

KINROSS

Great Bear

Great Bear Gold Project Impact Statement

Appendix E-1:

Sound and Vibration Baseline Report (Leaves On)





2022 Sound and Vibration Baseline Report (Leaves On Program)

Great Bear Project
Red Lake, Ontario
Project # OMGS21045

Prepared for:

Kinross Gold Corporation
25 York Street #17, Toronto, ON M5J 2V5

December 2022



2022 Sound and Vibration Baseline Report (Leaves-On Program)

Great Bear Project
Red Lake, Ontario
Project # OMGS21045

Prepared for:

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December 2022

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Executive Summary

Wood Group Asset Integrity Solutions Inc. operating as Wood VDN was engaged to prepare a baseline sound and vibration report for the Great Bear Project (the Project) for Kinross Gold Corporation.

The Project is located in an area of historic gold mining and exploration in the northwest of the province of Ontario approximately 24 km south of Red Lake, Ontario (Figure 1-1). The regional topography features low, rolling hills with numerous small lakes and spruce bogs. On the property, the terrain is gently sloping with an elevation range of 350 to 460 m above sea level. There are a few streams, including Dixie Creek, that have mature meandering courses. The project property is partially forested with mature stands and younger growth of black spruce, poplar, birch, and jack pine, typical of the boreal forest.

Four (4) monitoring locations were selected for the baseline sound and vibration investigation. The locations were selected to be representative of potential sensitive receptors based on proximity and directionality in relation to the proposed Project location. This report summarizes relevant sound and vibration data collected by Wood during the baseline monitoring field program conducted from September 27 to October 04, 2022, timed for when leaves were still on the trees. This report describes the baseline monitoring locations and dates of the monitoring program; outlines the baseline data collection methodology; and presents summaries of the baseline monitoring data.

The baseline sound levels were characterized using the hourly A-weighted equivalent sound level ($L_{Aeq-1hr}$) and the Day-Night Sound Level (L_{dn}) values. The baseline vibration levels were characterized using the peak particle velocity (PPV) (V_{PPV}) and root-mean-square (RMS) velocity (V_{RMS}) values. The following findings, representing the four locations monitored, have been made from the baseline assessment presented in this report:

- The baseline sound level monitoring results showed average hourly $L_{Aeq-1hr}$ levels of under 40 dBA during daytime (07:00 to 23:00) and under 30 dBA during nighttime (23:00 to 07:00). The average L_{dn} levels at the monitoring locations were found to be lower than 40 dBA.
- The baseline vibration monitoring results showed V_{PPV} values under 0.005 mm/s for more than 95% of the data collected at all four monitoring locations. The average V_{RMS} is approximately 0.001 mm/s at all four monitoring locations.

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1.0 Introduction

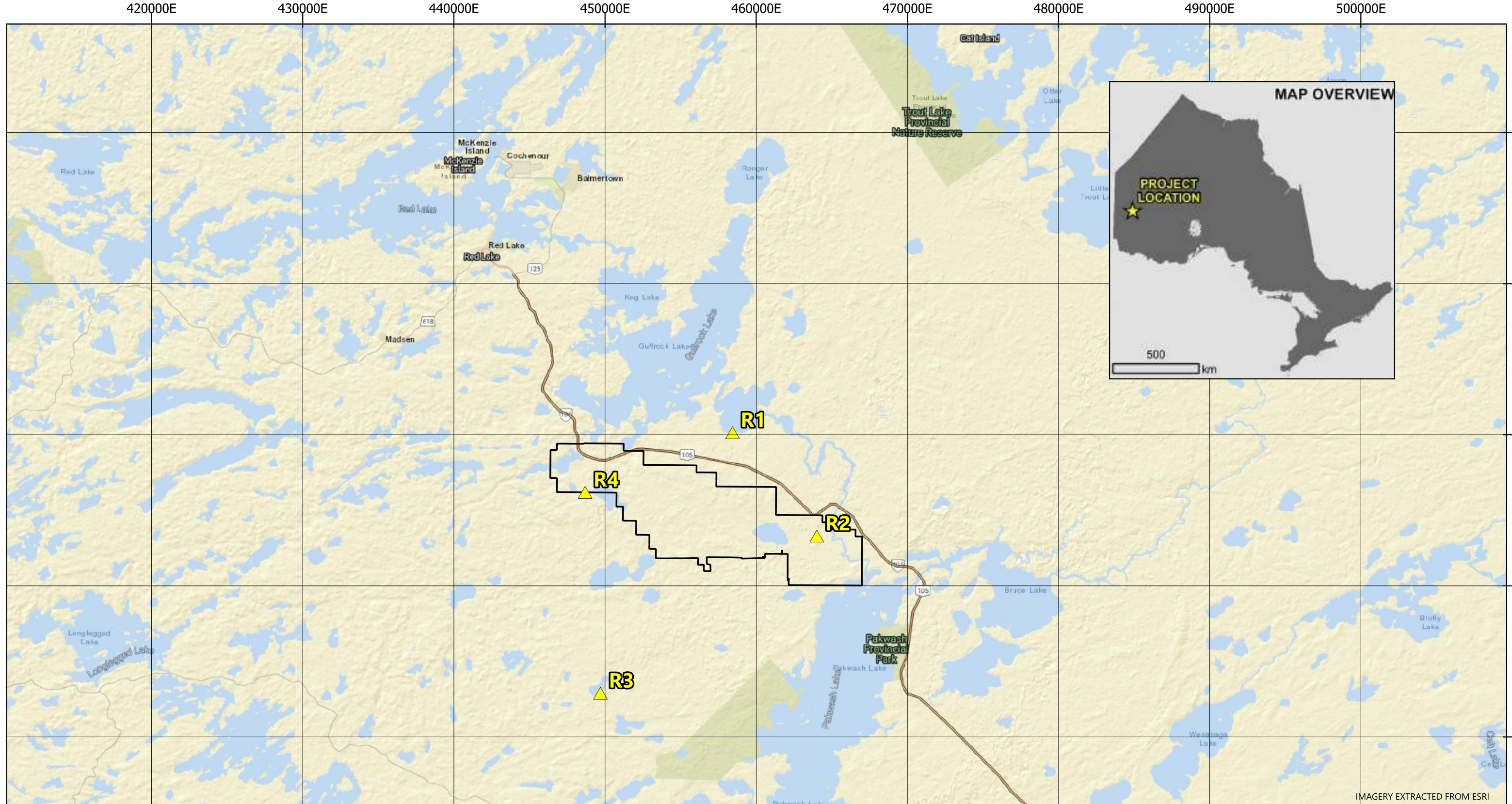
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Great Bear Resources Ltd. (GBR), a wholly owned subsidiary of Kinross Gold Corp. (KGC), is currently defining the mineral resource at the Project. Resource estimation work is in progress and GBR's development concept is a conventional open pit and underground gold mining and milling operation. The production rate is anticipated to be approximately 15,000 tonnes per day (TPD).



This report summarizes relevant sound and vibration data collected by Wood during the baseline monitoring field program conducted from September 27 to October 04, 2022. This report describes the baseline monitoring locations and dates of the monitoring program; outlines the baseline data collection methodology; and presents summaries of the baseline monitoring data.

Four appendices have been attached to this report. Technical terms and definitions are provided in Appendix A. Calibration certificates for the equipment used on site are provided in Appendix B. Detailed sound and vibration monitoring results are presented in Appendices C and D, respectively.



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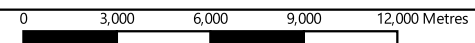
LEGEND

-  Baseline Noise & Vibration Locations
-  Great Bear Project Outline



Great Bear Project

Project Location and
Monitoring Locations



Datum & Projection:
NAD83 / UTM zone 15N



PROJECT NO: OMGS21045

FIGURE 1-1

SCALE: 1:242494

DATE: December 2022

2.0 Baseline Monitoring Program

The leaves-on baseline sound and vibration monitoring field program was conducted September 27 to October 04, 2022. Details of the monitoring program are outlined in Table 2-1 which includes the UTM coordinates of the monitoring locations and the periods of monitoring at each location.

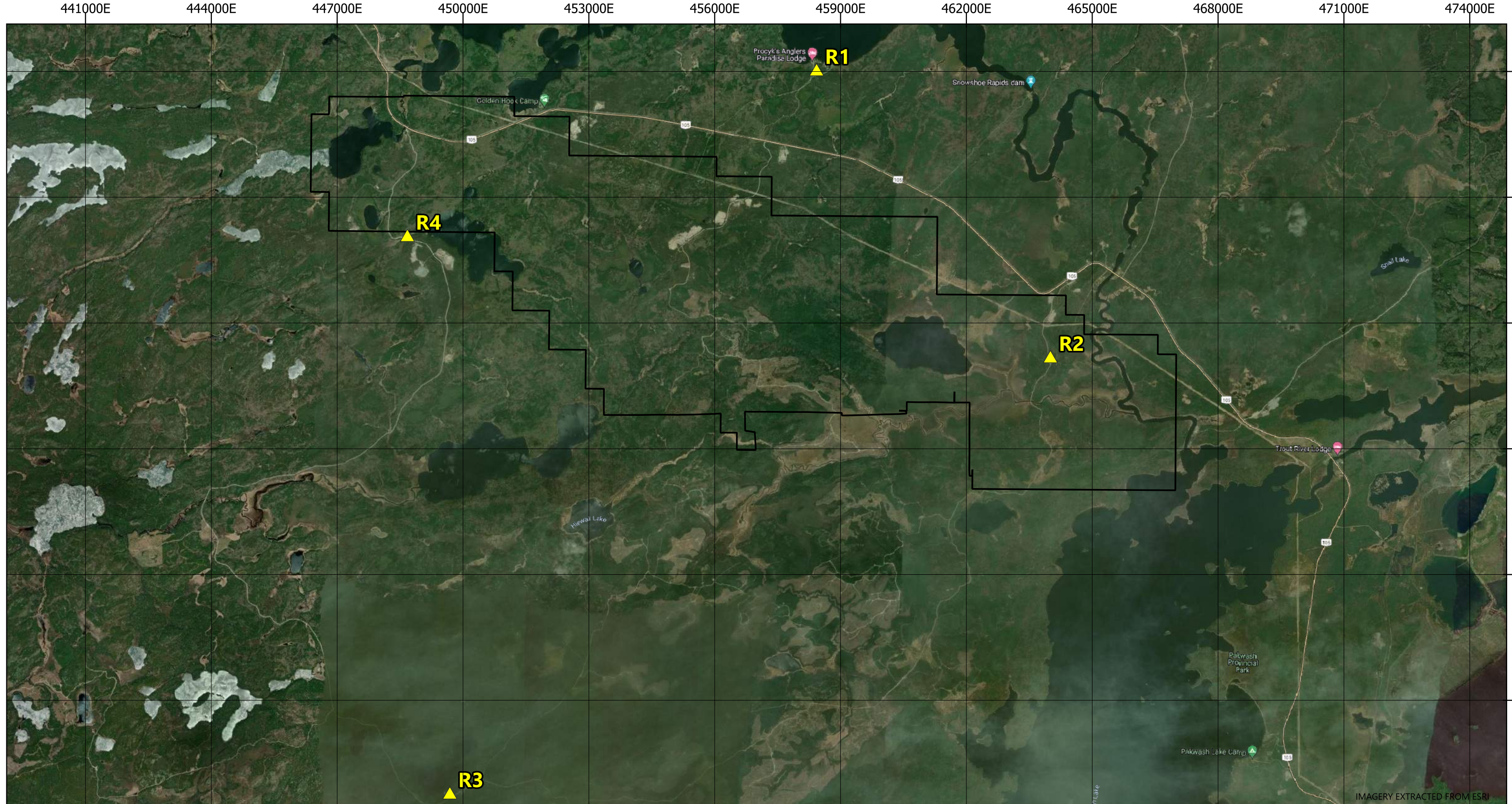
Figure 2-1 provides a geographical overview of the monitoring locations. The locations were selected to be representative of potential sensitive receptors based on proximity and directionality in relation to the Project location. The selection of appropriate locations for baseline monitoring were further constrained by accessibility conditions during the field work. The four representative receptors, R1, R2, R3 and R4 are located north, east, southwest, and west of the Project, respectively. For each monitoring station, photos have been included in this section to show the equipment setup (See Figure 2-2 to Figure 2-5).

Table 2-1: Baseline Monitoring Locations



Monitoring Location	Monitoring Station Identifier ²	Start Date	End Date	UTM Coordinates ¹	
				Easting	Northing
R1	NMT1	September 27, 2022	October 04, 2022	458426	5639996
	VMT1	September 29, 2022	October 01, 2022		
R2	NMT2	September 27, 2022	October 04, 2022	464002	5633047
	VMT1	October 01, 2022	October 02, 2022		
R3	NMT3	September 27, 2022	October 04, 2022	449556	5622820
	VMT1	October 02, 2022	October 03, 2022		
R4	NMT4	September 27, 2022	October 04, 2022	448092	5635837
	VMT1	September 27, 2022	September 29, 2022		

Note:

1. All coordinates in UTM coordinate system Zone 15N (NAD83)
2. NMT: Noise Monitoring Terminal
VMT: Vibration Monitoring Terminal



LEGEND

-  Baseline Noise & Vibration Locations
-  Great Bear Project Outline



Great Bear Project

Baseline Sound and Vibration
Monitoring Locations

Datum & Projection:
NAD83 / UTM zone 15N



PROJECT NO: OMGS21045

FIGURE 2-1

SCALE: 1:87385

DATE: December 2022

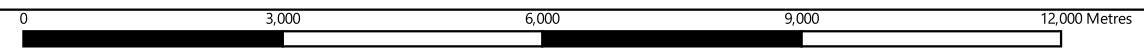


Figure 2-2: Monitoring Setup at R1



(a) Sound Level Meter (SLM) Setup

Figure 2-3: Monitoring Setup at R2



(a) Sound Level Meter (SLM) Setup

Figure 2-4: Monitoring Setup at R3



(a) Sound Level Meter (SLM) Setup

Figure 2-5: Monitoring Setup at R4



(a) Sound Level Meter (SLM) Setup

3.0 Measurement Methodology

3.1 Environmental Acoustics

Sound is mechanical energy transmitted by pressure waves through a medium such as air. There are several measurement scales that are used to describe the intensity or level of the environmental sound at a particular location. The most common is the A-weighted sound level expressed in the decibel unit (dBA). The dBA scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 dBA increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities (Bell & Bell, 1994).

The measurement of sound level with standard instruments equipped with an A-weighting filter results in a de-emphasis of the very low and very high frequency components of sound in a manner similar to the frequency response of the human ear. This correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless indicated otherwise.

Because sound levels can vary noticeably over a short period of time, a method for describing the average character of the sound must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy equivalent sound descriptor is called the sound equivalent level (L_{eq}). The most common averaging period is hourly; however, L_{eq} can describe any series of noise events for any selected duration. The leaves-on sound monitoring program utilized hourly A-weighted sound levels ($L_{Aeq-1hr}$) to process data collected over the entire monitoring period. Sound levels not belonging to environmental sounds, such as maintenance checks by operators, was excluded as part of the data processing further described in Section 4.

3.2 Sound Monitoring Stations

The equipment at each sound monitoring location included a Brüel & Kjær Type 1 integrating sound level meter (American National Standards Institute, 2006) (International Electrotechnical Commission, 2013) set to slow response, A-weighting, and programmed to measure 1-hour history data for the following metrics: L_{Aeq} , L_{ASmin} , and L_{ASmax} . The metrics collected will inform the assessment of potential effects with respect to:

- One-hour equivalent sound level $L_{Aeq-1hr}$ during the predictable worst-case hour of operation, as per MECP NPC-300 (Ontario Ministry of the Environment, Conservation and Parks (MECP), August 2013)
- Daytime sound Level (L_d), nighttime sound level (L_n) and day-night sound level (L_{dn}) as per Health Canada Noise Guideline (Health Canada, January 2017).

The sound level meters were each outfitted with a manufacturer approved pre-amplifier and free-field microphone. Each of the sound monitoring setups were installed in an environmental protection case with the microphone mounted on an external tripod and fitted with an appropriate windscreen. The microphones were set to a typical outdoor listening height of between 1.5 and 2.0 metres (m) above ground. Table 3-1 presents a summary of the equipment deployed on-site. Calibration certificates for the deployed equipment are provided in Appendix B.

Field calibrations were also conducted before and after the monitoring. An acoustical calibrator (International Electrotechnical Commission, 2003) from Brüel & Kjær (Type 4231) was used for field calibrations. The calibration variance, before and after the monitoring, was less than ± 0.5 decibel (dB).

3.3 Weather Information Collection

Sound levels and sound monitoring equipment can be affected by local meteorological conditions. To account for this influence, Project-specific weather data provided by Kinross was used to identify periods when sound monitoring could have been affected. Monitoring data collected during periods of inclement weather were excluded from the monitoring data set. The inclement weather conditions defined in NPC-103 (Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977c) was considered for the purpose of this program, that occur when:

- Humidity levels are above 90%;
- Precipitation has occurred;
- Wind velocity has exceeded 20 kilometres per hour (km/h); or
- Temperature is outside the operating range defined by the manufacturer of the sound level meter (i.e., -10 degrees Celsius ($^{\circ}\text{C}$) to +50 $^{\circ}\text{C}$).

3.4 Vibration Monitoring Stations

The equipment used for baseline vibration monitoring included a Brüel & Kjær Type 2250 Vibration Analyzer set to measure 1-second history data of Peak Particle Velocity (PPV) (V_{PPV}) and Root-Mean-Square (RMS) velocity (V_{RMS}) along the vertical axis. Each of the vibration monitor systems was fitted with a PCB Piezotronics accelerometer. One analyzer was used for all four locations. At each of the vibration monitoring locations the accelerometer was securely installed on the ground by use of a four-pronged plate mount which was pushed firmly into the ground to fix the unit in place.

The metrics collected correspond to the assessment of two distinct areas of potential impact:

- Peak Particle Velocity (PPV) (V_{PPV}) is used for assessment of potential damages to structure of buildings due to vibration, in particular from blasting, as outlined in NPC-119. (Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977a)
- Root-Mean-Square (RMS) velocity (V_{RMS}) is used for assessment of potential impacts related to human perception of vibrations, as outlined in NPC-207. (Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977b)

Table 3-2 presents a summary of the equipment deployed on-site. Calibration certificates can be found in Appendix B.

3.5 Field Inspection and Activities

Site activities in relation to inspection and maintenance of the monitoring stations were undertaken during the monitoring program. Notable sound and velocity levels were recorded during the inspection period when the sound levels and ground vibrations were affected by these site activities (e.g., field transportation). These recordings were not considered as representative of the baseline levels. Monitoring data collected during the period of site inspection and maintenance were excluded from the dataset.

There were ongoing drilling activities for defining mineral resources at the Project site. Based on coordination provided by the client, all active drilling sites are located beyond 5 km of the four monitoring locations. Therefore, impact on recorded data from drilling sites is expected to be negligible during the program.

Table 3-1: List of Sound Monitoring Equipment Used on Site

Monitoring Location	Monitoring Station Identifier	Equipment Type	Model	Serial Number	Last Factory Calibration Date
R1	NMT1	Sound Level Meter	2250	3011887	July 18, 2022
		Pre-amplifier	ZC-0032	30310	
		Microphone	4189	3130964	
R2	NMT2	Sound Level Meter	2250	3004496	May 23, 2022
		Pre-amplifier	ZC-0032	20253	
		Microphone	4189	2888559	
R3	NMT3	Sound Level Meter	2250	3004068	February 18, 2021
		Pre-amplifier	ZC-0032	19685	
		Microphone	4189	2877087	
R4	NMT4	Sound Level Meter	2250	3004786	February 18, 2022
		Pre-amplifier	ZC-0032	20299	
		Microphone	4189	2888637	
-	-	Acoustical Calibrator	4231	3021832	October 7, 2021

Table 3-2: List of Vibration Monitoring Equipment Used on Site

Monitoring Location	Monitoring Station Identifier	Equipment Type	Model	Serial Number	Last Factory Calibration Date
R1, R2, R3, R4	VMT1	Vibration Analyzer	2250	3023697	January 25, 2022 ¹
		Accelerometer	PCB 393B04	53563	October 23, 2018 ²
-	-	Calibrator	4231	3022638	June 28, 2022

Notes:

1. The vibration analyzer, i.e., Brüel & Kjær Type 2250, is compatible with various types of transducers and the calibration certificates provided by the equipment vendor are not specific to the listed accelerometer.
2. The accelerometers were also calibrated by use of a portable vibration calibrator from Brüel & Kjær (Type 4294) by the equipment vendor prior to shipment.

4.0 Monitoring Results

4.1 Sound Monitoring Results

4.1.1 Hourly Sound Levels

Sound monitoring took place from September 27 (installation date) to October 04, 2022 (removal date) at the four locations (R1, R2, R3 and R4) identified in Table 2-1 and Figure 4-1.

