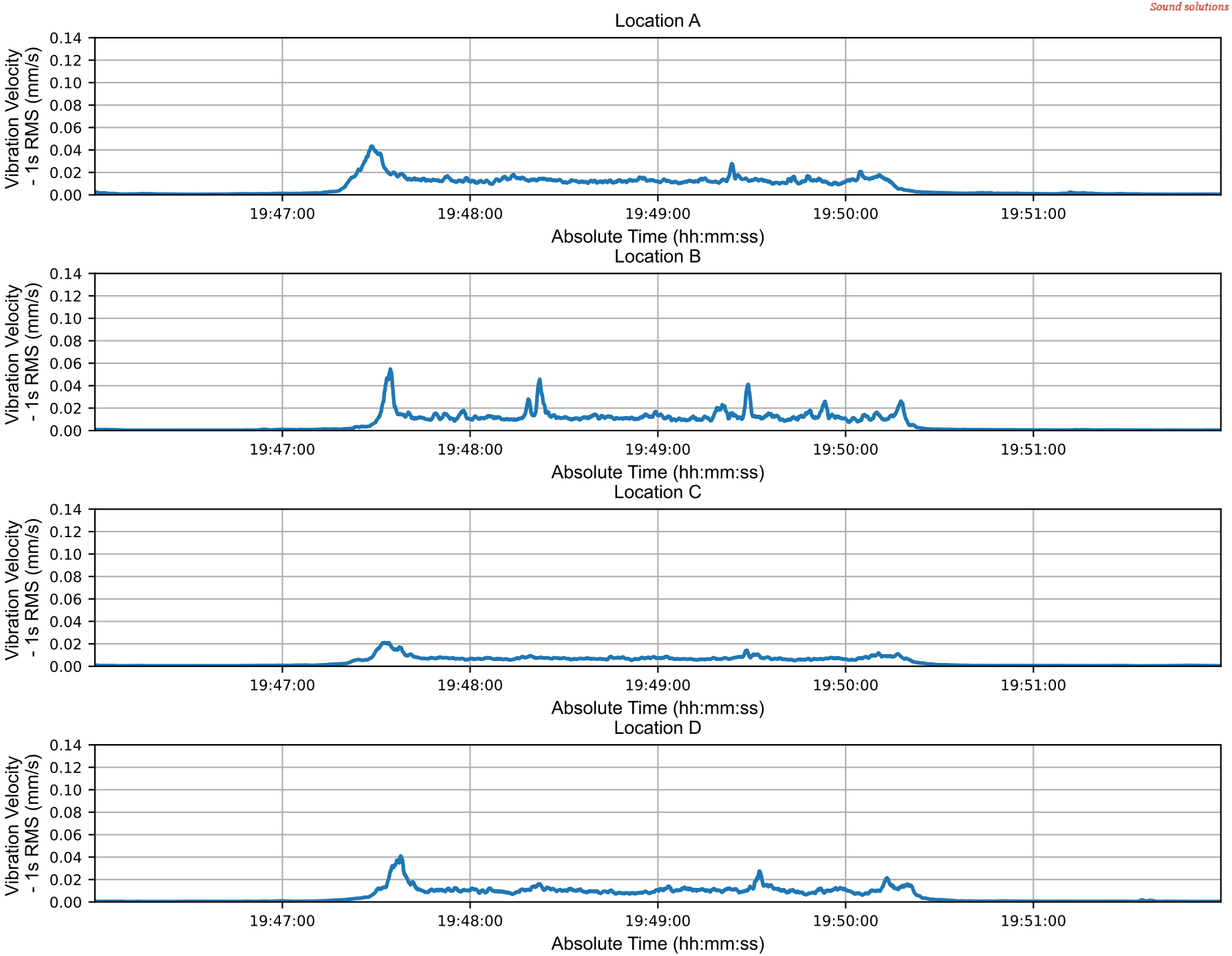
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Absolute Time (hh:mm:ss)
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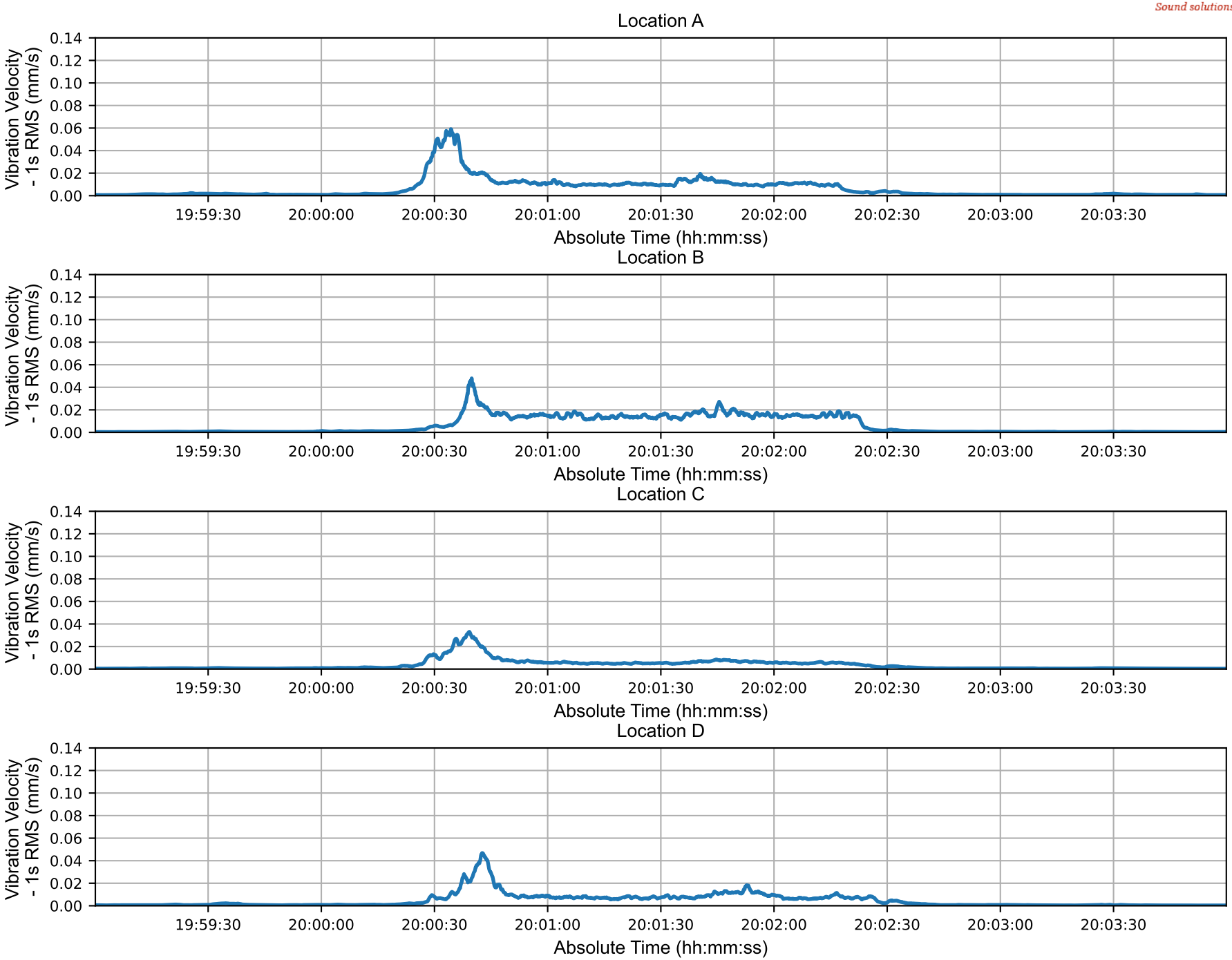