Table 4-1 presents a summary of the collected sound data, including the number of complete hourly records¹ and the number of hourly records where the sound data was measured during inclement weather conditions. Sound monitoring data is presented for the daytime (07:00 to 23:00) and nighttime (23:00 to 07:00) periods as defined in NPC-300 (Ontario Ministry of the Environment, Conservation and Parks (MECP), August 2013). The metrics presented in Table 4-1 correspond to the arithmetic average of the hourly L_{Aeq} , minimum of the hourly value of $L_{A_{Smin}}$ and maximum of the hourly value of $L_{A_{Smax}}$.

The monitoring results are also presented in bar graphs in Figure 4-1 which shows the range of minimum hourly $L_{A_{Smin}}$ to maximum hourly $L_{A_{Smax}}$ while the cross line indicates the average hourly L_{Aeq} . Hourly sound levels captured for each receptor are provided in Appendix C. The data suggests low background sound levels with the average hourly L_{Aeq} under 40 dBA during daytime and under 30 dBA during nighttime at four monitoring locations. The highest range of ($L_{A_{Smin}} - L_{A_{Smax}}$) was recorded at R2 during daytime and at R1 during nighttime. The calculated L_{A90} value, which is commonly used to describe background sound level and is defined as the sound level just exceeded for 90% of the time, shows the highest background sound levels of 26 dBA at R1 during daytime and 24 dBA at R1 location during nighttime.

4.1.2 Day-Night Sound Levels

The daytime sound level (L_d), nighttime sound level (L_n) and day-night sound level (L_{dn}) were calculated for each day of the monitoring period as defined in Health Canada Noise Guideline (Health Canada, January 2017). A summary of the calculation results is presented in Table 4-2 which shows the minimum, arithmetic average, and maximum values of the three metrics (i.e., L_d , L_n and L_{dn}).

Detailed daily day-night sound levels can be found in Table 4-3 and Table 4-4. The collected data points are also shown in Figure 4-2 with a boxplot presentation to show the overall variability of the sound levels (see Appendix A for definition of box plot and general legend). On average R1 and R4 have been identified with the highest baseline L_{dn} level of 42 dBA.

4.1.3 Statistical Review

The data collected was also used to assess the hourly L_{Aeq} statistics at each time of the day over 24 hours. The results are presented in Figure 4-3 through Figure 4-6. The results show that the sound levels during nighttime periods are typically lower than daytime.

¹ For the purposes of this report, hourly record corresponds to an hour of time where sound data has been collected with an integration time of 1 hour, starting at the top of each hour. Records collected that do not meet the criteria of integration time suggest interrupted measurement with possible causes such as equipment maintenance and have been discarded from this report.

4.2 Vibration Monitoring Results

4.2.1 Vibration Levels

Vibration monitoring took place from September 27 to October 04, 2022 at the four locations identified in Table 2-1 and Figure 2-1. Vibration monitoring data is presented in terms of the Peak Particle Velocity (PPV) (V_{PPV}) and Root-Mean-Square (RMS) velocity (V_{RMS}) metrics recorded for 1-second intervals along the vertical axis. Baseline vibration conditions were summarized with respect to the V_{PPV} and V_{RMS} levels based on the following metrics:

- For the V_{PPV} metric the 95th percentile value of the measured PPV values, which is considered to represent the likely maximum value of V_{PPV} at a location. The outliers of the dataset may have been affected by random disturbance which are not considered typical baseline scenarios
- For the V_{RMS} metric the arithmetic average of the V_{RMS} values.

A summary of the collected data is presented in Table 4-5. For all four locations, the 95th percentile of the measured V_{PPV} values are under 0.005 mm/s, which is notably low. Similar levels of average V_{RMS} are observed at four locations with the value rounded to 0.001 mm/s.

A summary for daytime (07:00 to 23:00) and nighttime (23:00 to 07:00) levels of the V_{PPV} metric is also included in Table 4-6. The results show that there is no notable difference between the vibration levels recorded during daytime and nighttime. 1-second time history data measured at each monitoring location is provided in Appendix D.

4.2.2 Statistical Review

Statistical analysis was carried out on the 1-second V_{PPV} and V_{RMS} metrics. Summaries of the statistical analysis are presented in terms of boxplots in Figure 4-7.

It was observed that more than 95% of the V_{PPV} values were recorded at a constant value of 0.002 mm/s when rounded to three decimal places at R1, R2, R3 and R4 with 0.003mm/s. This constant value is considered the lower measurement range of the instrument for V_{PPV} recording, and levels under range were recorded at the constant value. A review of the results also suggests that the vibration levels measured at all four locations are of similar magnitude.

Table 4-1: Sound Levels Summary

Monitoring Station	Number of Hourly Records ¹		Sound Metrics Collected (1-hour) ²							
	Total	Inclement Weather	Daytime [07:00-23:00]				Nighttime [23:00-07:00]			
			L _{Asmin}	L _{Aeq}	L _{Asmax}	L _{AS90}	L _{Asmin}	L _{Aeq}	L _{Asmax}	L _{AS90}
R1	159	70	17	36	81	27	18	29	60	24
R2	161	71	17	36	87	26	18	27	53	23
R3	161	73	17	30	82	24	17	23	42	20
R4	161	71	16	36	76	26	16	26	67	22

Notes:

- The number of records with length of measurement equal to 1:00 hour taken for the period indicated:
Total: total number of hourly records; Inclement weather: total number of hourly records that fall within a period of inclement weather as defined in Section 3.3.
- Denotes all metrics collected in terms of one-hour values, not coinciding with an hour where inclement weather conditions were observed. For each of the metrics the following processing was considered:
L_{Asmin} – Denotes the minimum of the 1-hour L_{Asmin} collected
L_{Aeq} – Denotes the arithmetic average of the 1-hour L_{Aeq} collected
L_{Asmax} – Denotes the maximum of the 1-hour L_{Asmax} collected
L_{AS90} – Denotes the arithmetic average of the 1-hour L_{AS90} collected

Table 4-2: Day-Night Sound Levels Summary

Monitoring Station	Sound Metrics Collected ^{1, 2}								
	L _d			L _n			L _{dn}		
	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.
R1	37	40	44	27	31	37	38	42	45
R2	33	40	48	25	29	33	35	39	42
R3	29	34	41	19	35	40	31	35	40
R4	39	42	46	22	29	35	39	42	45

Notes:

- Denotes all metrics calculated based on one-hour values, not coinciding with an hour where inclement weather conditions were observed, and excluding data collected during periods of site inspection and maintenance. For each of the metrics the following processing was considered:
L_d – Denotes the daytime equivalent sound level from 07:00 to 22:00
L_n – Denotes the nighttime equivalent sound level from 22:00 to 07:00
L_{dn} – Denotes the day-night sound level for a 24-hr period, with the night-time contributions adjusted by +10 dB.
- Metrics presented: maximum, arithmetic average (mean), and minimum.

Table 4-3: Detailed Day-Night Sound Levels R1 and R2

Monitoring Period	Sound Metrics Collected ^{1,2}					
	Monitoring Location R1			Monitoring Location R2		
	L _d	L _n	L _{dn}	L _d	L _n	L _{dn}
Tue, 2022-09-27	34	-	-	48	-	-
Wed, 2022-09-28	44	27	42	42	29	42
Thur, 2022-09-29	43	37	45	43	29	42
Fri, 2022-09-30	41	32	41	39	33	41
Sat, 2022-10-01	43	33	43	33	32	39
Sun, 2022-10-02	38	27	38	34	25	35
Mon, 2022-10-03	-	30	-	-	25	-
Tue, 2022-10-04	-	-	-	-	-	-

Notes:

1. Denotes all metrics calculated based on one-hour values, not coinciding with an hour where inclement weather conditions were observed. For each of the metrics the following processing was considered:
 L_d – Denotes the daytime equivalent sound level from 07:00 to 22:00
 L_n – Denotes the nighttime equivalent sound level from 22:00 to 07:00
 L_{dn} – Denotes the day-night sound level for a 24-hr period, with the night-time contributions adjusted by +10 dB.
2. Where “-” stands for the metrics of periods with no data available due to inclement weather.

Table 4-4: Detailed Day-Night Sound Levels R3 and R4

Monitoring Period	Sound Metrics Collected ^{1,2}					
	Monitoring Location R3			Monitoring Location LR4		
	L _d	L _n	L _{dn}	L _d	L _n	L _{dn}
Tue, 2022-09-27	29	-	-	40	-	-
Wed, 2022-09-28	39	23	37	43	23	41
Thur, 2022-09-29	36	25	36	46	33	45
Fri, 2022-09-30	41	26	40	42	34	43
Sat, 2022-10-01	29	25	32	39	35	42
Sun, 2022-10-02	31	19	31	40	22	39
Mon, 2022-10-03	-	23	-	-	27	-
Tue, 2022-10-04	-	-	-	-	-	-

Notes:

1. Denotes all metrics calculated based on one-hour values, not coinciding with an hour where inclement weather conditions were observed. For each of the metrics the following processing was considered:
 L_d – Denotes the daytime equivalent sound level from 07:00 to 22:00
 L_n – Denotes the nighttime equivalent sound level from 22:00 to 07:00
 L_{dn} – Denotes the day-night sound level for a 24-hr period, with the night-time contributions adjusted by +10 dB.
2. Where “-” stands for the metrics of periods with no data available due to inclement weather.

Table 4-5: Vibration Levels Summary

Monitoring Station	Total Number of 1-second Records ¹	Vibration Metrics Collected (1-second) ^{2, 3}	
		PPV [mm/s]	RMS [mm/s]
R1	175063	0.002	0.001
R2	85982	0.002	0.001
R3	81747	0.002	0.001
R4	174379	0.003	0.001

Notes:

1. The total number of 1-second records taken for the monitoring period, excluding data collected during site inspections
2. Denotes all metrics collected in terms of one-second values. For each of the metrics the following processing was considered:
 PPV: Denotes the 95th percentile value of PPV from all monitoring data along the vertical axis.
 RMS: Denotes the arithmetic average of RMS velocity from all monitoring data along the vertical axis.
3. The values presented are rounded to 3 decimal places.

Table 4-6: Day-Night Vibration Levels Summary

Monitoring Station	PPV Metrics Collected (1-second) ^{1, 2}					
	Daytime [07:00-23:00]			Nighttime [23:00-07:00]		
	Min.	Avg.	95th	Min.	Avg.	95th
R1	0.002	0.002	0.004	0.002	0.002	0.002
R2	0.002	0.002	0.002	0.002	0.002	0.002
R3	0.002	0.002	0.003	0.002	0.002	0.002
R4	0.002	0.003	0.002	0.002	0.002	0.002

Notes:

4. Denotes PPV collected in terms of one-second values from monitoring data along the vertical axis excluding data during site inspections.
5. The values presented are rounded to 3 decimal places.

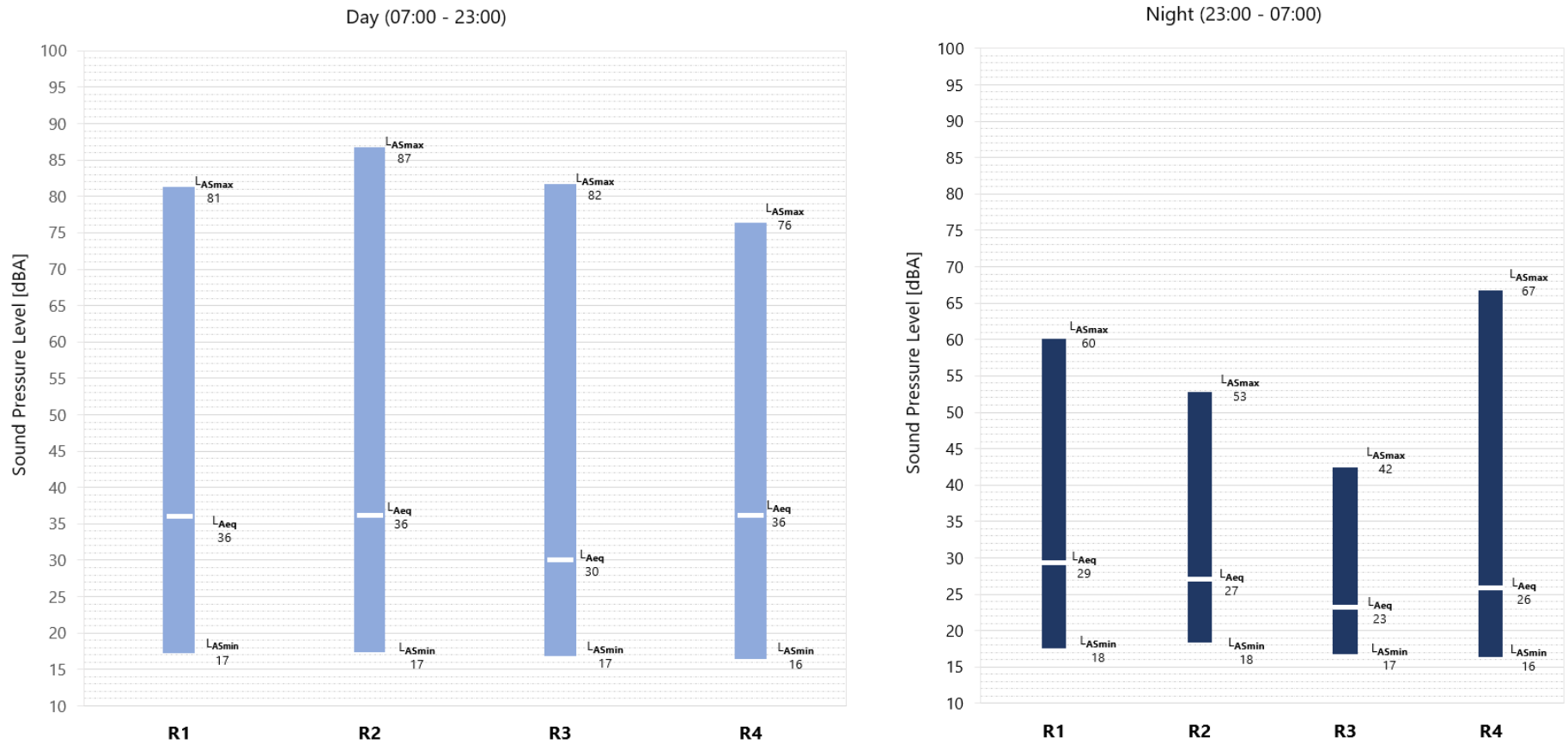


Figure 4-1: Sound Levels Summary

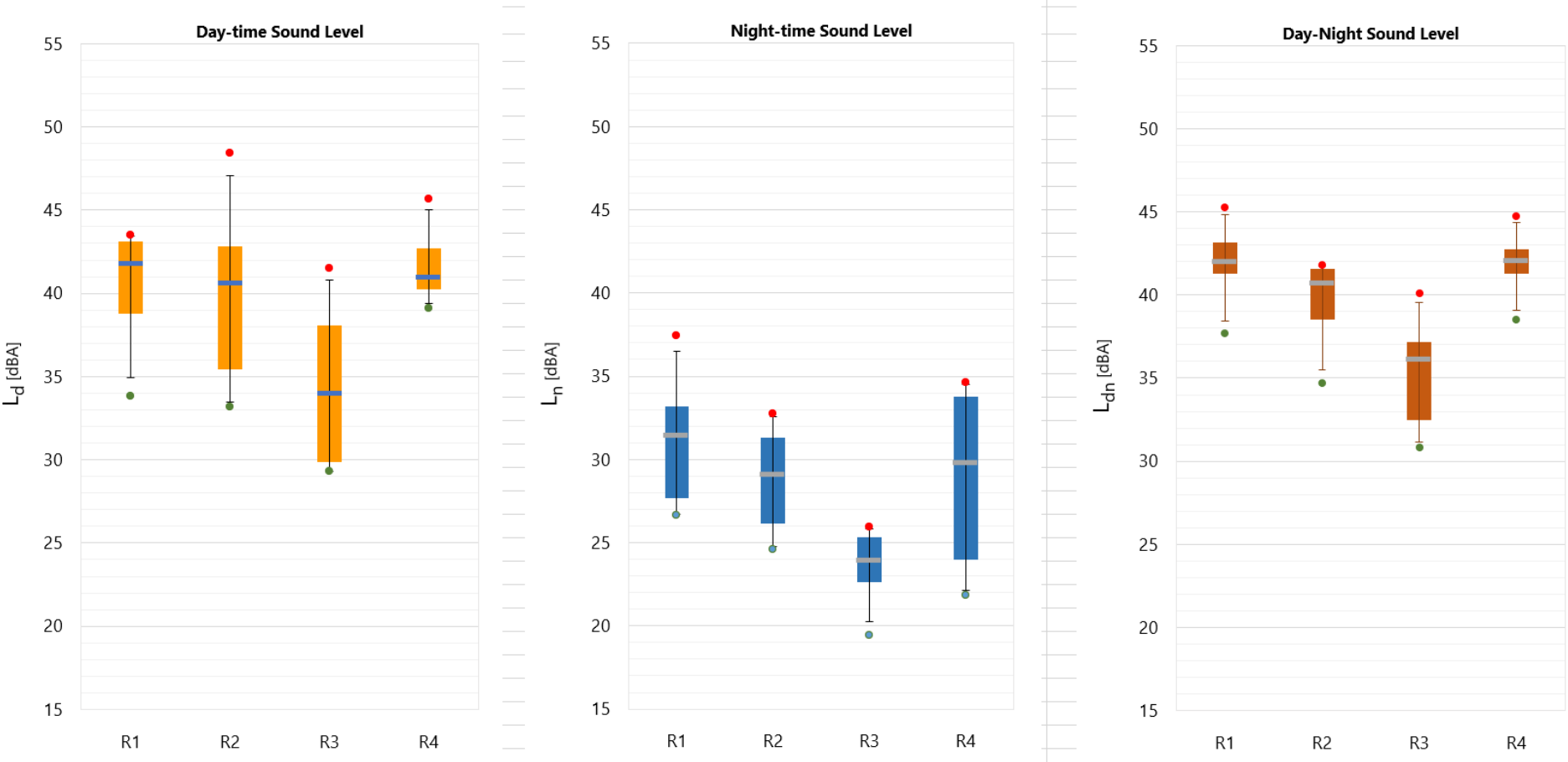


Figure 4-2: Day-Night Sound Levels Summary

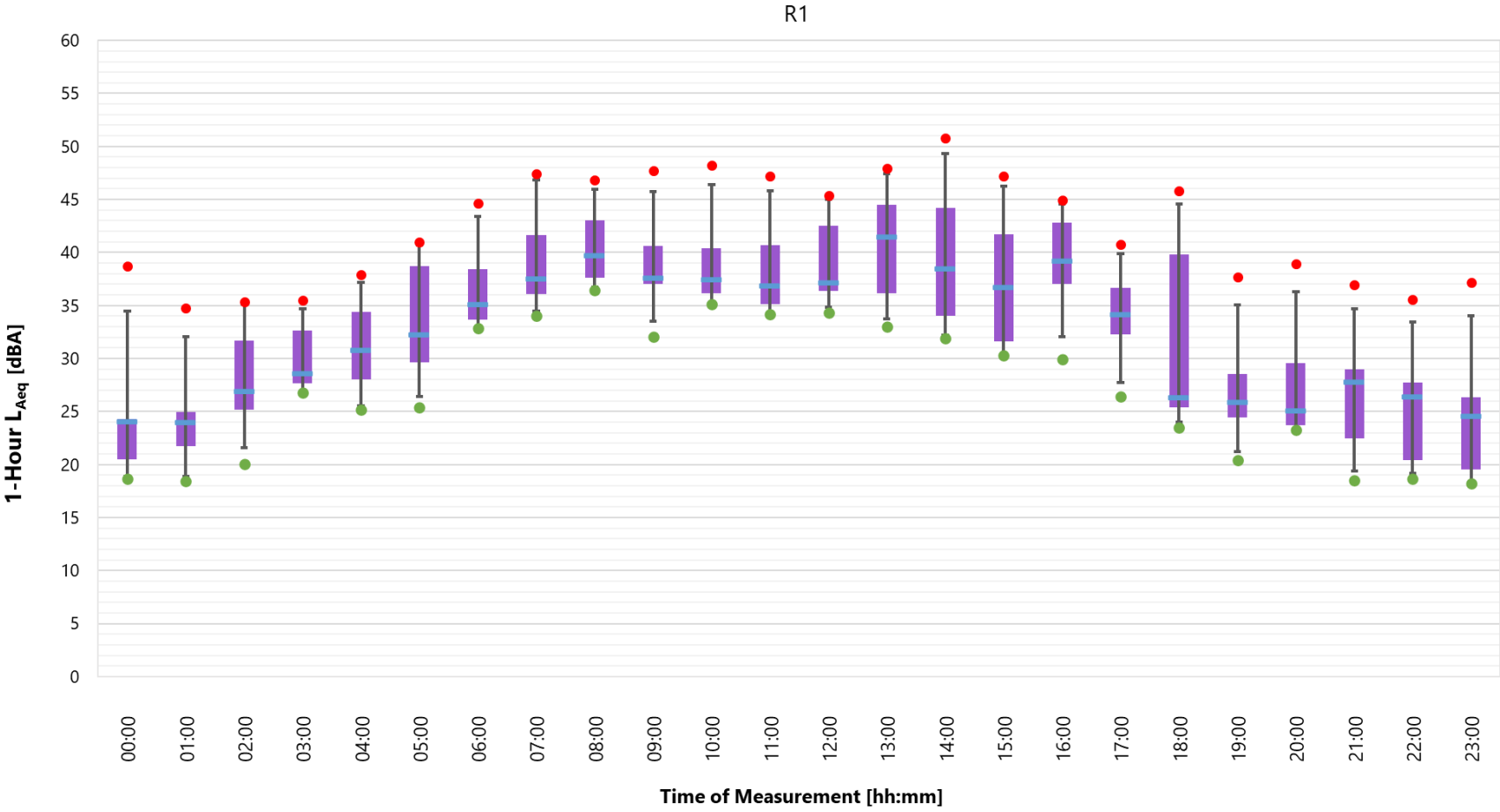


Figure 4-3: Hourly Review of LAeq (1-hour) for a 24-hour Period at R1

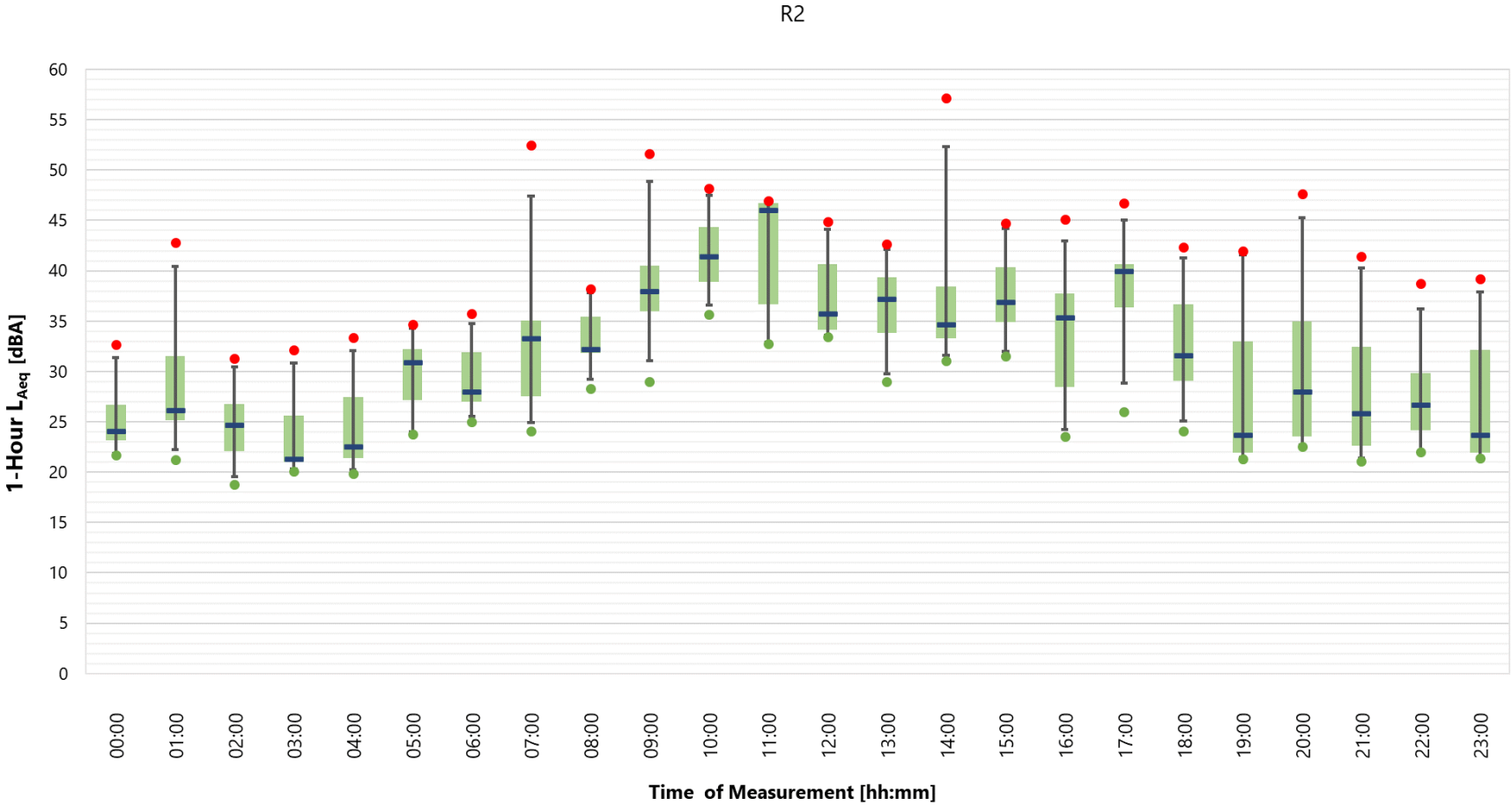


Figure 4-4: Hourly Review of L_{Aeq} (1-hour) for a 24-hour Period at R2

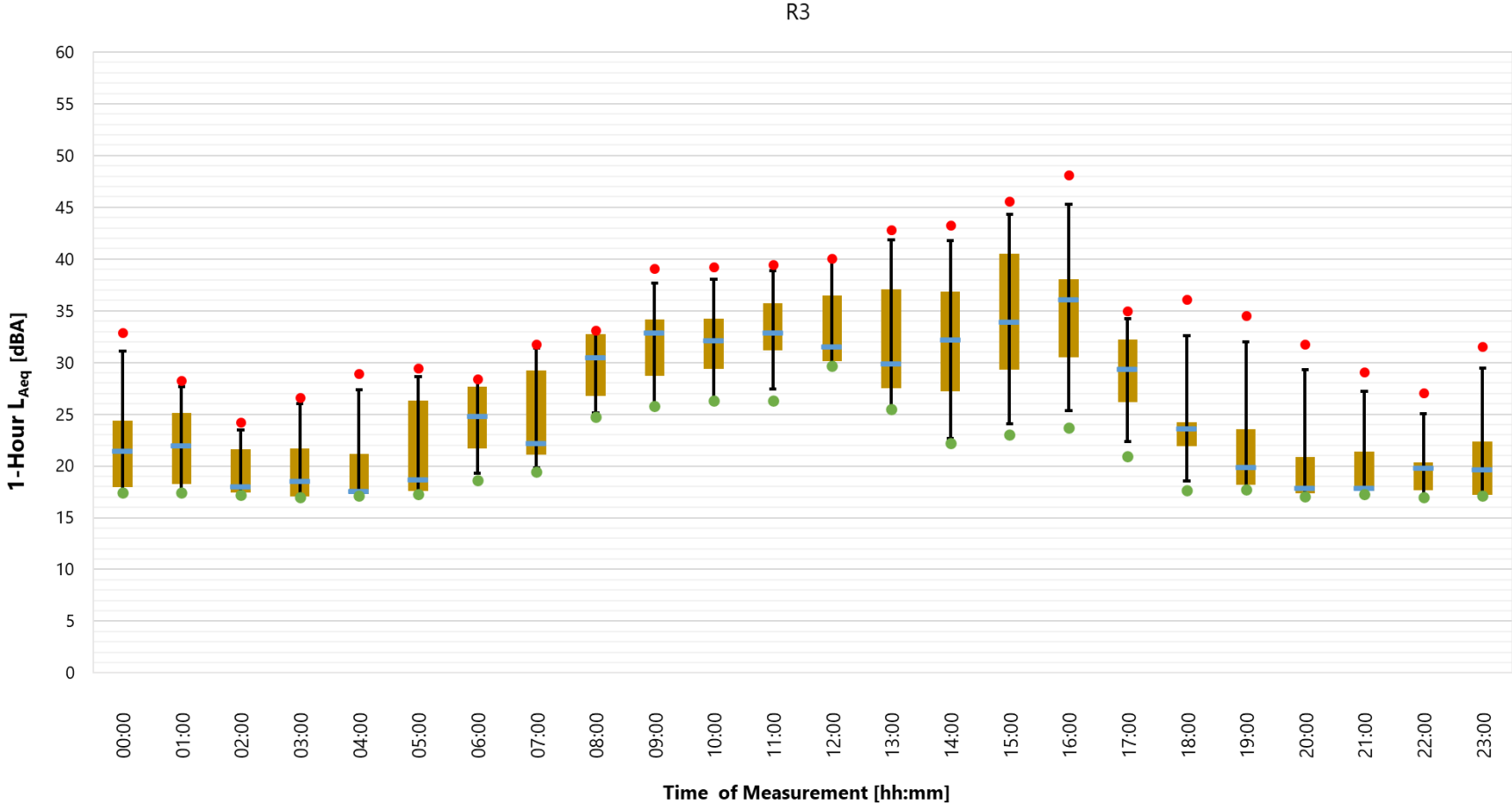


Figure 4-5: Hourly Re view of L_{Aeq} (1-hour) for a 24-hour Period at R3

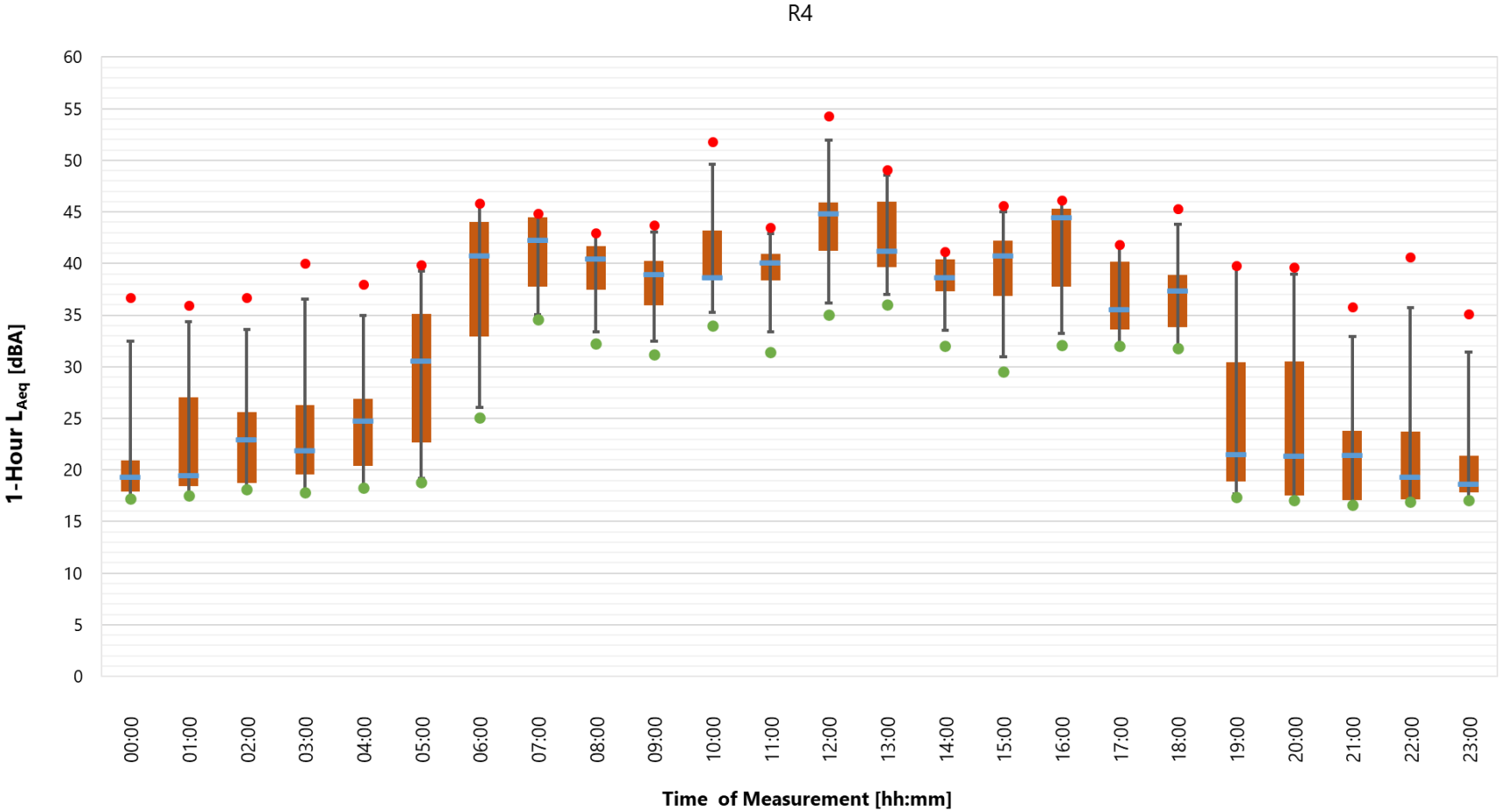


Figure 4-6: Hourly Review of L_{Aeq} (1-hour) for a 24-hour Period at R4

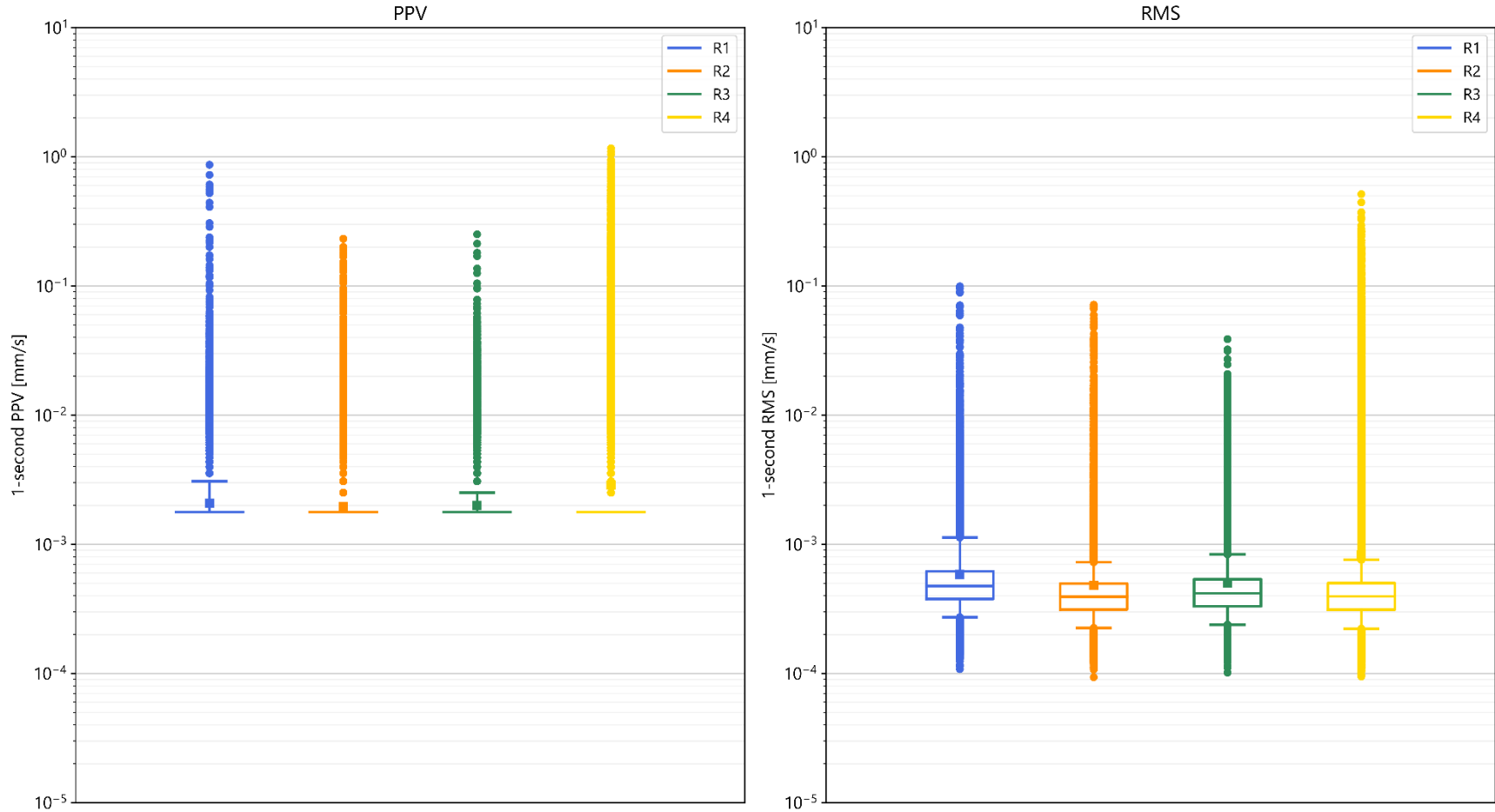


Figure 4-7: Vibration Levels Summary¹

¹ Notes on the boxplot presentation of V_{PPV} values: more than 95% of measured V_{PPV} values are under range, i.e., recorded as a constant value of approximately 0.002 mm/s for R1, R2, R3 and R4. As a result, elements of the boxplot are overlapping, i.e., overlapping minimum value, 5th percentile, second quartile, median, third quartile and 95th percentile.

5.0 Closing

This Sound and Vibration Baseline Report was prepared for Kinross Gold Corporation by Wood. The quality of information and conclusions contained herein is consistent with the level of effort involved in Wood's services and based on: i) information available at the time of preparation; ii) data supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report.

Yours truly,

Wood Group Asset Integrity Solutions, Inc.
Vibration, Dynamics and Noise (VDN)

Prepared by:



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Vibration, Dynamics & Noise

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Approved by:

Mike Cyca, MSC, PEng
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Vibration, Dynamics & Noise

6.0 References

- American National Standards Institute, 2006. *ANSI S1.4-1983 (R2006) plus Amendment S1.4A-1985 (R2006) – American National Standard Specification for Sound Level Meters*, Washington, D.C.: ANSI.
- Bell, L. H. & Bell, D. H., 1994. *Fundamentals of Industrial Noise Control*. New York: Marcel Dekker Incorporated.
- Health Canada, January 2017. *Guidance for Evaluating Human Health Impacts in Environmental Assessment: NOISE*, s.l.: s.n.
- International Electrotechnical Commission, 2003. *IEC 60942 – Electroacoustics – Sound calibrators*, Geneva: s.n.
- International Electrotechnical Commission, 2013. *IEC 61672-1 – Electroacoustics – Sound level meters – Part 1: Specifications*, Geneva: International Electrotechnical Commission.
- Nova Scotia Environment and Labour (NSE), 2005. *Guidelines for Environmental Noise Measurement and Assessment*, s.l.: s.n.
- Ontario Ministry of the Environment (MOE), 1977c. *Publication NPC-103 Procedures, published under the Model Municipal Noise Control Bylaw*, s.l.: s.n.
- Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977a. *Publication NPC-119 Blasting, published under the Model Municipal Noise Control Bylaw. Revision Oct. 1982*, s.l.: s.n.
- Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977b. *Publication NPC-207 Impulsive Vibration in Residential Buildings, published under the Model Municipal Noise Control Bylaw. Revision Jan. 1988*, s.l.: s.n.
- Ontario Ministry of the Environment, Conservation and Parks (MECP), 1977c. *Publication NPC-103 Procedures, published under the Model Municipal Noise Control Bylaw*, s.l.: s.n.
- Ontario Ministry of the Environment, Conservation and Parks (MECP), August 2013. *Publication NPC-300 Noise Assessment Criteria for Stationary Sources and for Land Use Planning*, s.l.: s.n.