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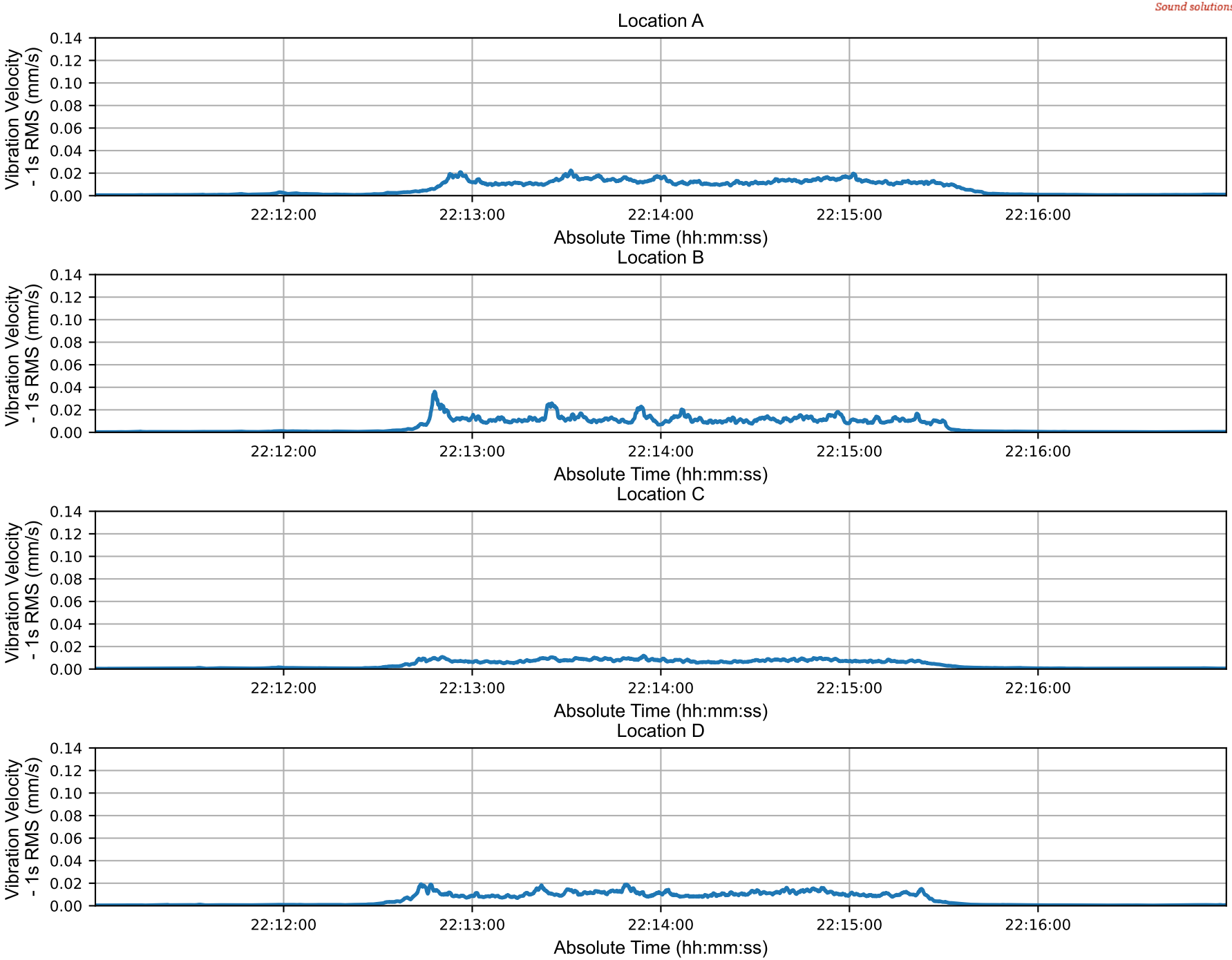