Appendix A

Technical Terms and Acoustical Descriptors

Technical Terms and Acoustical Descriptors

<i>Frequency</i>	<p>Typically the rate in Hertz (Hz) - previously denoted cycles per second, at which an event is repeated.</p> <p><i>Normal human hearing extends over a range of frequencies from about 15 Hz to about 15 kHz.</i></p>
<i>A-Weighting Network</i>	<p>A frequency-response adjustment of a sound level meter that makes its reading conform to human response. The sensitivity of the human ear is frequency dependent. At low and high frequencies, the ear is not very sensitive, but between 500 Hz and 6 kHz the ear is very sensitive. The A-weighting filter is a broadband filter that covers the interval from 20 Hz to 20 kHz. The shape of the A-weighting curve approximates the frequency sensitivity of the human ear. So the A-weighted value of a noise source is an approximation to how the human ear perceives the noise. Written as dB(A) or dBA</p>
<i>Z-Weighting Network</i>	<p>Z for 'Zero' frequency weighting, which implies no frequency weighting. In reality the range is 10 Hz to 20 kHz \pm 1.5 dB.</p> <p>Introduced (IEC 61672 2003) to replace the Flat or Linear Filters. Written as dB(Z) or dBZ</p>
<i>Exponential Averaging</i>	<p>Generates a continuous running average where the most recently sampled levels have more influence on the average than older samples. This provides a convenient form to examine rapidly changing data with the benefit of some averaging to smooth the spectra.</p>
<i>Linear Averaging</i>	<p>The process of adding together a sequence of spectra measurements and then dividing the total by the number of samples. The result is a true arithmetic average on a sample-by-sample basis. Averaging smooths out random noise components in a spectrum.</p>
<i>Time Constants or Time Weightings</i>	<p>Time constants used for exponential averaging.</p> <p>Three-time constants can be used and are defined as:</p> <ul style="list-style-type: none">• Fast "F" time constant corresponds to 125 ms;• Slow "S" time constant corresponds to 1s; and• Impulse "I" time constant corresponding to 35 ms while the signal level is increasing and 1,500 ms while the signal level is decreasing.
<i>P(t) – "Sound Pressure"</i>	<p>The instantaneous difference between the actual pressure and the average barometric pressure at a given location.</p>

Sound Pressure Level (SPL)

A measurement of instantaneous sound pressure and equal to 20 times the logarithm (base 10) of the ratio of the instantaneous sound pressure of a sound divided by the reference sound pressure of 20 μ Pa (0 dB). Reported and measured in decibels (dB or dBA).

$L_{x\text{eq}}(T)$ – “Equivalent continuous sound level with a frequency weighting, x”

The equivalent continuous sound level (also called time-average sound level), $L_{x\text{eq}}(T)$, is defined as twenty times the logarithm to base ten of the ratio of a root-mean-square sound pressure during a time interval (T) to the reference sound pressure, sound pressure being obtained with a frequency weighting, x.

x can be replaced by:

- A for A-weighted;
 - B for B-weighted;
 - C for C-weighted; or
 - Z for Z-weighted.
-

$L_{xy\text{max}}(T)$ – “Maximum sound level, with a frequency weighting, x, and with a time-weighting, y”

The maximum time-weighted sound level, $L_{xy\text{max}}(T)$, is defined as the greatest time-weighted sound level, $L_{xy}(t)$, within a measurement interval (T).

x can be replaced by:

- A for A-weighted;
 - B for B-weighted;
 - C for C-weighted; or
 - Z for Z-weighted.
 - Y can be replaced by:
 - S for slow time weighting, or
 - F for fast time weighting.
-

$L_{xy\text{min}}(T)$ – “Minimum sound level, with a frequency weighting, x, and with a time-weighting, y”

The minimum time-weighted sound level, $L_{xy\text{min}}(T)$, is defined as the smallest time-weighted sound level, $L_{xy}(t)$, within a measurement interval (T).

x can be replaced by:

- A for A-weighted,
 - B for B-weighted,
 - C for C-weighted, or
 - Z for Z-weighted.
 - Y can be replaced by:
 - S for slow time weighting, or
 - F for fast time weighting.
-

L_{xyN} – “N th Exceedance level, with a frequency weighting, x, and with a time-weighting, y”	<p>Is the sound pressure level which is exceeded N percent of the measurement time. The sound pressure being obtained with a frequency weighting, x and a time-weighting, y.</p>
<p>where N is between 0.1 to 99.9</p>	<p>x can be replaced by:</p> <ul style="list-style-type: none"> • A for A-weighted; • B for B-weighted; • C for C-weighted; or • Z for Z-weighted. • Y can be replaced by: • S for slow time weighting, or • F for fast time weighting.
$L_{xpeak}(T)$ – “Peak sound level”	<p>The peak sound level, $L_{xpeak}(T)$, is defined as twenty times the logarithm to base ten of the ratio of the greatest absolute instantaneous sound pressure, $p_x(t)$, instantaneous sound pressure being obtained with a frequency weighting, x</p> <p>x can be replaced by:</p> <ul style="list-style-type: none"> • A for A-weighted; • B for B-weighted; • C for C-weighted; or • Z for Z-weighted.
<i>Octave Band</i>	<p>A band of frequencies where the upper limiting frequency (u.l.f.) is twice the lower limiting frequency (l.l.f.). <i>Octave bands are identified by their centre-frequencies. The octave bands standardized for acoustic measurements include those centered at 31.5, 63, 125, 250, 500, 1000, 2000, 4000, & 8000 Hz.</i></p>
<i>Velocity</i>	<p>Rate of change in position, measured in distance per unit of time. When measuring vibration signals, velocity represents the rate of change in displacement.</p> <p>Units: Millimetres per second [mm/s].</p>
<i>Peak Particle Velocity (PPV)</i>	<p>Highest particle velocity which is recorded during a particular vibration event.</p> <p>Unit: Millimetres per second [mm/s].</p>

Root Mean Square (RMS) Velocity

Square root of the average of the squared instantaneous vibration velocity (V) over a specified time interval or integration time (T) reported in millimeters per second (mm/s).

For the purposes of vibration monitoring the integration time (T) is one second.

Unit: Millimetres per second [mm/s].

1/N Octave Band

A band of frequencies integrally divided from an Octave Band. The u.l.f. equals $2^{1/N}$ times the l.l.f. *The most commonly used frequency band is the 1/3 octave band.*

Five-Number Summary

The five-number summary is a set of descriptive statistics that provide information about a dataset. It consists of the five most important sample percentiles:

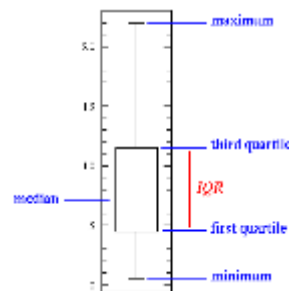
The sample minimum (smallest observation);

The lower quartile or first quartile;

The median (middle value);

The upper quartile or third quartile; and

The sample maximum (largest observation).

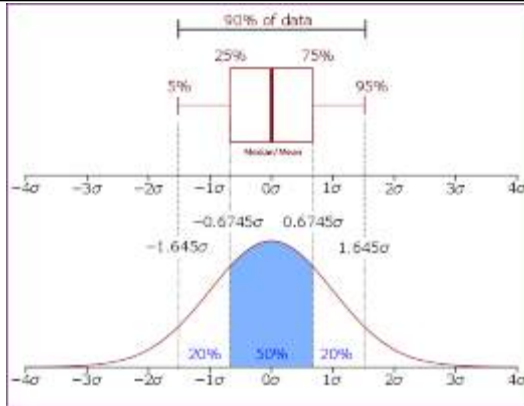


Box plot Representation or Box plot Graph

Box plot (also known as a box-and-whisker plot) is a type of graph that is designed specifically to show the distribution of a set of data based on a five-number summary.

The representation of the box plot and data varies depending on the used. Alternates of the Five-Number Summary are generally used.

Box plots are uniform in their use of the box: the bottom and top of the box are always the first and third quartiles, and the band inside the box is always the median, but the ends of the whiskers can represent several possible alternative values.



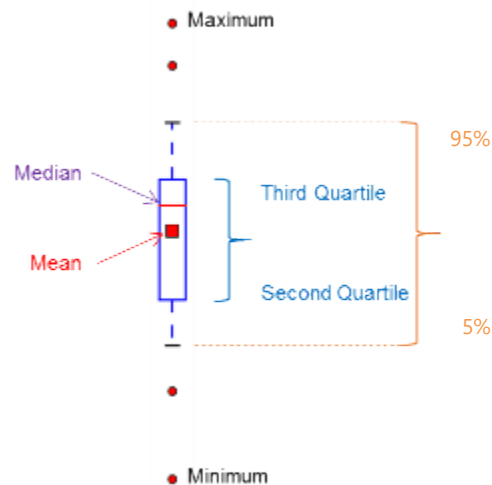
It should be noted that Box plots describe the sample and make no representation or assumptions regarding the population. Box plot data need not be normally distributed as represented in the figure above.

For the purpose of this report the type of representation chosen for the box plots represents a set of summary data that differs from the Five-Number Summary as follows:

The “whiskers” represent the 5 percentile and 95 percentile of the sample;

The red square indicated within the plot is the mean of the sample; and

The red dots represent any data points below or above the 5 and 95 percentiles respectively of the sample (including maximum and minimum of the sample).





Appendix B

Calibration Certificates

CERTIFICATE OF CALIBRATION

Certificate No: CAS-586242-K5B1W4-101

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3011887
Microphone:	Brüel & Kjær	4189	Serial No: 3130964
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 30310
Software version:	BZ7222 Version 4.7.6		

CLIENT: Xscala Rental Instruments Inc.
4819-3151 Lakeshore Blvd.
Kelowna, BC V1W 3S9 Canada

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.3 - DB: 8.30 Test Collection 2250-4189.

RESULTS:

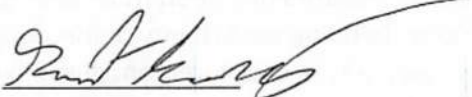
As Received Condition	As Received Data	Final Data
<input type="checkbox"/> Received in good condition	<input type="checkbox"/> Within acceptance criteria	<input checked="" type="checkbox"/> Within acceptance criteria
<input checked="" type="checkbox"/> Damaged - See Service report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input checked="" type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: 18 Jul. 2022

Certificate issued: 18 Jul. 2022

John Avitabile

Calibration Technician



Grant Kennedy
Quality Representative

The Hottinger Brüel & Kjær Calibration Laboratory
 3079 Premiere Parkway Suite 120
 Duluth, GA 30097
 Telephone: 770/209-6907
 Fax: 770/447-4033
 Web site address: <http://www.hbkworld.com>

CERTIFICATE OF CALIBRATION

Certificate No: CAS-557606-Q2R6C8-102

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3004496
Microphone:	Brüel & Kjær	4189	Serial No: 2888559
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 20253
Software version:	BZ7222 Version 4.7.6		

CLIENT: Xscala Rental Instruments Inc.
 4819-3151 Lakeshore Blvd.
 Kelowna, BC V1W 3S9 Canada

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
 Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.3 - DB: 8.30 Test Collection 2250-4189.

RESULTS:

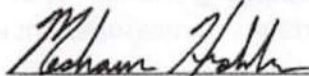
As Received Condition	As Received Data	Final Data
<input type="checkbox"/> Received in good condition	<input type="checkbox"/> Within acceptance criteria	<input checked="" type="checkbox"/> Within acceptance criteria
<input checked="" type="checkbox"/> Damaged - See Service report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input checked="" type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: 23 May, 2022

Certificate issued: 23 May, 2022

John Avitabile

Calibration Technician



Meshawn Hobbs
 Quality Representative

CERTIFICATE OF CALIBRATION

Certificate No: CAS-564551-F0Z8S6-103

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3004068
Microphone:	Brüel & Kjær	4189	Serial No: 2877087
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 19685
Software version:	BZ7222 Version 4.7.6		

CLIENT: Xscala Rental Instruments Inc.
 4819-3151 Lakeshore Blvd.
 Kelowna, BC V1W 3S9 Canada

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
 Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.3 - DB: 8.30 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
<input checked="" type="checkbox"/> Received in good condition	<input checked="" type="checkbox"/> Within acceptance criteria	<input checked="" type="checkbox"/> Within acceptance criteria
<input type="checkbox"/> Damaged - See attached report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: 18 Feb. 2022

Certificate issued: 18 Feb. 2022

John Avitabile

Calibration Technician



Kyle Chancey
 Quality Representative

Summary

Preliminary inspection	<u>Passed</u>
Environmental conditions, Prior to calibration	<u>Passed</u>
Reference information	<u>Passed</u>
Indication at the calibration check frequency	<u>Passed</u>
Acoustical signal tests of a frequency weighting, C weighting	<u>Passed</u>
Self-generated noise, Microphone installed	<u>Passed</u>
Self-generated noise, Electrical	<u>Passed</u>
Electrical signal tests of frequency weightings, A weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, C weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, Z weighting	<u>Passed</u>
Frequency and time weightings at 1 kHz	<u>Passed</u>
Long-term stability, Reference	<u>Passed</u>
Level linearity on the reference level range, Upper	<u>Passed</u>
Level linearity on the reference level range, Lower	<u>Passed</u>
Toneburst response, Time-weighting Fast	<u>Passed</u>
Toneburst response, Time-weighting Slow	<u>Passed</u>
Toneburst response, LAE	<u>Passed</u>
C-weighted peak sound level, 8 kHz	<u>Passed</u>
C-weighted peak sound level, 500 Hz	<u>Passed</u>
Overload indication	<u>Passed</u>
Long-term stability, 1. relative	<u>Passed</u>
High-level stability	<u>Passed</u>
Long-term stability, 2. relative	<u>Passed</u>
Environmental conditions, Following calibration	<u>Passed</u>

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

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 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 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 cover only a limited subset of the specifications in IEC 61672-1:2013.

Conformance to a performance specification is demonstrated when the following criteria are both satisfied: (a) a measured deviation from a design goal does not exceed the applicable acceptance limit and (b) the corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in IEC 61672-1:2013 for the same coverage probability of 95 %.



Calibration Certificate Number 1568.01

The Hottinger Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.hbkworld.com

CERTIFICATE OF CALIBRATION

Certificate No: CAS-564551-F0Z8S6-101

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3004786
Microphone:	Brüel & Kjær	4189	Serial No: 2888637
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 20299
Software version:	BZ7222 Version 4.7.6		

CLIENT: Xscala Rental Instruments Inc.
4819-3151 Lakeshore Blvd.
Kelowna, BC V1W 3S9 Canada

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.3 - DB: 8.30 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
<input checked="" type="checkbox"/> Received in good condition	<input checked="" type="checkbox"/> Within acceptance criteria	<input checked="" type="checkbox"/> Within acceptance criteria
<input type="checkbox"/> Damaged - See attached report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: 18 Feb. 2022

Certificate issued: 18 Feb. 2022

John Avitabile

Calibration Technician

Kyle Chancey
Quality Representative

Summary

Preliminary inspection	<u>Passed</u>
Environmental conditions, Prior to calibration	<u>Passed</u>
Reference information	<u>Passed</u>
Indication at the calibration check frequency	<u>Passed</u>
Acoustical signal tests of a frequency weighting, C weighting	<u>Passed</u>
Self-generated noise, Microphone installed	<u>Passed</u>
Self-generated noise, Electrical	<u>Passed</u>
Electrical signal tests of frequency weightings, A weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, C weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, Z weighting	<u>Passed</u>
Frequency and time weightings at 1 kHz	<u>Passed</u>
Long-term stability, Reference	<u>Passed</u>
Level linearity on the reference level range, Upper	<u>Passed</u>
Level linearity on the reference level range, Lower	<u>Passed</u>
Toneburst response, Time-weighting Fast	<u>Passed</u>
Toneburst response, Time-weighting Slow	<u>Passed</u>
Toneburst response, LAE	<u>Passed</u>
C-weighted peak sound level, 8 kHz	<u>Passed</u>
C-weighted peak sound level, 500 Hz	<u>Passed</u>
Overload indication	<u>Passed</u>
Long-term stability, 1. relative	<u>Passed</u>
High-level stability	<u>Passed</u>
Long-term stability, 2. relative	<u>Passed</u>
Environmental conditions, Following calibration	<u>Passed</u>

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

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 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 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 cover only a limited subset of the specifications in IEC 61672-1:2013.

Conformance to a performance specification is demonstrated when the following criteria are both satisfied: (a) a measured deviation from a design goal does not exceed the applicable acceptance limit and (b) the corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in IEC 61672-1:2013 for the same coverage probability of 95 %.

The Hottinger Brüel & Kjær Calibration Laboratory
 3079 Premiere Parkway Suite 120
 Duluth, GA 30097
 Telephone: 770/209-6907
 Fax: 770/447-4033
 Web site address: <http://www.hbkworld.com>

CERTIFICATE OF CALIBRATION

Certificate No: CAS-557606-Q2R6C8-101

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3023697
Microphone:	Brüel & Kjær	4189	Serial No: 3100315
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 26283
Software version:	BZ7130 Version 4.7.6		

CLIENT: Xscala Rental Instruments Inc.
 4819-3151 Lakeshore Blvd.
 Kelowna, BC V1W 3S9 Canada

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
 Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.3 - DB: 8.30 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
<input checked="" type="checkbox"/> Received in good condition	<input checked="" type="checkbox"/> Within acceptance criteria	<input checked="" type="checkbox"/> Within acceptance criteria
<input type="checkbox"/> Damaged - See attached report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: 24 Jan. 2022

Certificate issued: 25 Jan. 2022

John Avitabile

Calibration Technician



Kyle Chancey

Quality Representative

Summary

Preliminary inspection	<u>Passed</u>
Environmental conditions, Prior to calibration	<u>Passed</u>
Reference information	<u>Passed</u>
Indication at the calibration check frequency	<u>Passed</u>
Acoustical signal tests of a frequency weighting, C weighting	<u>Passed</u>
Self-generated noise, Microphone installed	<u>Passed</u>
Self-generated noise, Electrical	<u>Passed</u>
Electrical signal tests of frequency weightings, A weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, C weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, Z weighting	<u>Passed</u>
Frequency and time weightings at 1 kHz	<u>Passed</u>
Long-term stability, Reference	<u>Passed</u>
Level linearity on the reference level range, Upper	<u>Passed</u>
Level linearity on the reference level range, Lower	<u>Passed</u>
Toneburst response, Time-weighting Fast	<u>Passed</u>
Toneburst response, Time-weighting Slow	<u>Passed</u>
Toneburst response, LAE	<u>Passed</u>
C-weighted peak sound level, 8 kHz	<u>Passed</u>
C-weighted peak sound level, 500 Hz	<u>Passed</u>
Overload indication	<u>Passed</u>
Long-term stability, 1. relative	<u>Passed</u>
High-level stability	<u>Passed</u>
Long-term stability, 2. relative	<u>Passed</u>
Environmental conditions, Following calibration	<u>Passed</u>

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

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 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 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 cover only a limited subset of the specifications in IEC 61672-1:2013.

Conformance to a performance specification is demonstrated when the following criteria are both satisfied: (a) a measured deviation from a design goal does not exceed the applicable acceptance limit and (b) the corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in IEC 61672-1:2013 for the same coverage probability of 95 %.

CERTIFICATE OF CALIBRATION

No.: CAS-585359-K6R2G7-401

Type: 4231

Serial No.: 3022638

Page 2 of 2

Sound Pressure Levels

All stated values are valid at environmental reference conditions

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94	93.80	94.20	94.03	0.11
114	113.80	114.20	114.03	0.11

Frequency

Nominal Frequency [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	985.00	1015.00	1000.02	0.10

Total Distortion*

Distortion mode: TD* THD*

Calibration Level [dB]*	Accept Limit [%]*	Measured Distortion [%]*	Measurement Uncertainty [%]*
94	1.00	0.41	0.13
114	1.00	0.16	0.13

Environmental Reference Conditions:

Pressure: 101.3 kPa, Temperature: 23 °C, Relative Humidity: 50%

Instrument List

Type	Description	Serial no	Cal. date	Due date	Calibrated by	Trace number
3560	PULSE Analyzer	2723320	2021-10-18	2022-10-31	KC	CAS-541708-J2Z8Q8-301
9545	Transfer Microphone	3	2021-10-27	2022-10-31	MH	CAS-541708-J2Z8Q8-403
4228	Reference Sound Source	2905896	2021-04-30	2023-04-30	MH	CAS-512601-T0X4B1-404

During the calibration the calibrator has been loaded by the load volume of the Transfer Microphone. The load volumes for a number of different types of Transfer Microphones are listed in the table below.

For Brüel & Kjaer Pistonphones types 4220 and 4228 the result of the SPL calibration has been corrected to be valid for a load volume of 1333 mm³. For all other types the result is valid with the actual load volume.

Transfer Microphone Type	Fulfils standard IEC 61094-1 LS	Fulfils standard IEC 61094-4 WS	Load Volume 1" (1/2" mic including DP-0776)	Load Volume 1/2"
4180	yes	yes	1126 mm ³	43 mm ³
4192	-	yes	1273 mm ³	190 mm ³
9545	-	-	1333 mm ³	-

Condition "As Received":

Comments

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: 393B04

Serial Number: 53563

Description: ICP® Accelerometer

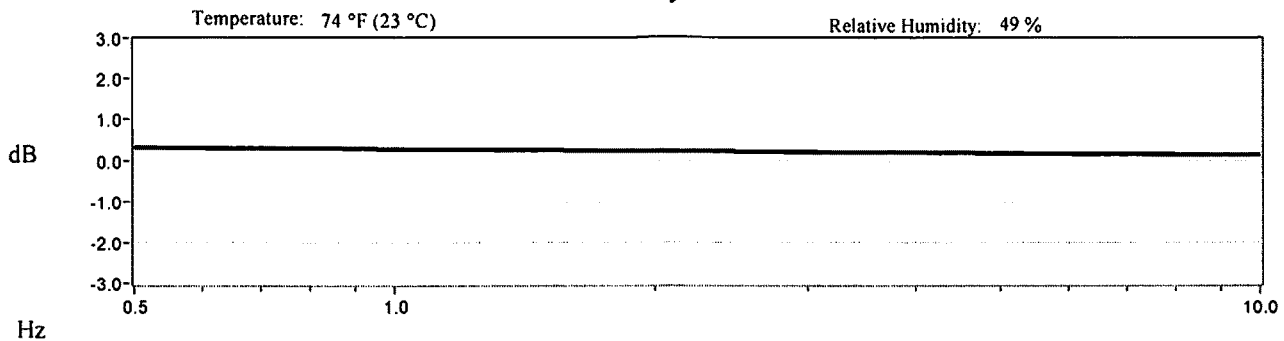
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz 998 mV/g
(101.8 mV/m/s²)

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
0.5	3.8	10	1.6
1	3.3		
2	2.8		
5	2.1		
7	1.9		

Mounting Surface: Stainless Steel w/Silicone Grease Fastener: 10-32 Female Fixture Orientation: Vertical

Acceleration Level (pk): 1.00 g (9.81 m/s²)

*The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.207 x (freq)². *The gravitational constant used for calculations by the calibration system is: 1 g = 9.80665 m/s².

Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

Notes

1. Calibration is traceable to one or more of the following; PTB 10065, PTB 10066 and NIST 683/283498.
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 Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 0.5-0.99 Hz; +/- 1.8%, 1-30 Hz; +/- 1.0%, 30.01-199 Hz; +/- 1.5%, 200-1 kHz; +/- 3.0%.

Technician: Donald Whalen

Date: 10/23/2018



CALIBRATION CERT #1862.02

PCB PIEZOTRONICS™
VIBRATION DIVISION

Headquarters: 3425 Walden Avenue, Depew, NY 14043

Calibration Performed at: 10869 Highway 903, Halifax, NC 27839

TEL: 888-684-0013

FAX: 716-685-3886

www.pcb.com

CAL57-3623145632.570*0





Appendix C
Sound Monitoring Results

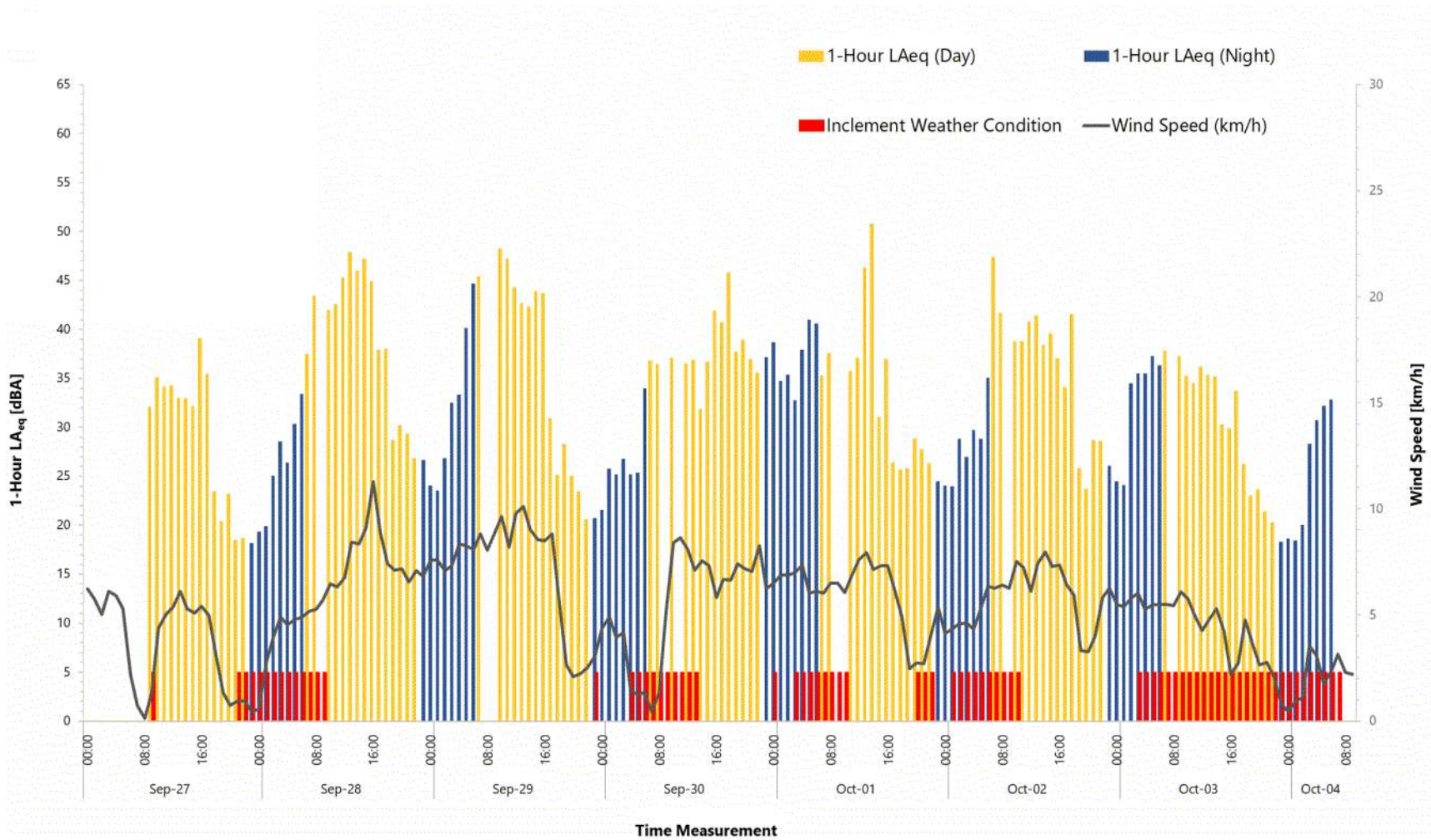


Figure C-1: Sound Levels at R1 (1-hour L_{Aeq})

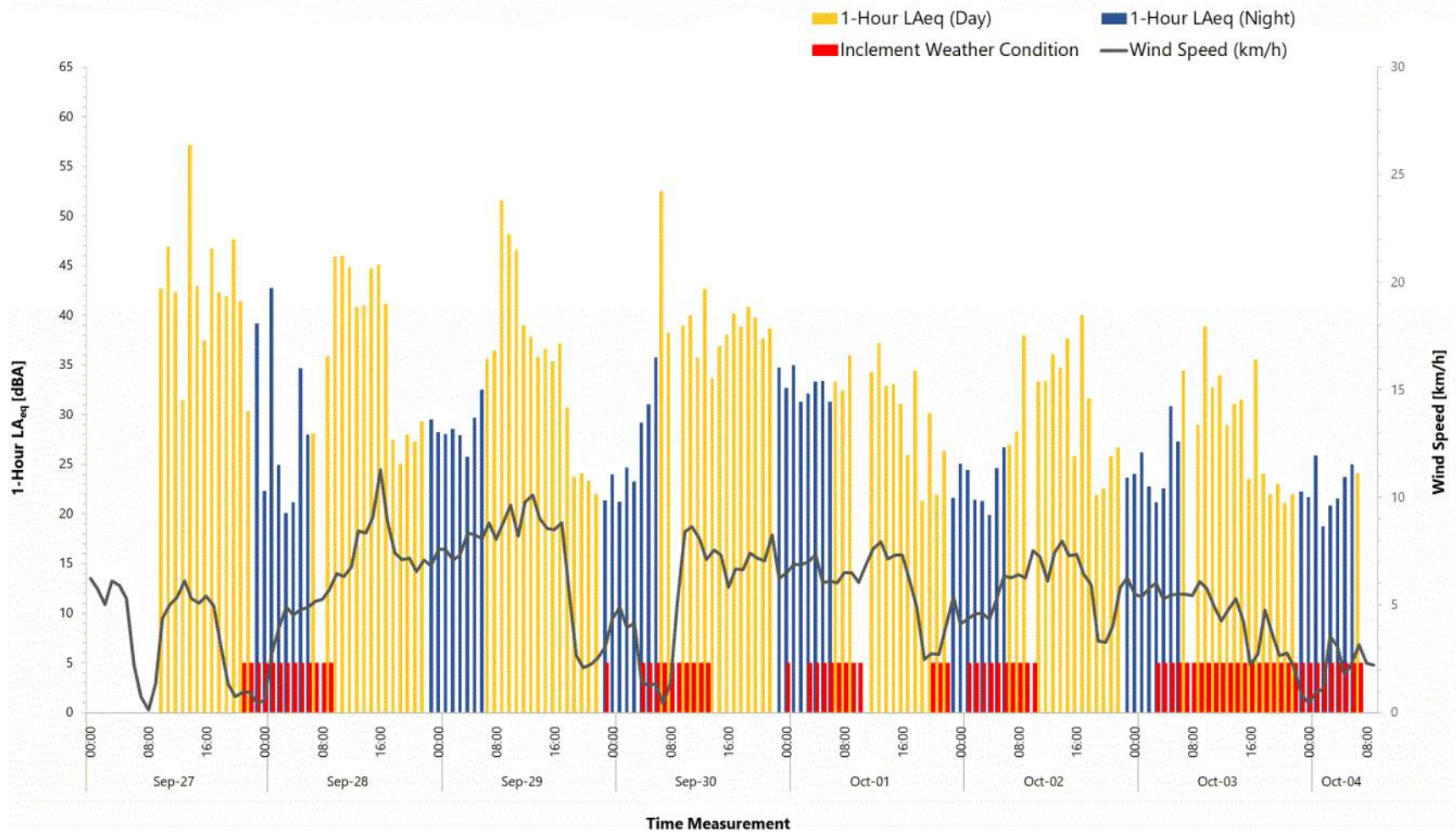


Figure C-2: Sound Levels at R2 (1-hour LAeq)

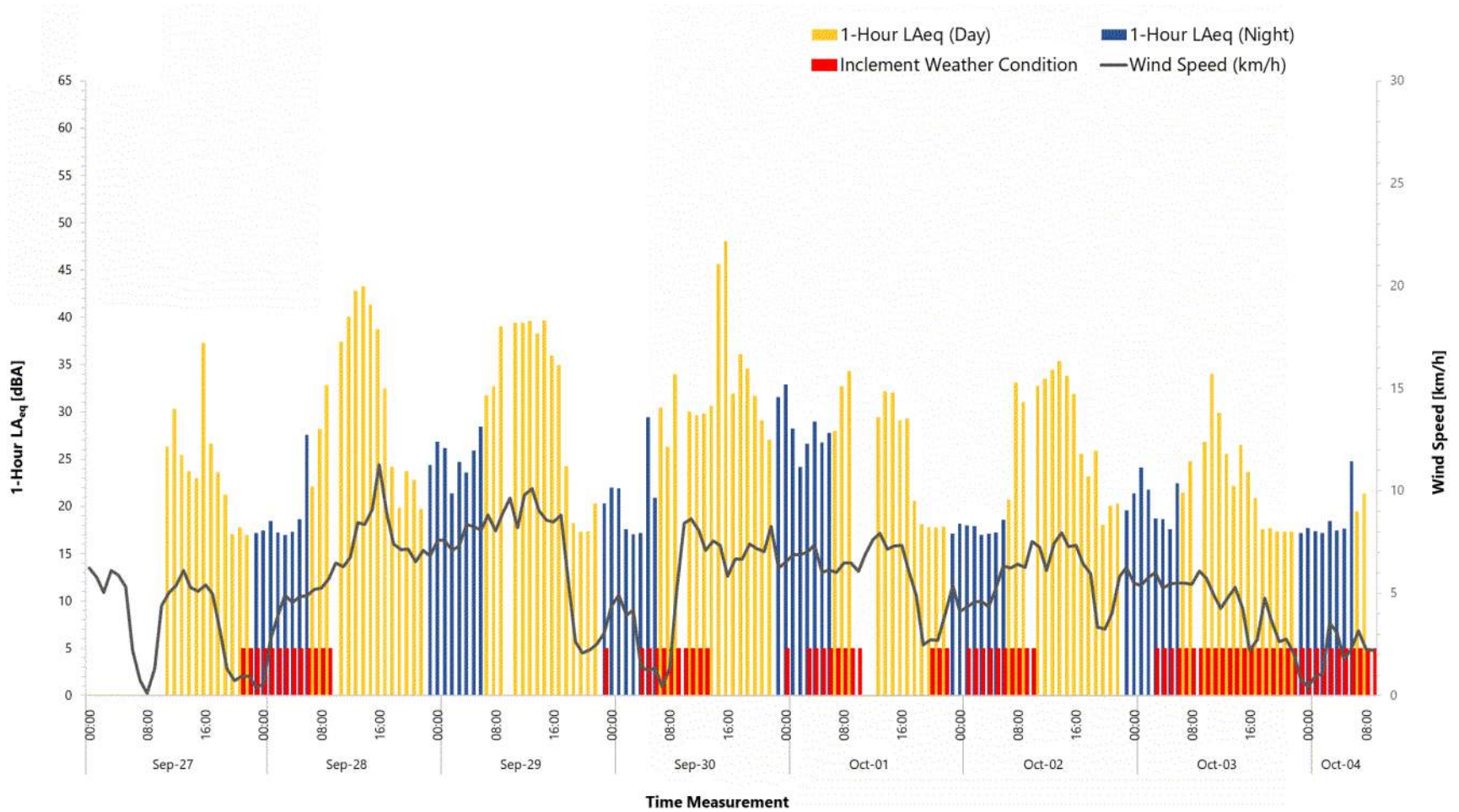


Figure C-3: Sound Levels at R3 (1-hour L_{Aeq})

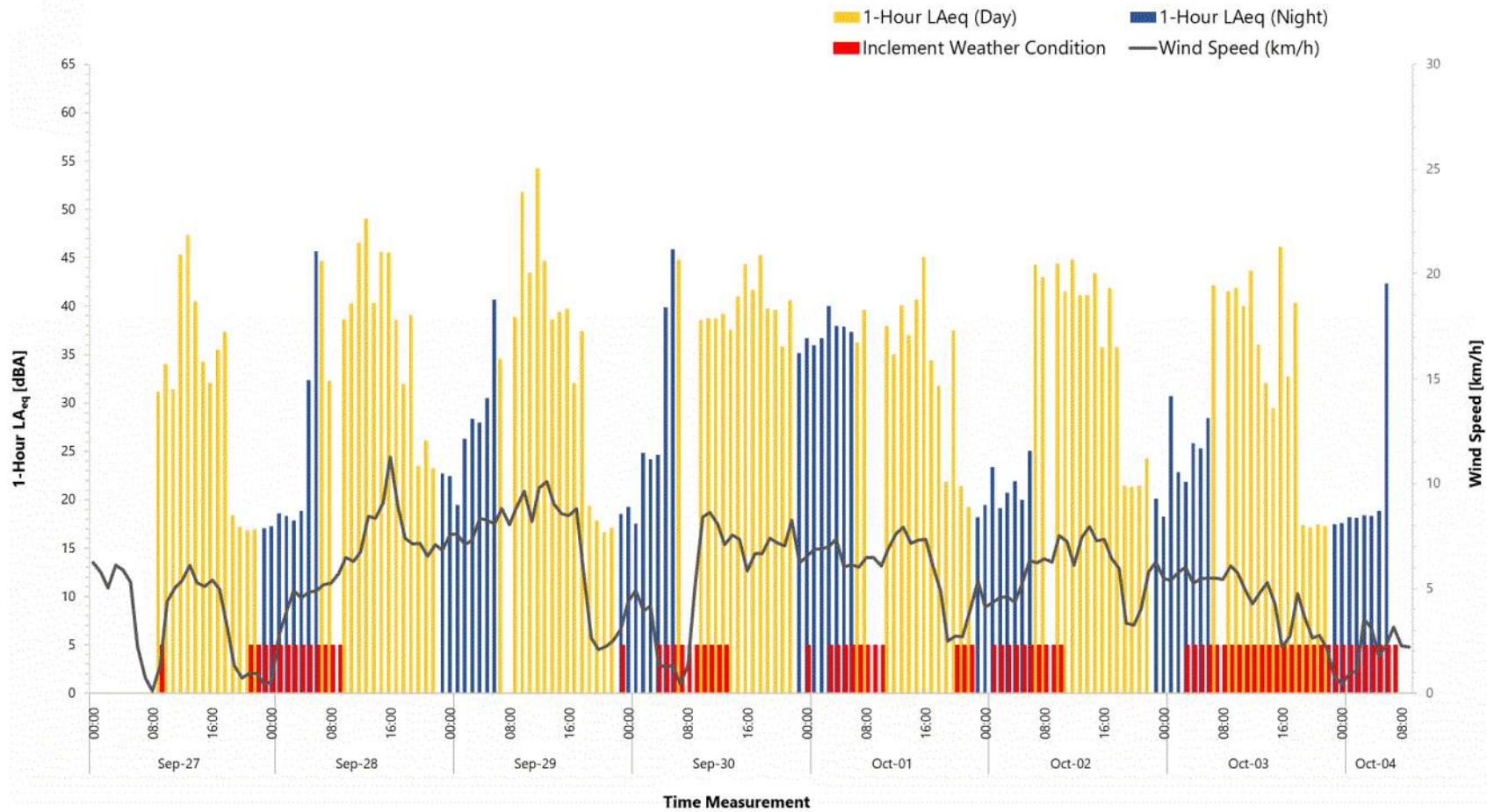


Figure C-4: Sound Levels at R4 (1-hour LAeq)