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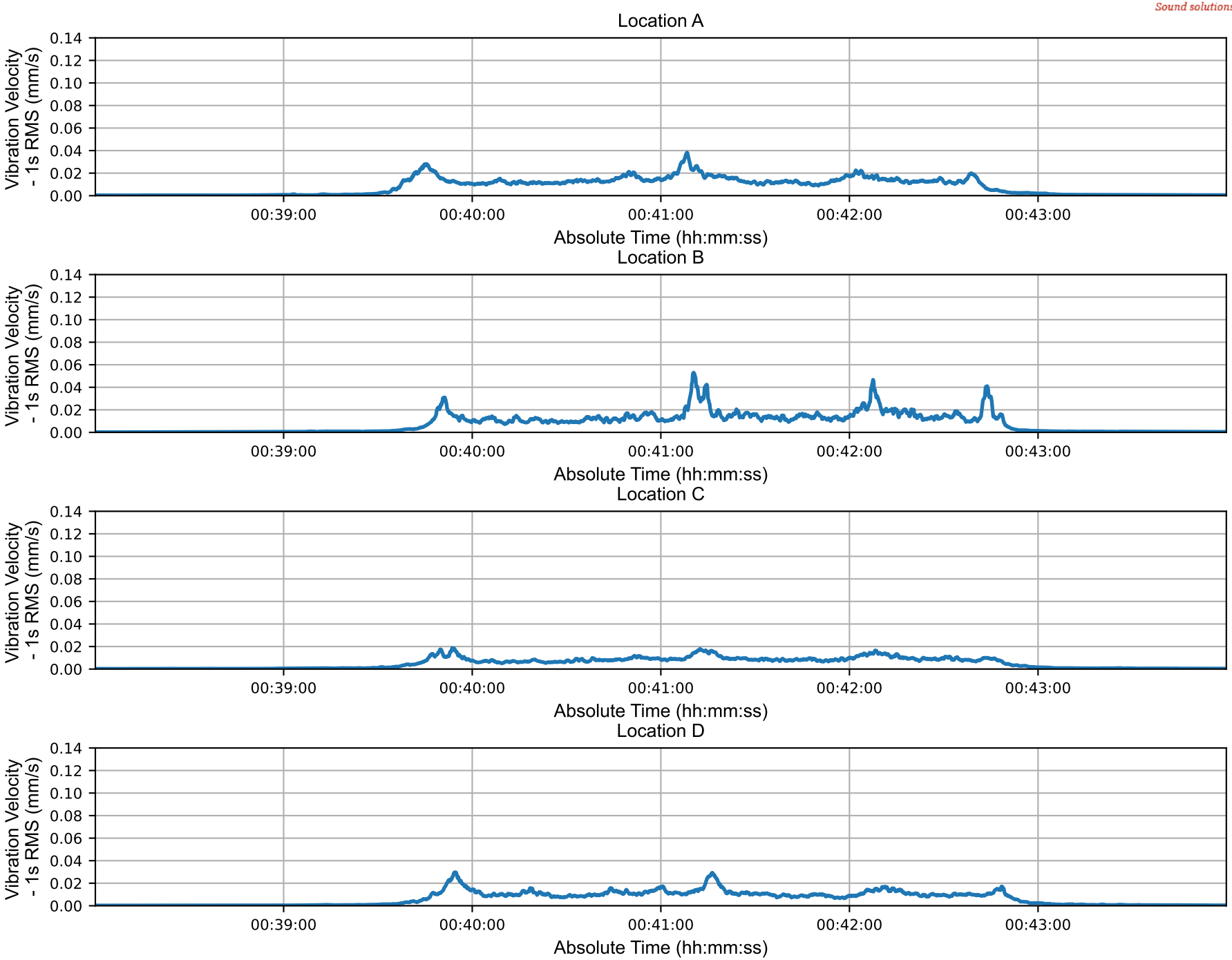
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Vibration Velocity - 1s RMS (mm/s)
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Location C
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Location D
Vibration Velocity - 1s RMS (mm/s)