Appendix D
Vibration Monitoring Results

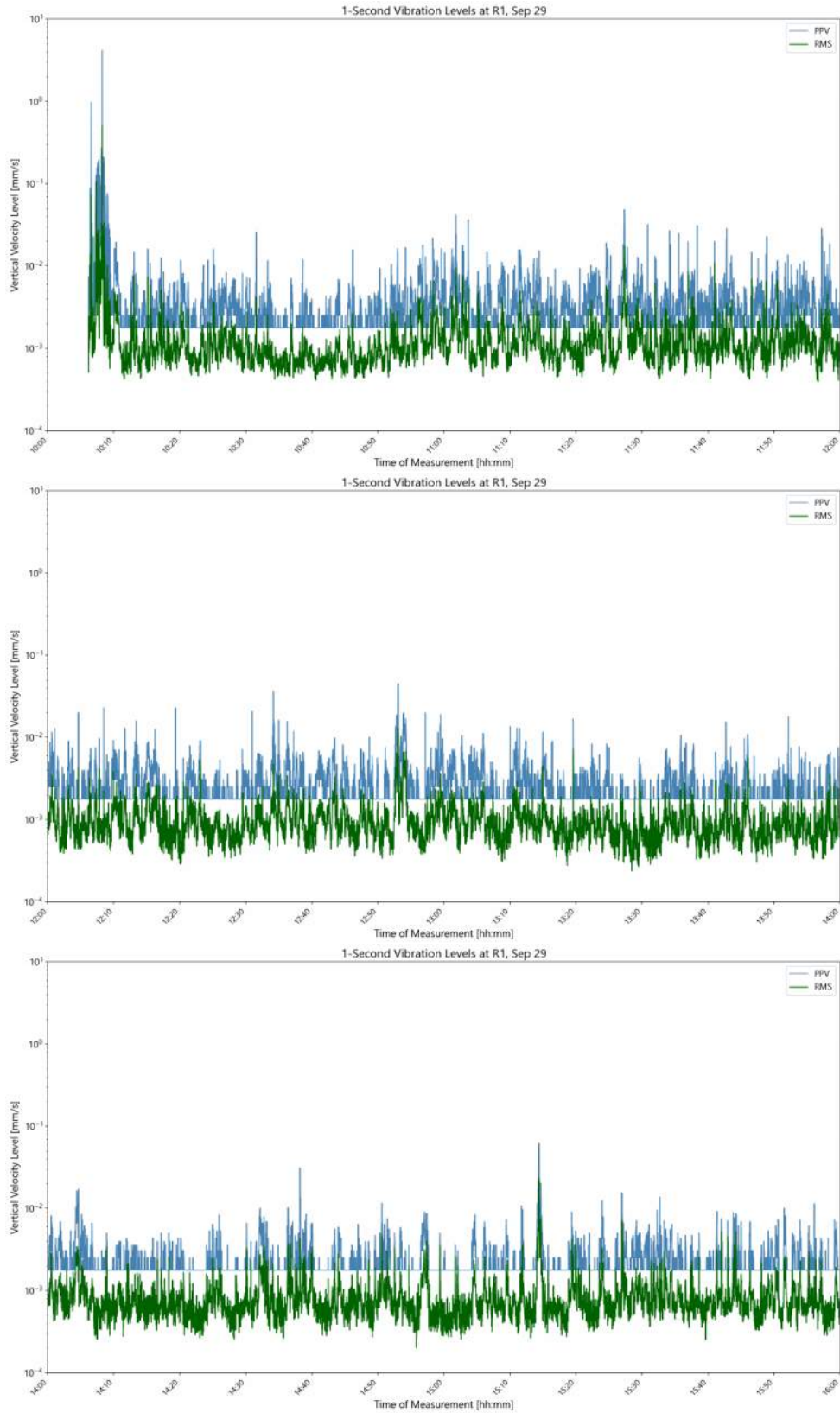


Figure D-1: R1 1-Second Velocity History

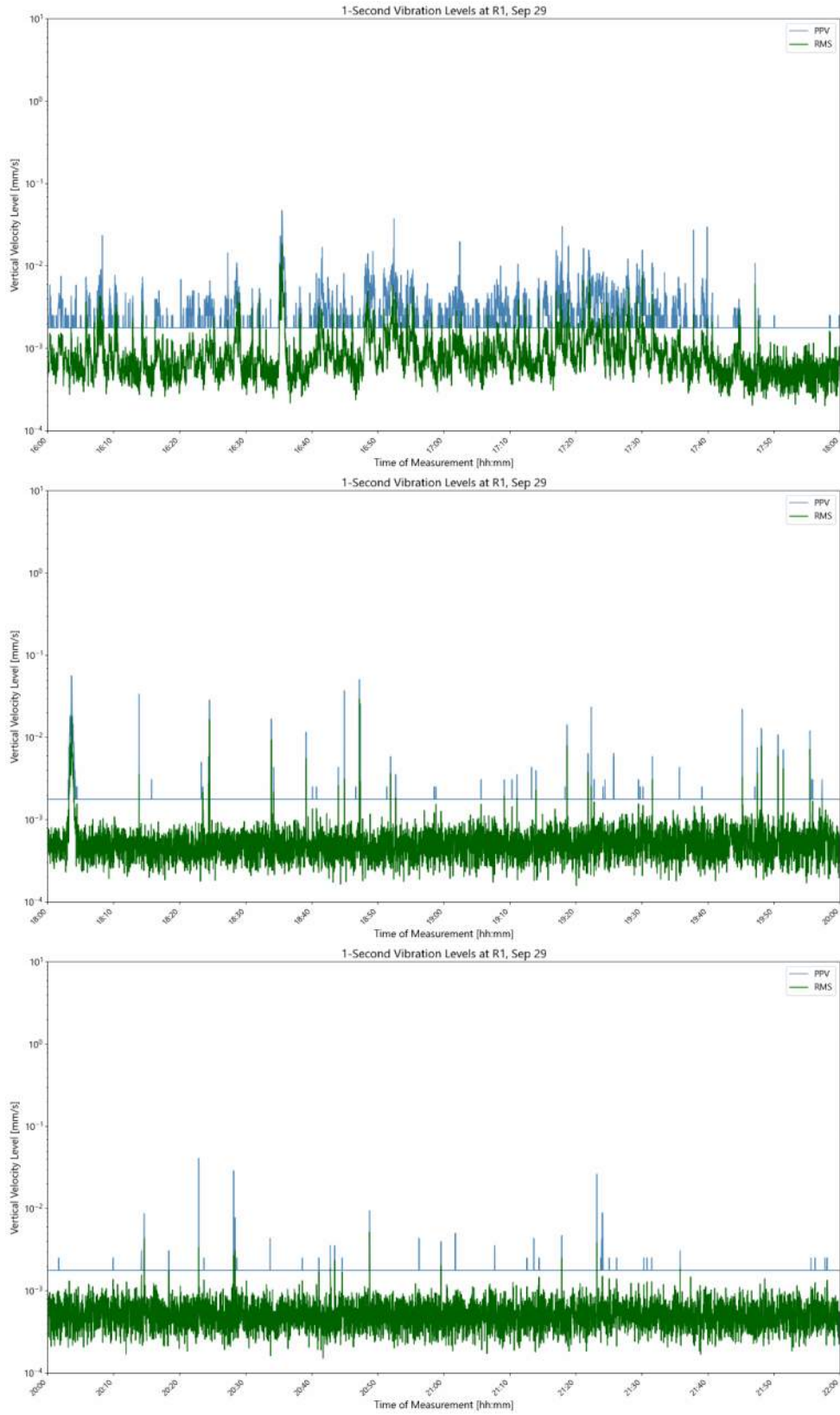


Figure D-2: R1 1-Second Velocity History

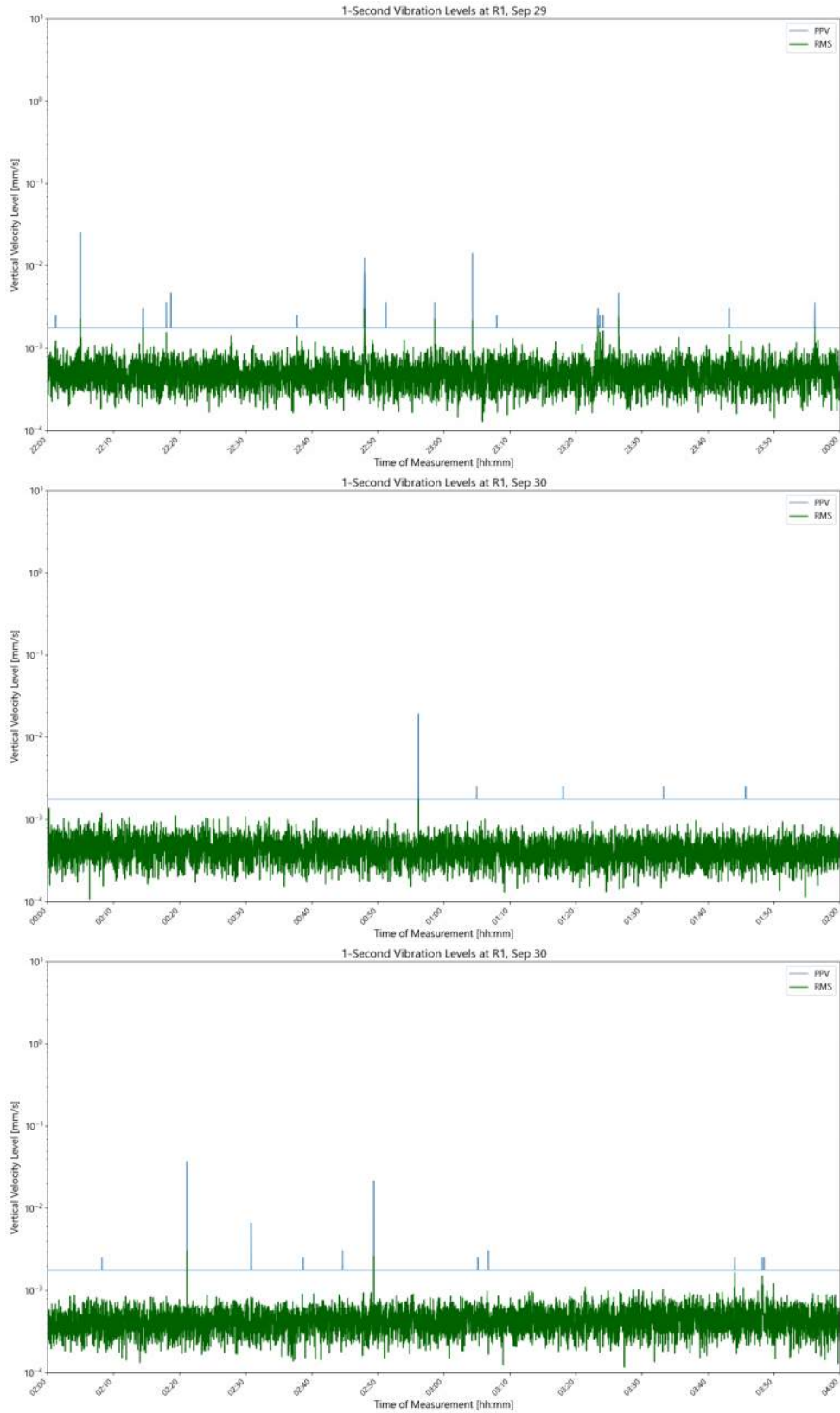


Figure D-3: R1 1-Second Velocity History

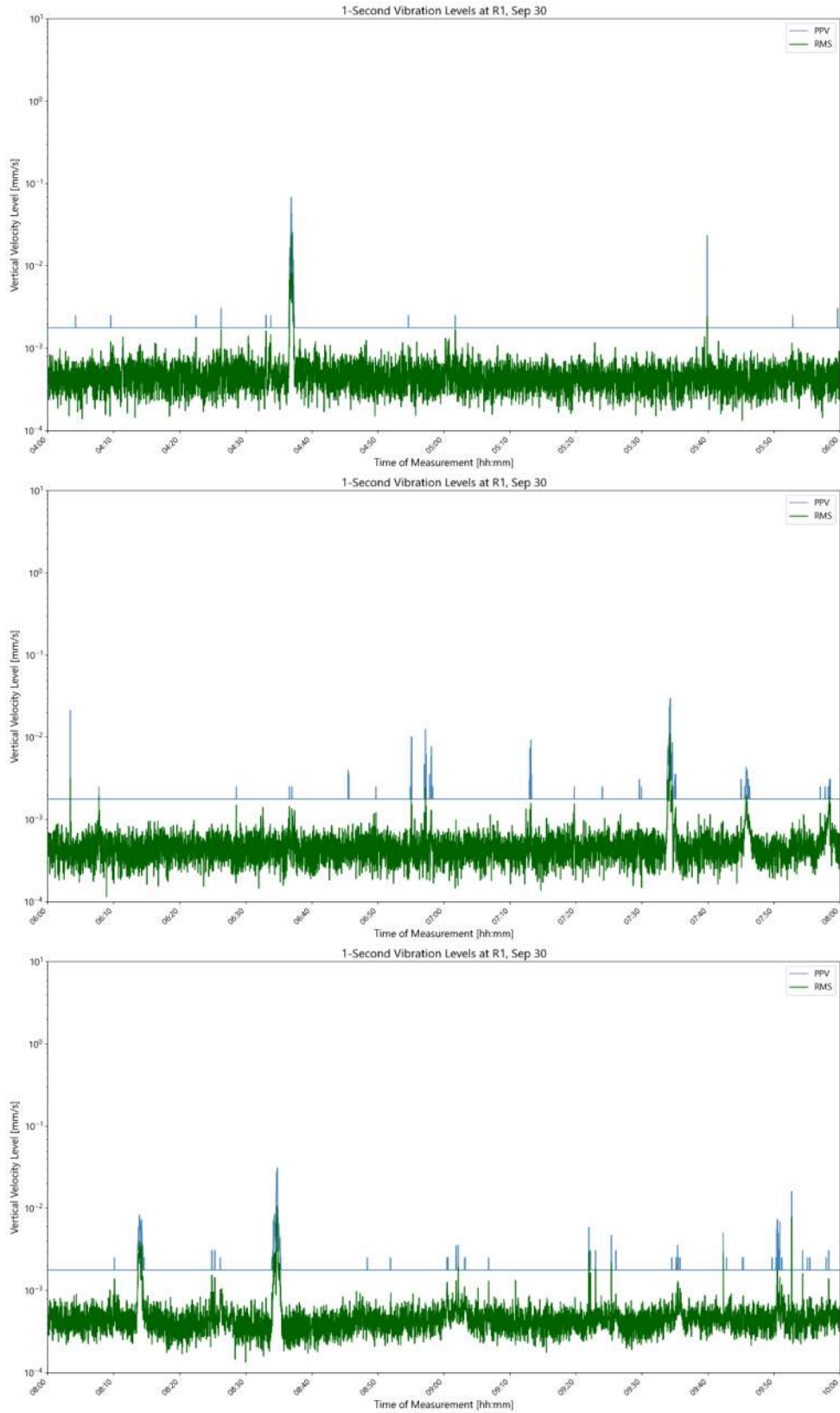


Figure D-4: R1 1-Second Velocity History

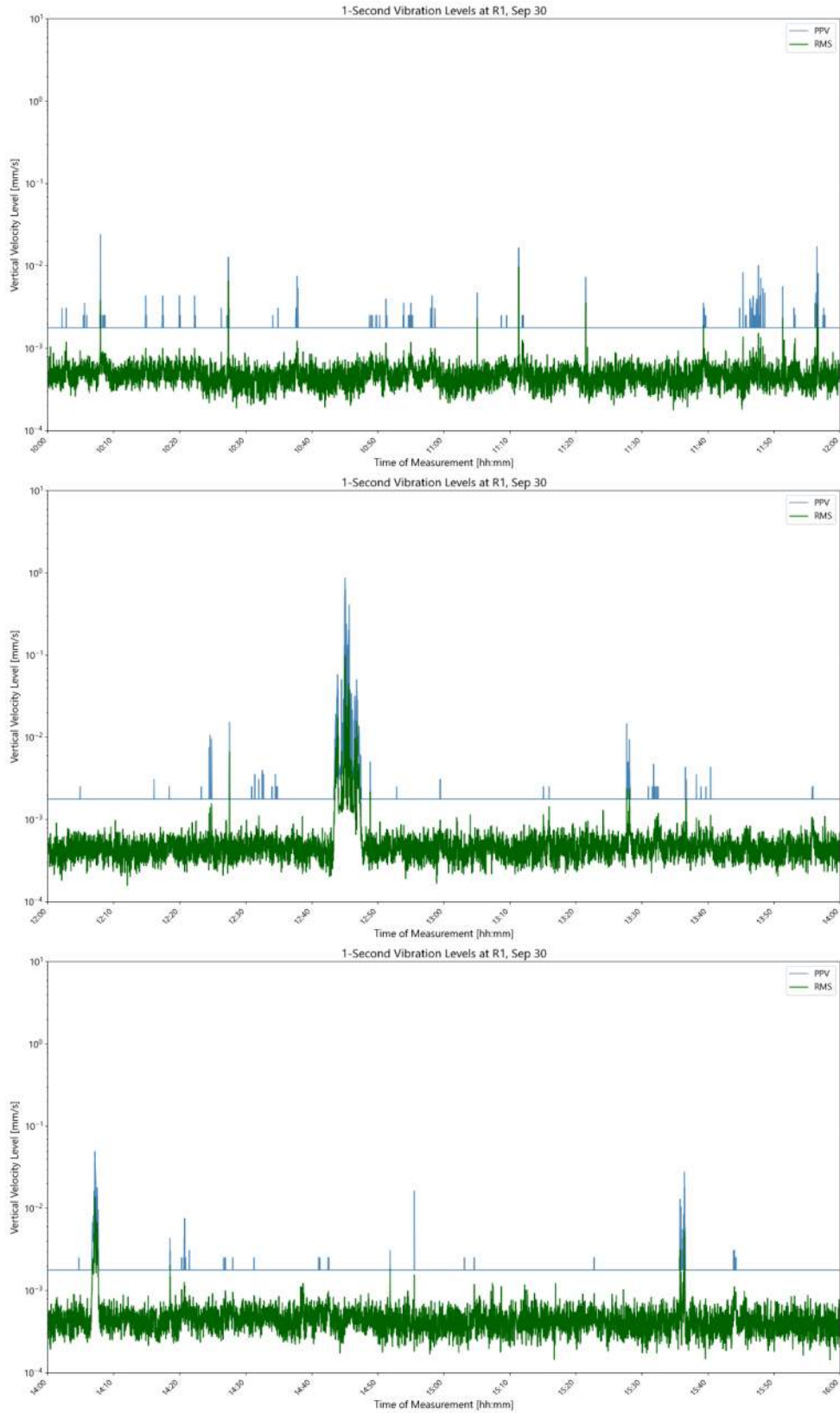


Figure D-5: R1 1-Second Velocity History

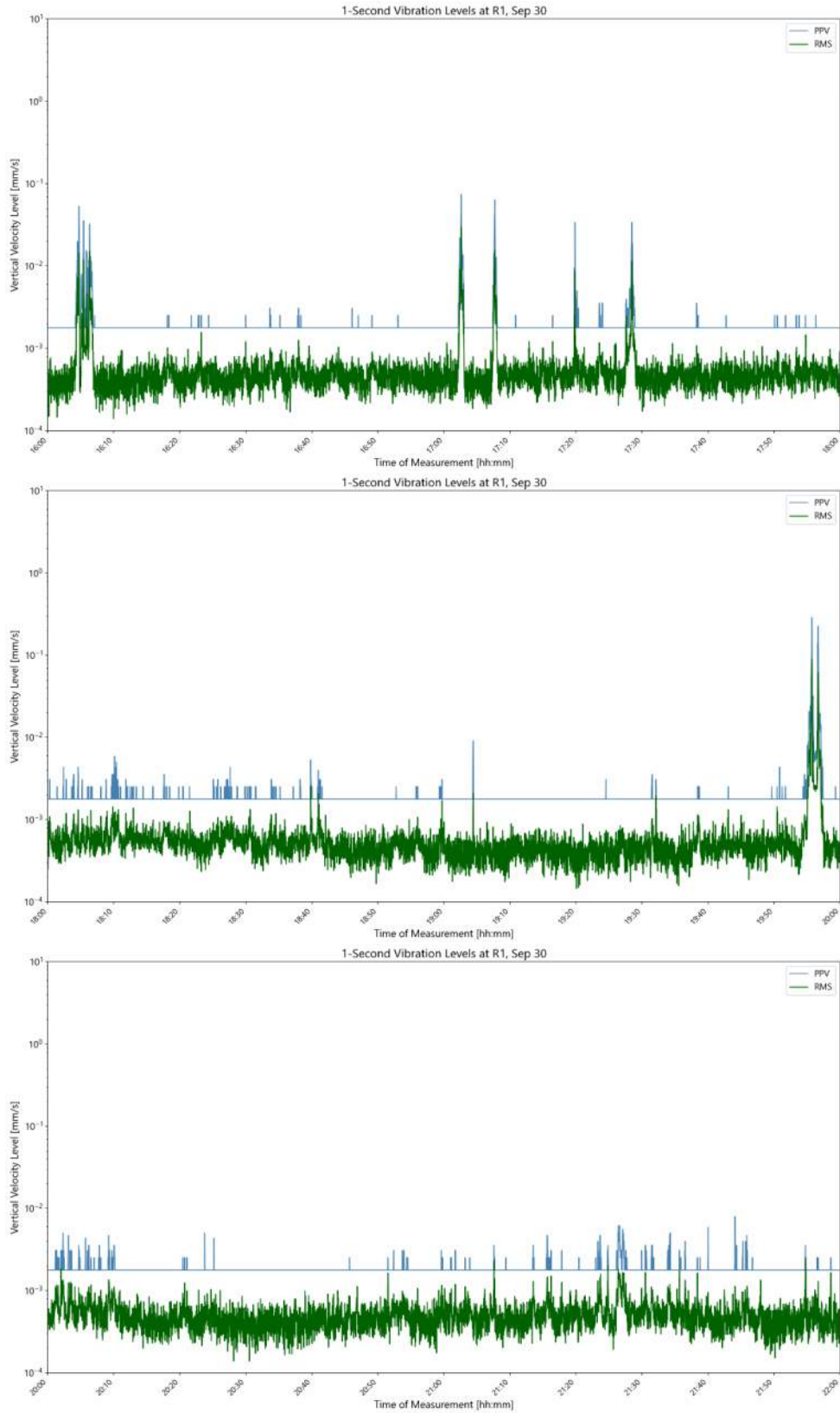


Figure D-6: R1 1-Second Velocity History

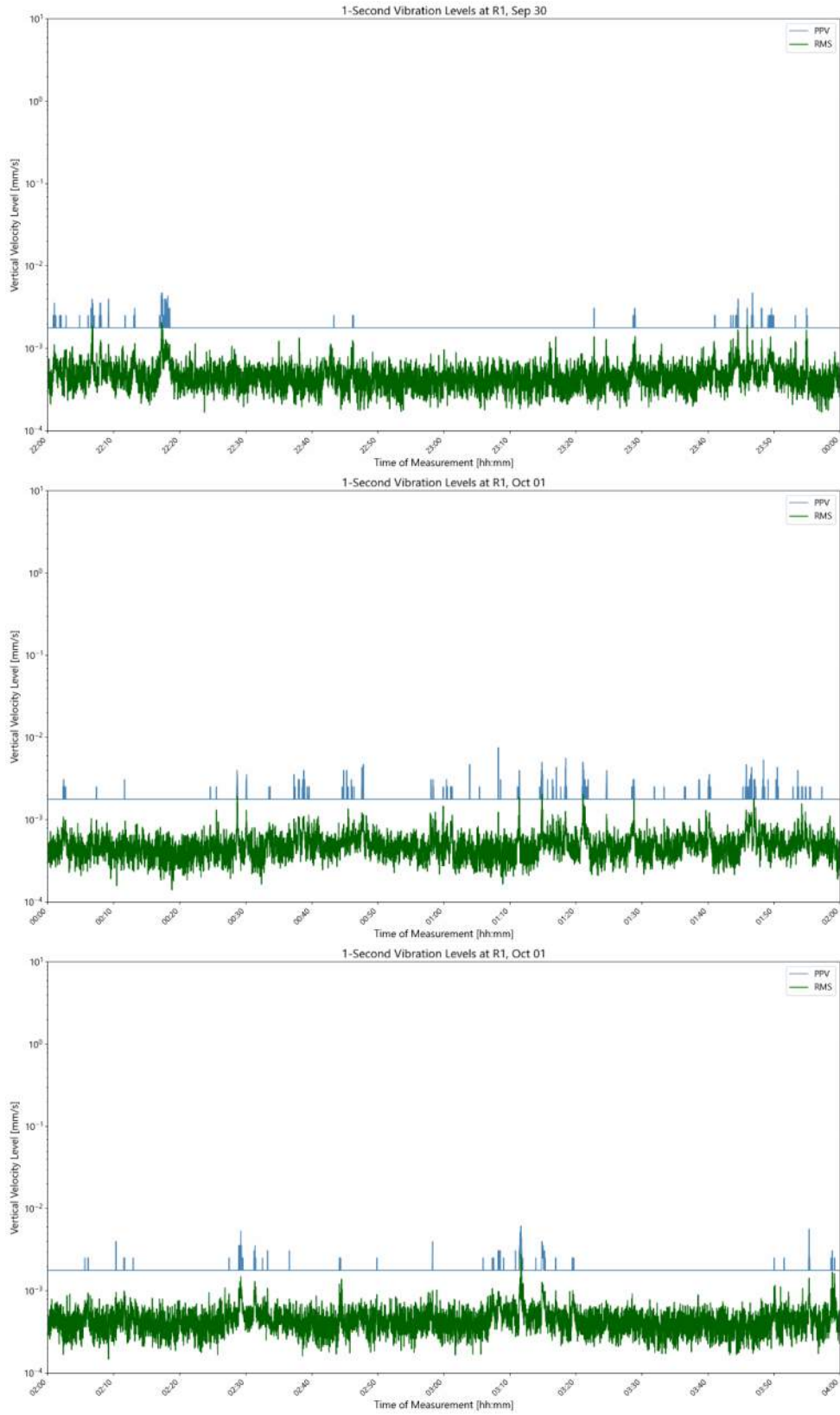


Figure D-7: R1 1-Second Velocity History

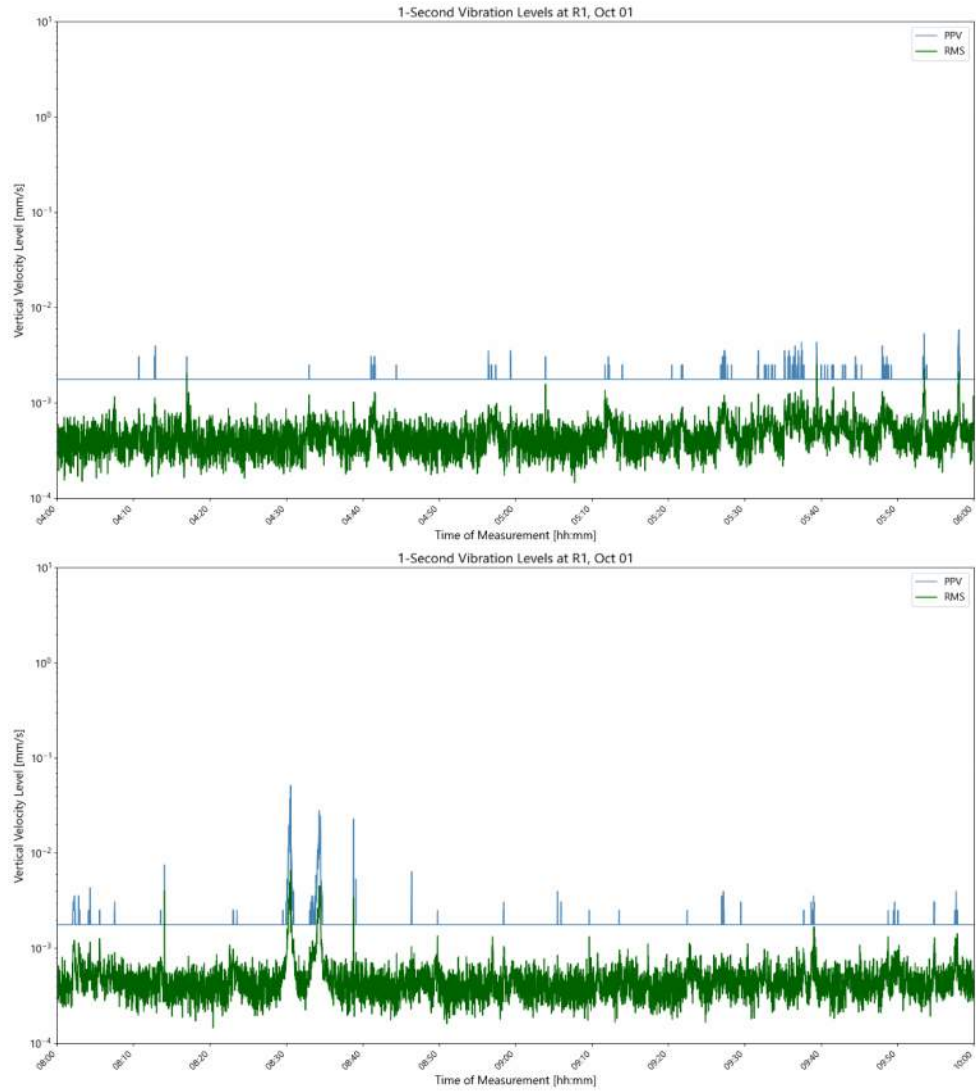


Figure D-8: R1 1-Second Velocity History

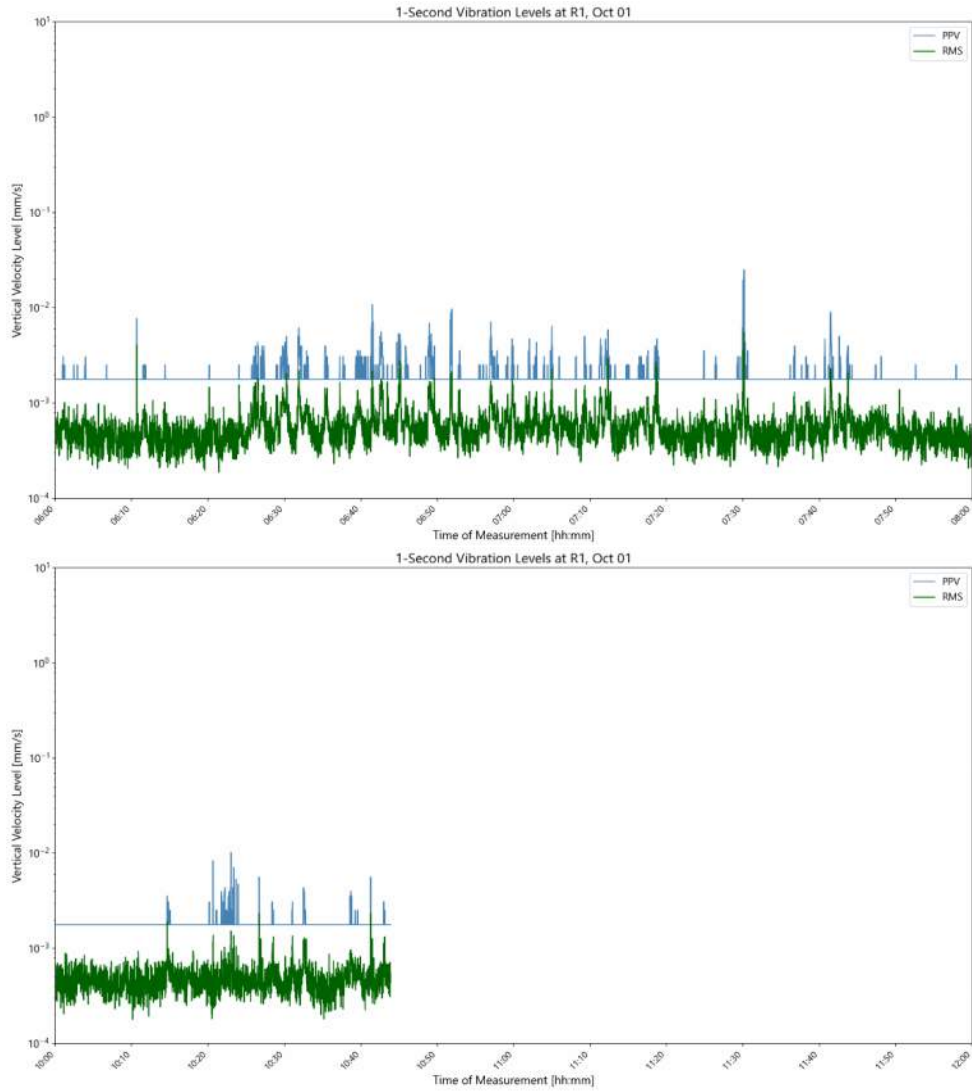


Figure D-9: R1 1-Second Velocity History

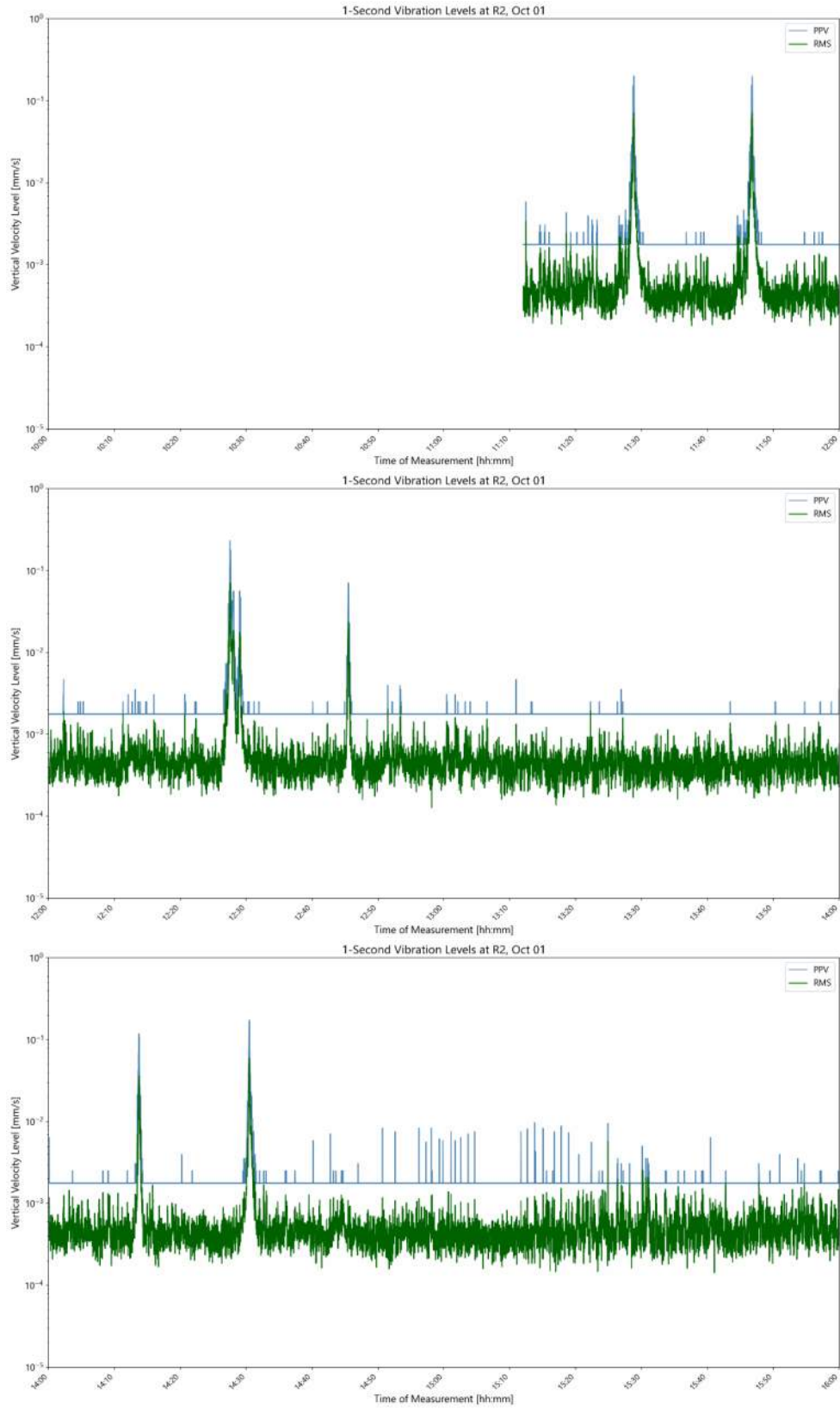


Figure D-10: R2 1-Second Velocity History

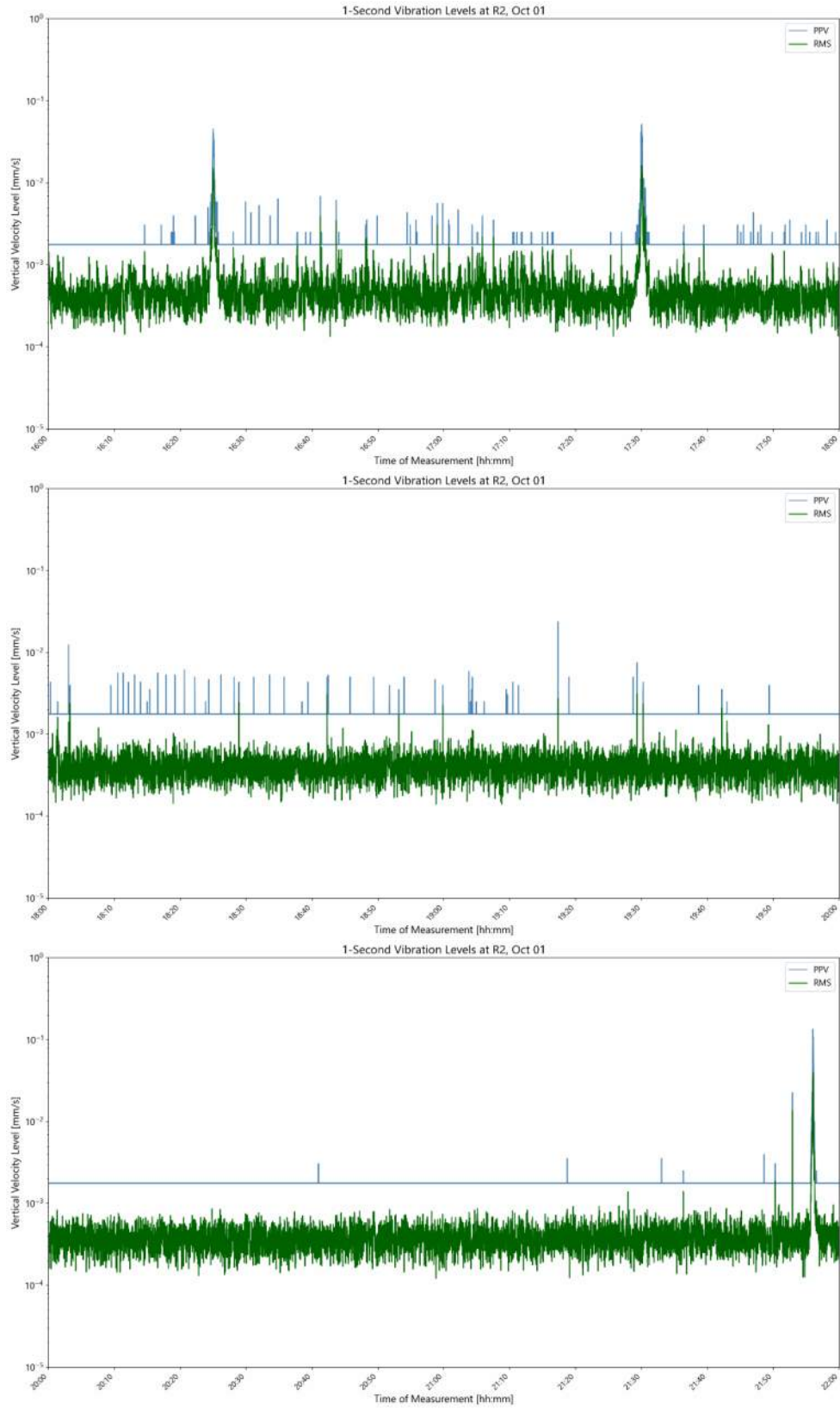


Figure D-11: R2 1-Second Velocity History

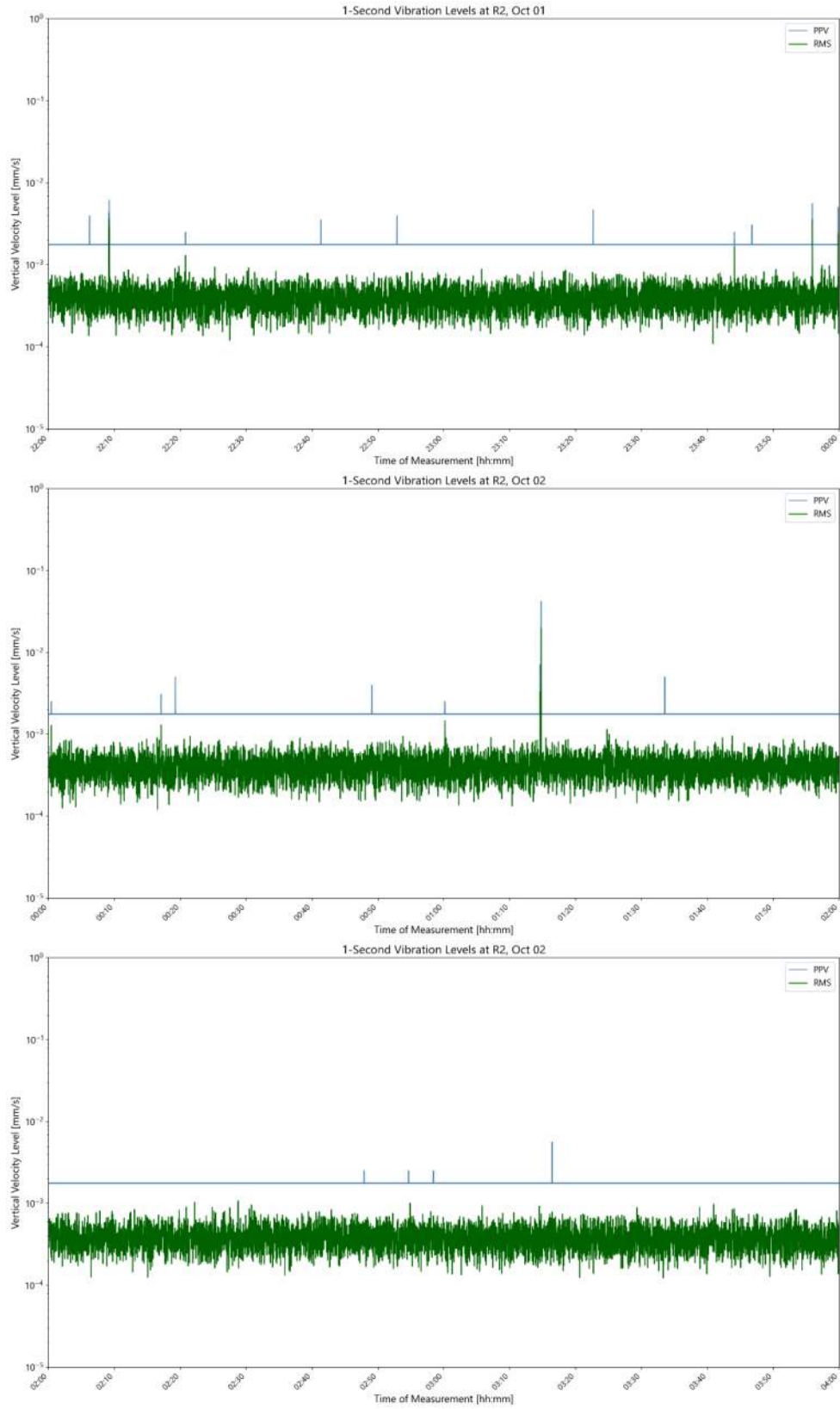


Figure D-12: R2 1-Second Velocity History