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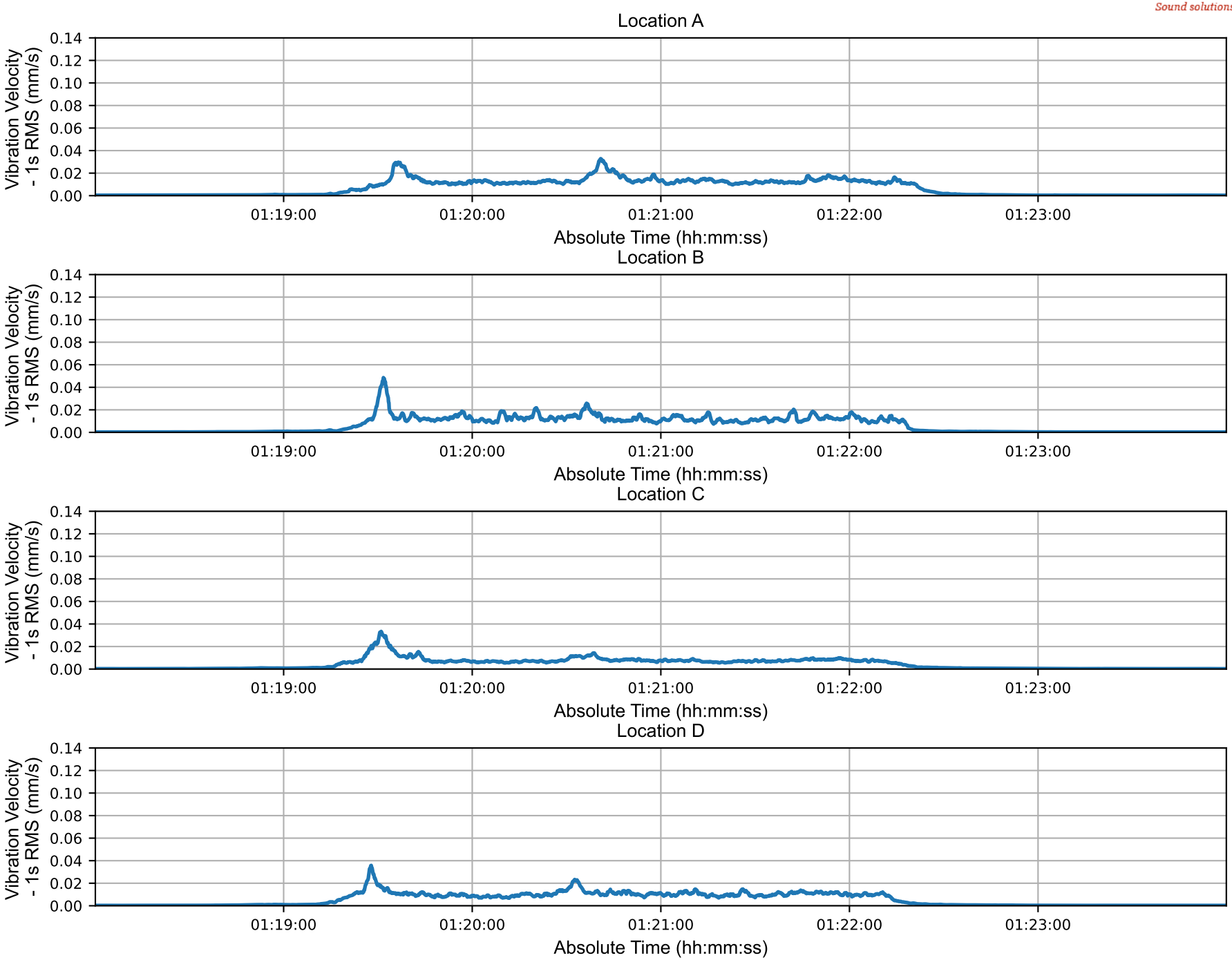
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01:21:00
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01:23:00
Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
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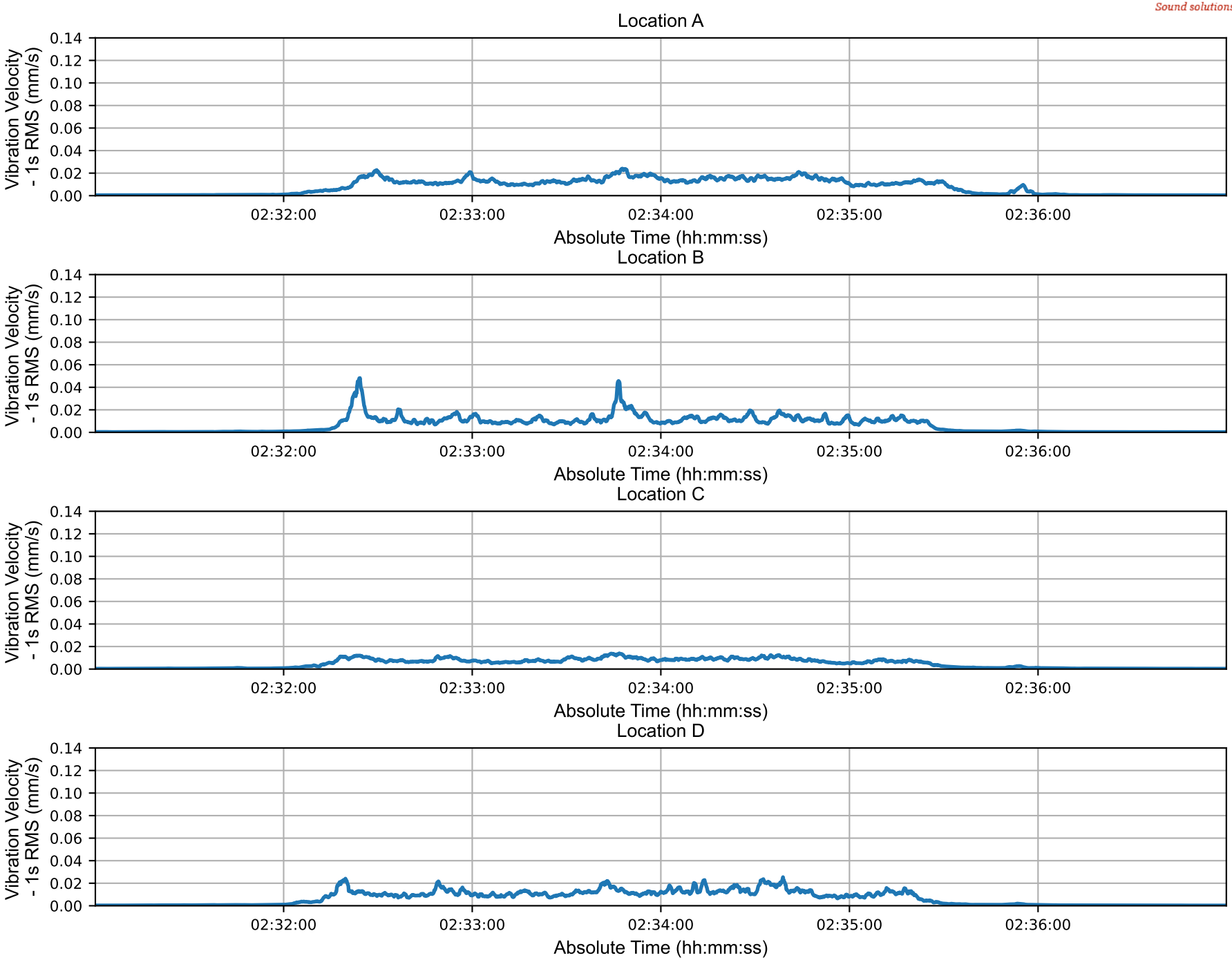
Absolute Time (hh:mm:ss)

Pass-By #16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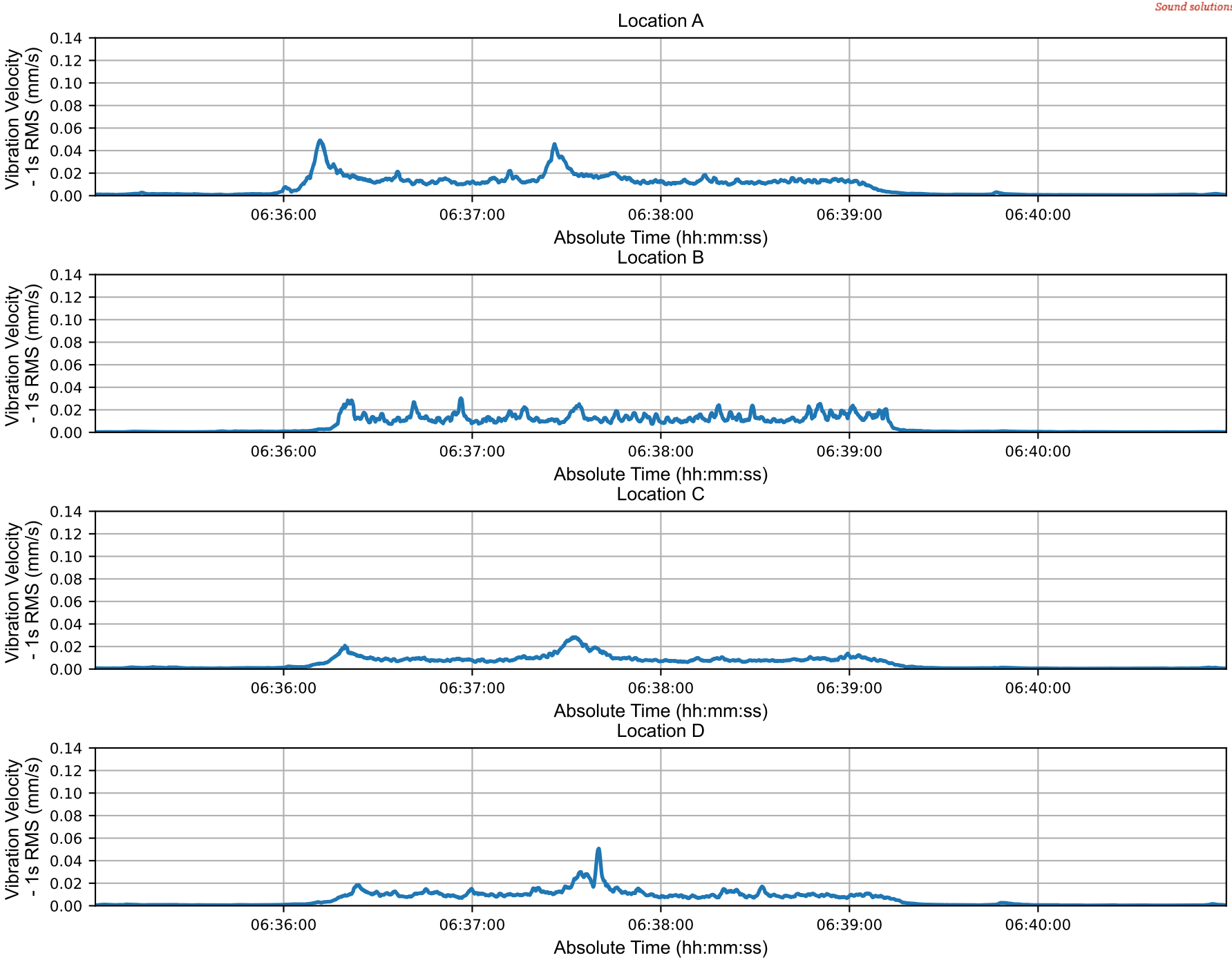
02:34:00
02:35:00
02:36:00
Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)

Pass-By #17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Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)

Pass-By #18

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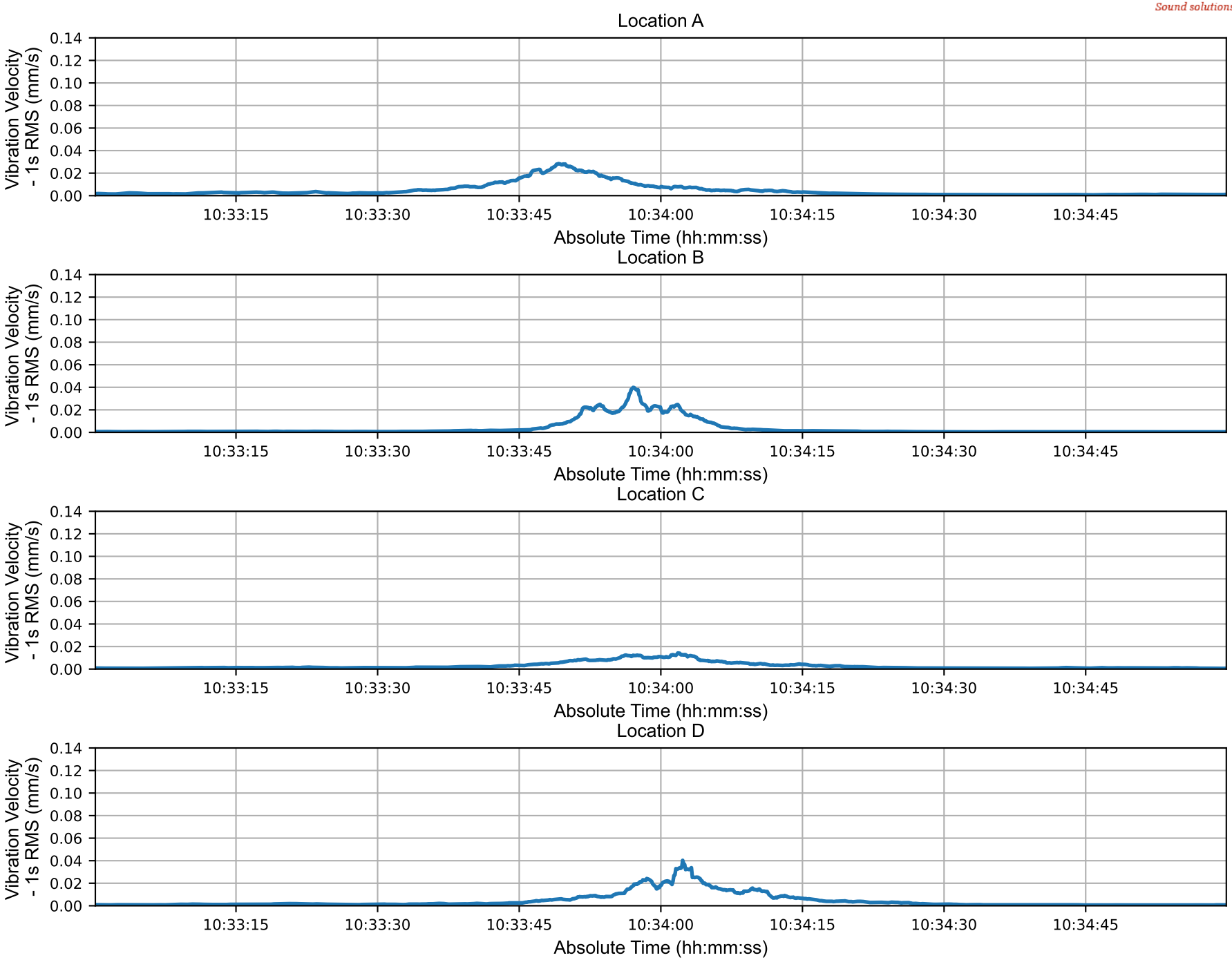

Pass-By #19

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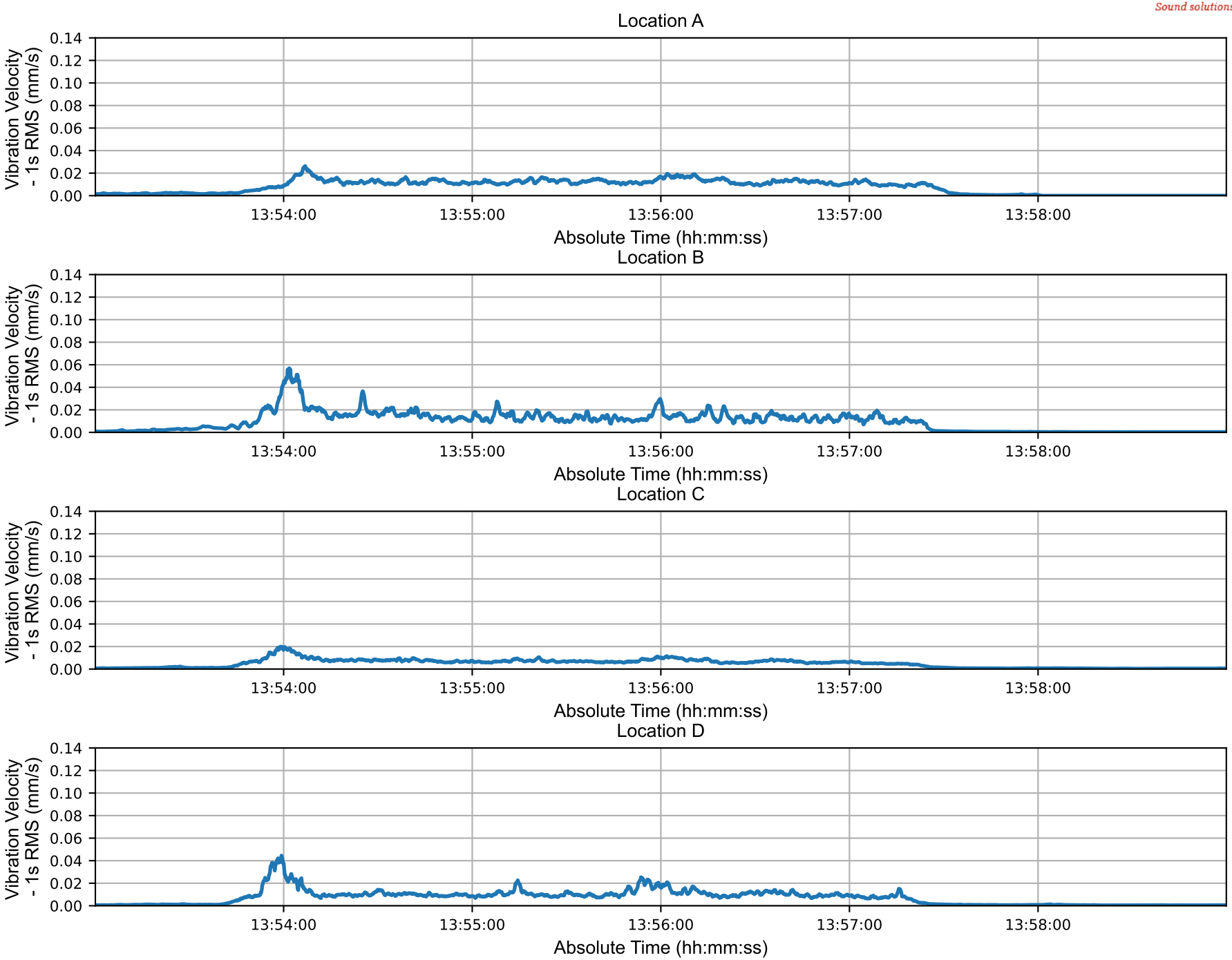
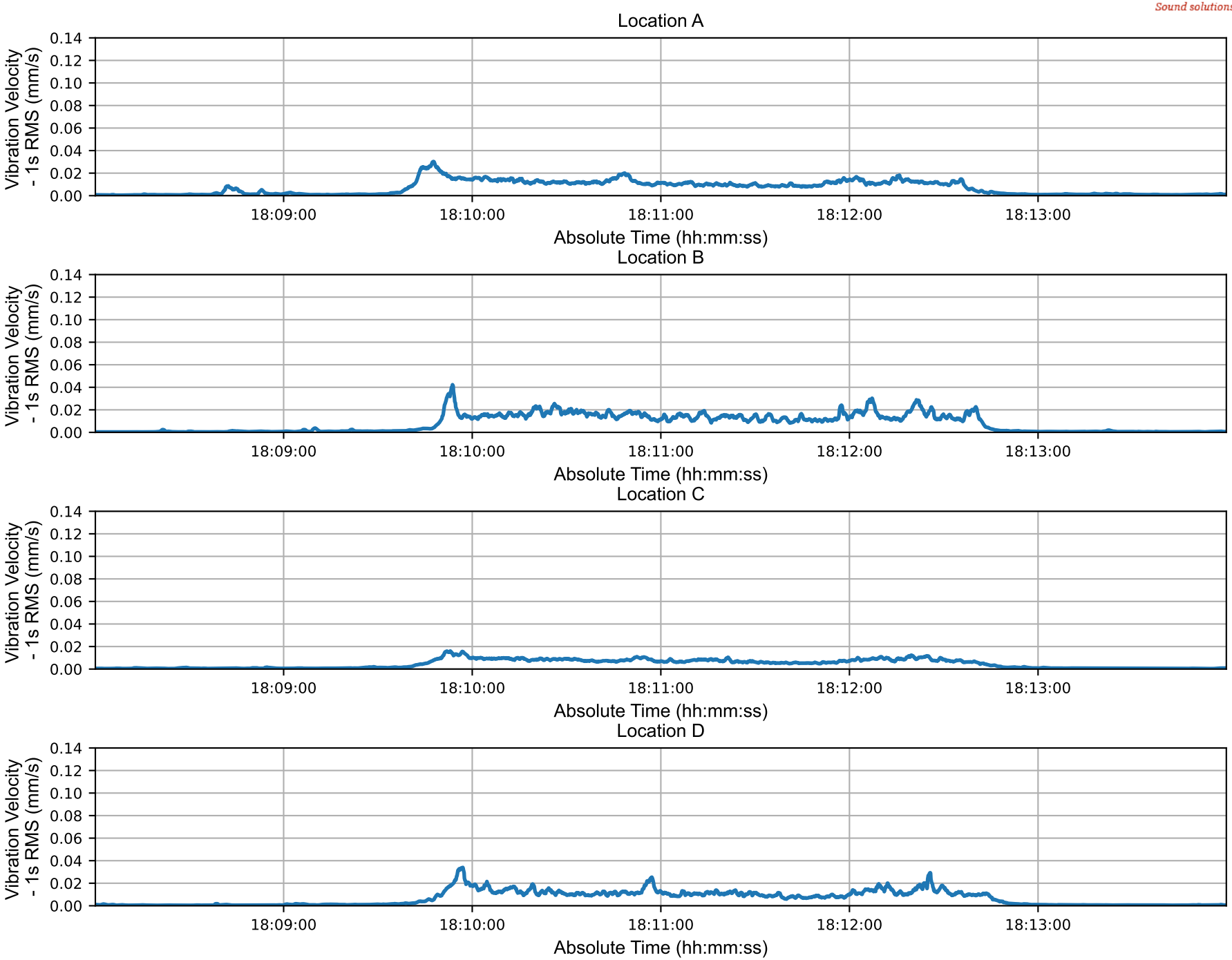


Pass-By #20


Location A
Vibration Velocity - 1s RMS (mm/s)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
18:09:00
18:10:00
18:11:00
18:12:00
18:13:00
Absolute Time (hh:mm:ss)
Location B
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location C
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)
Location D
Vibration Velocity - 1s RMS (mm/s)
Absolute Time (hh:mm:ss)

Pass-By #21

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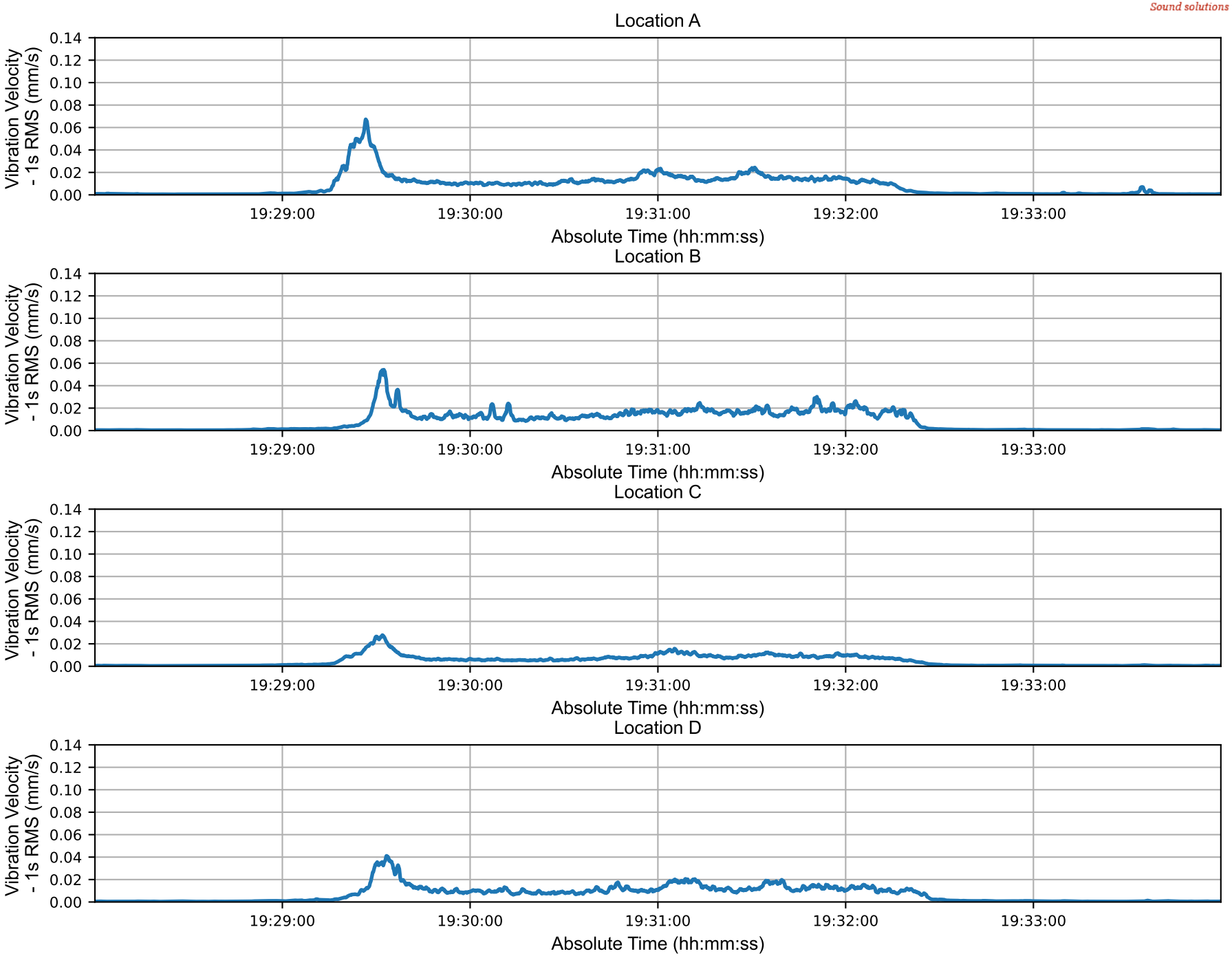

Pass-By #22

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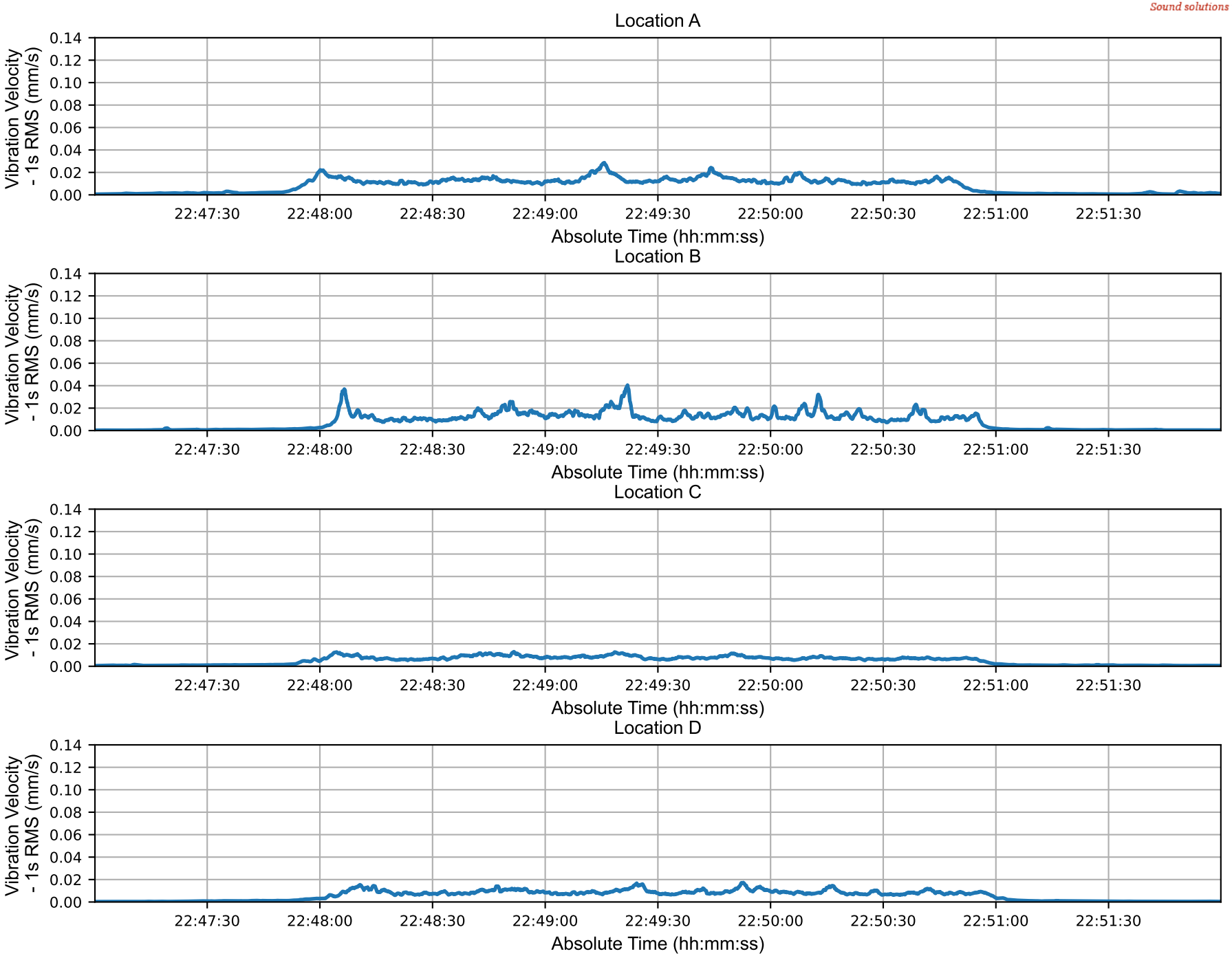

Pass-By #23

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