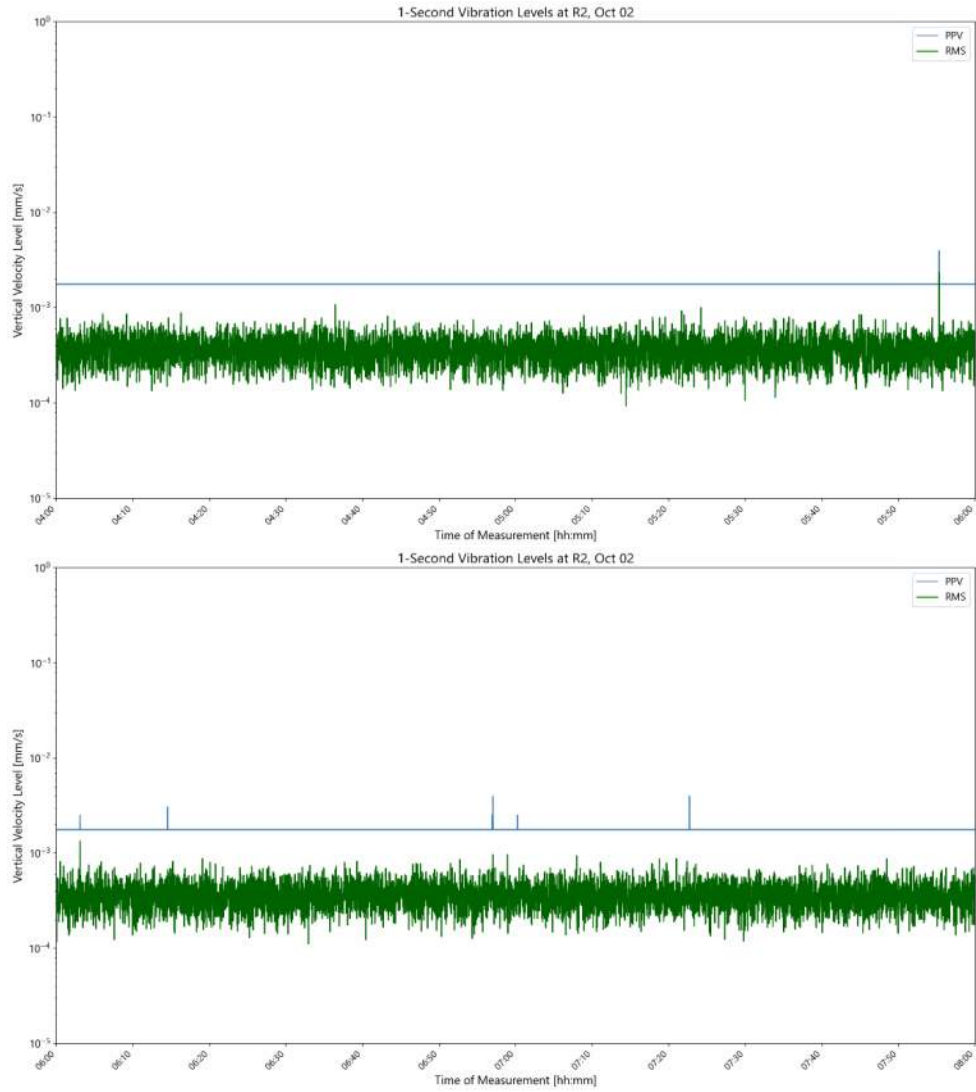


Figure D-13: R2 1-Second Velocity History

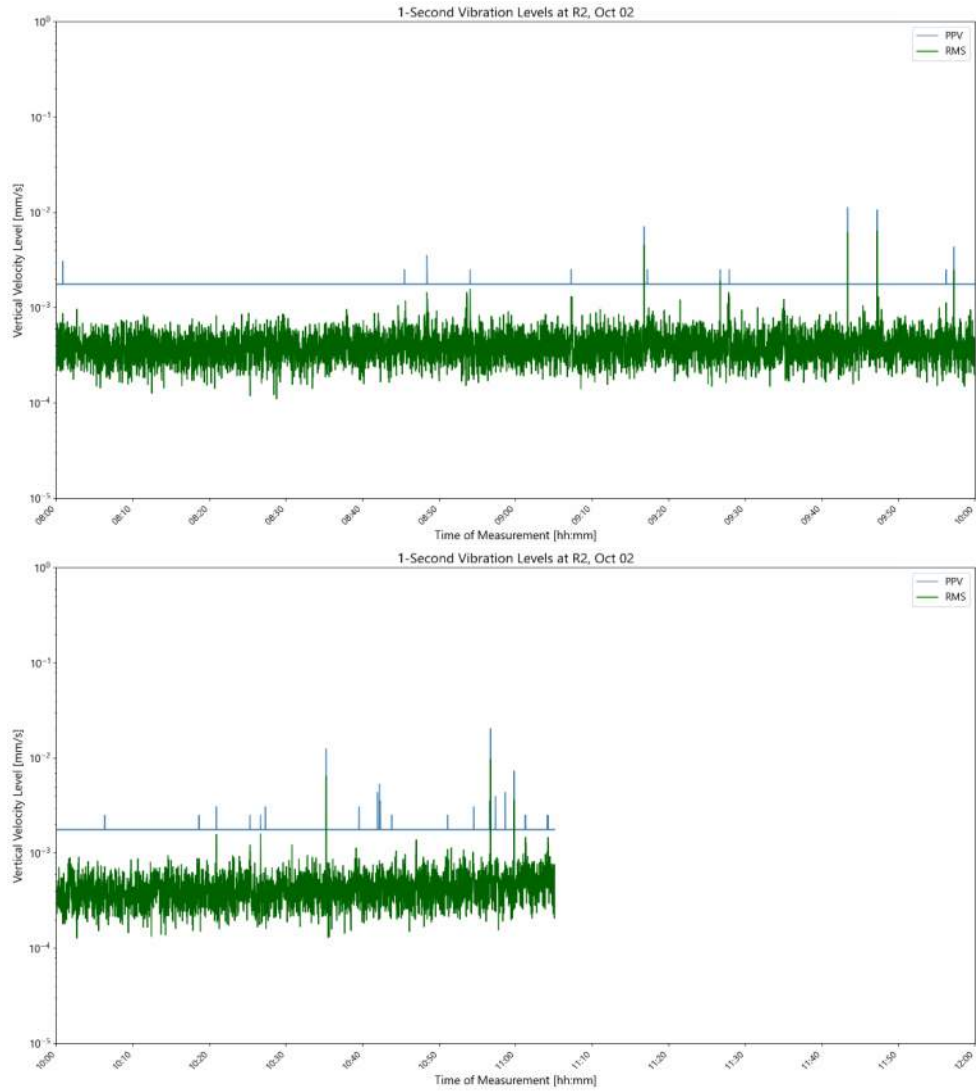


Figure D-14: R2 1-Second Velocity History

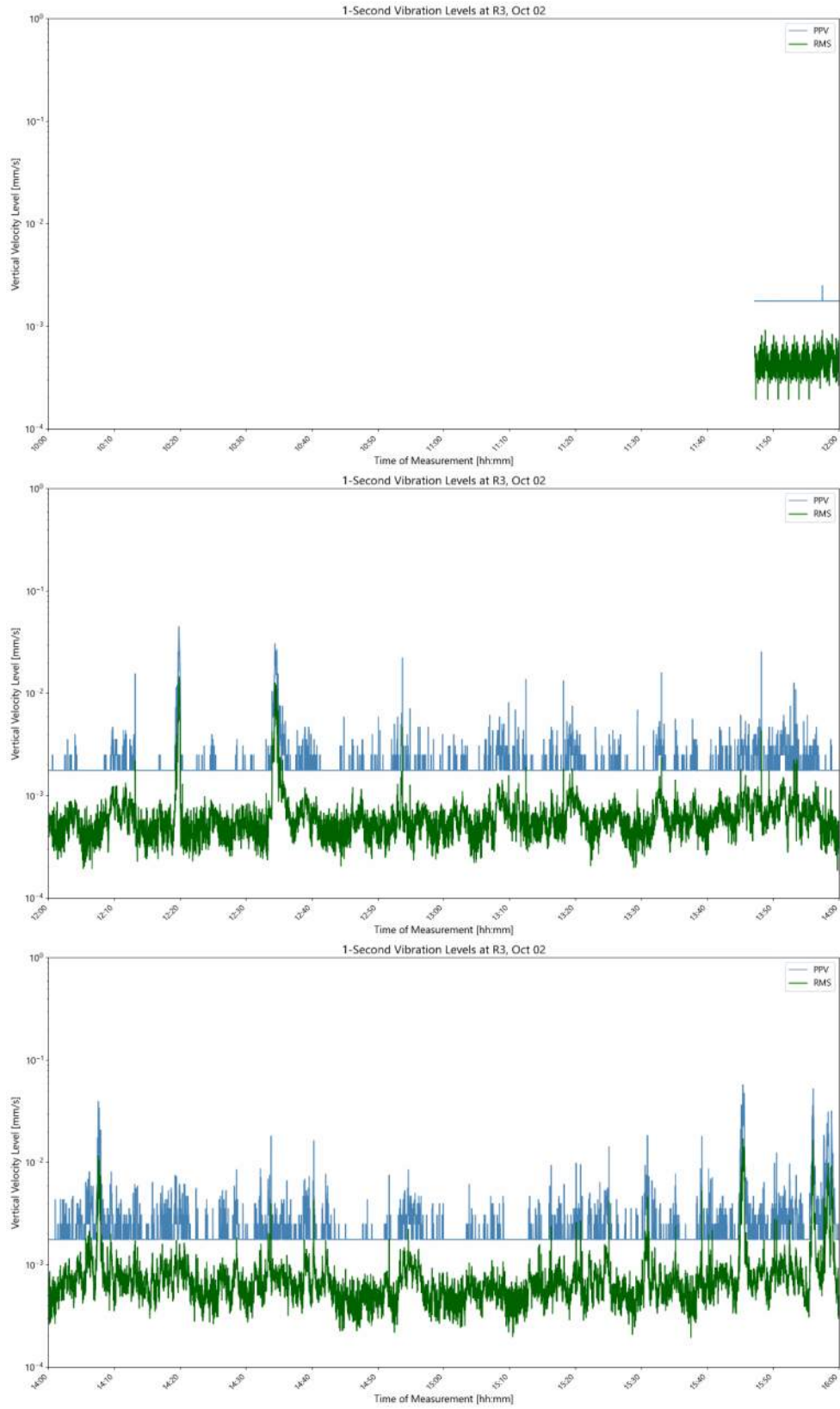


Figure D-15: R3 1-Second Velocity History

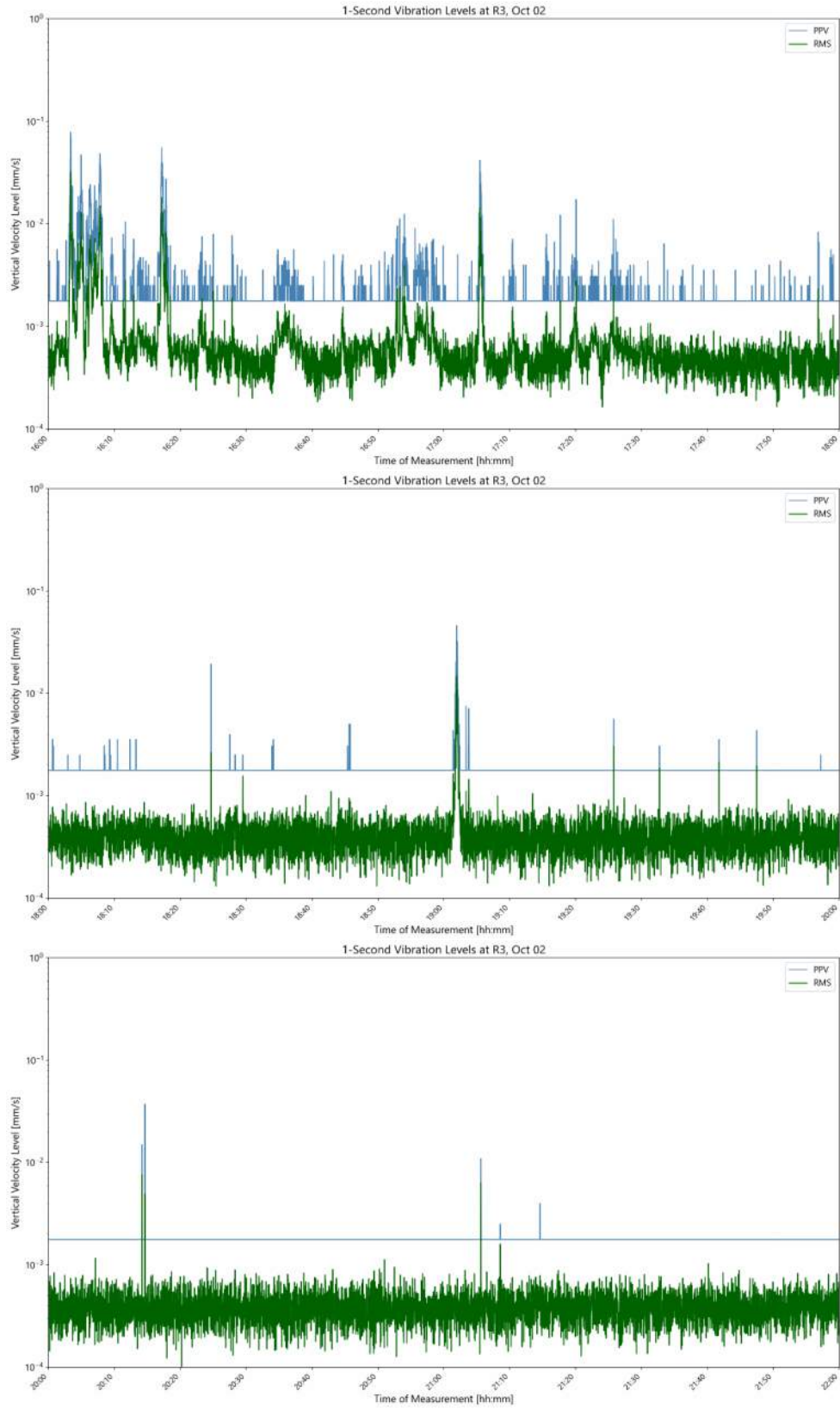


Figure D-16: R3 1-Second Velocity History

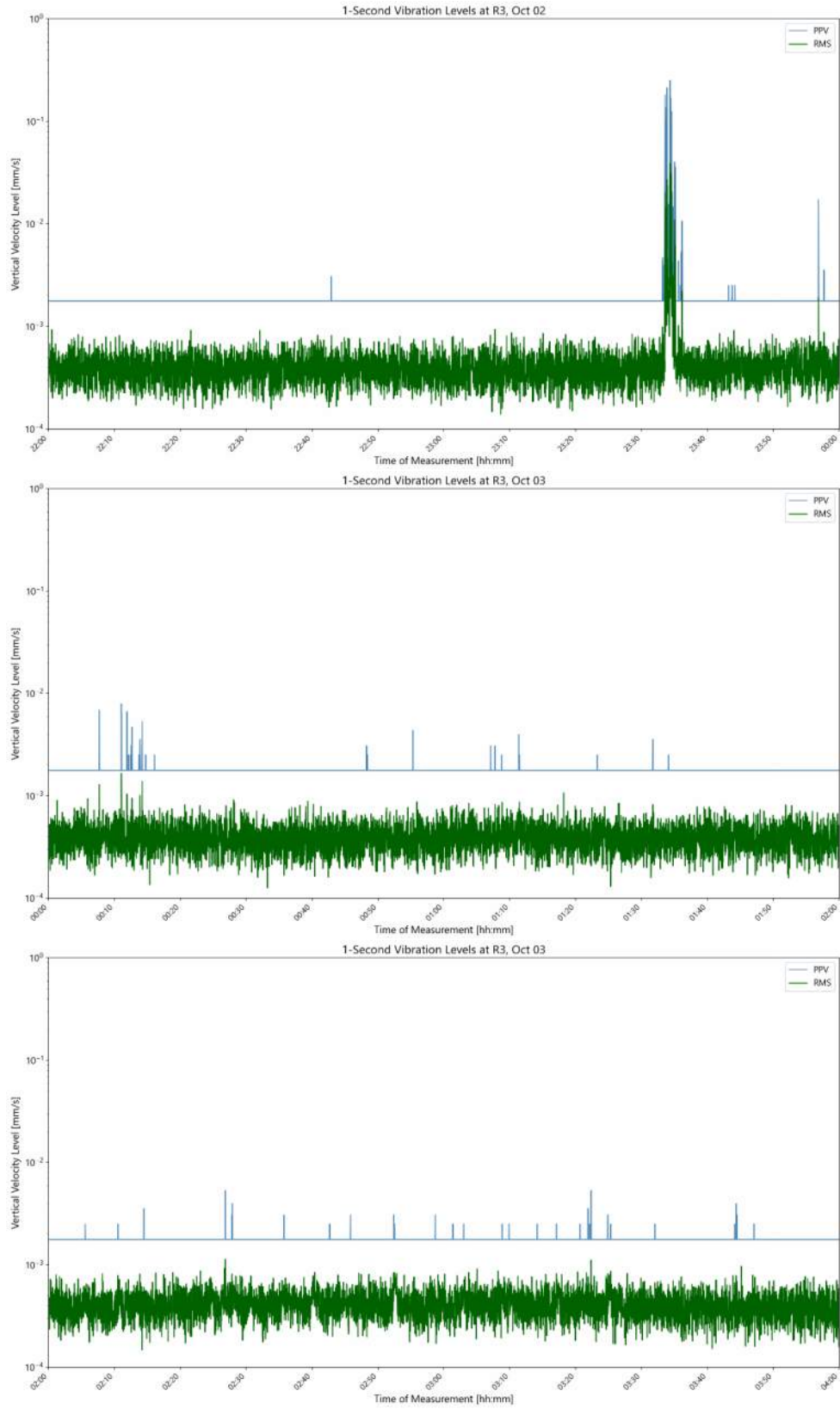


Figure D-17: R3 1-Second Velocity History

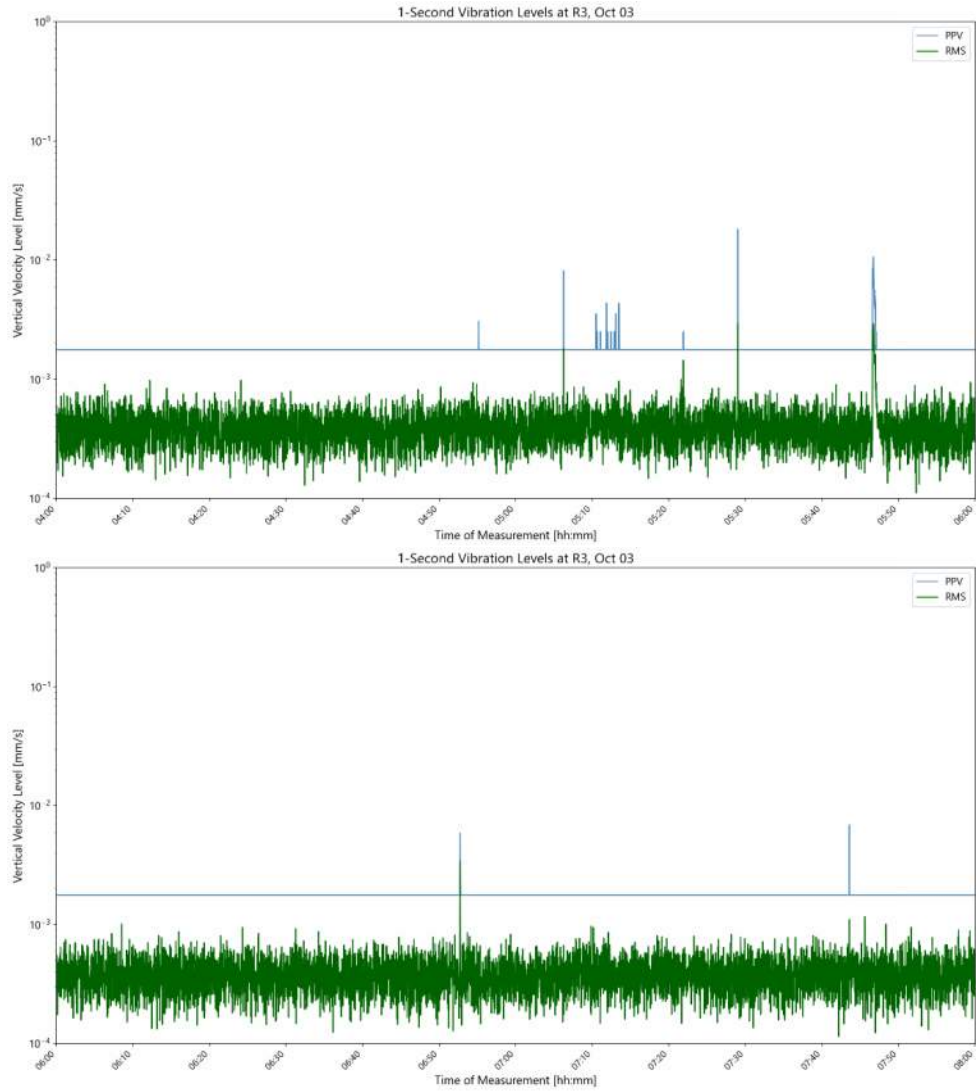


Figure D-18: R3 1-Second Velocity History

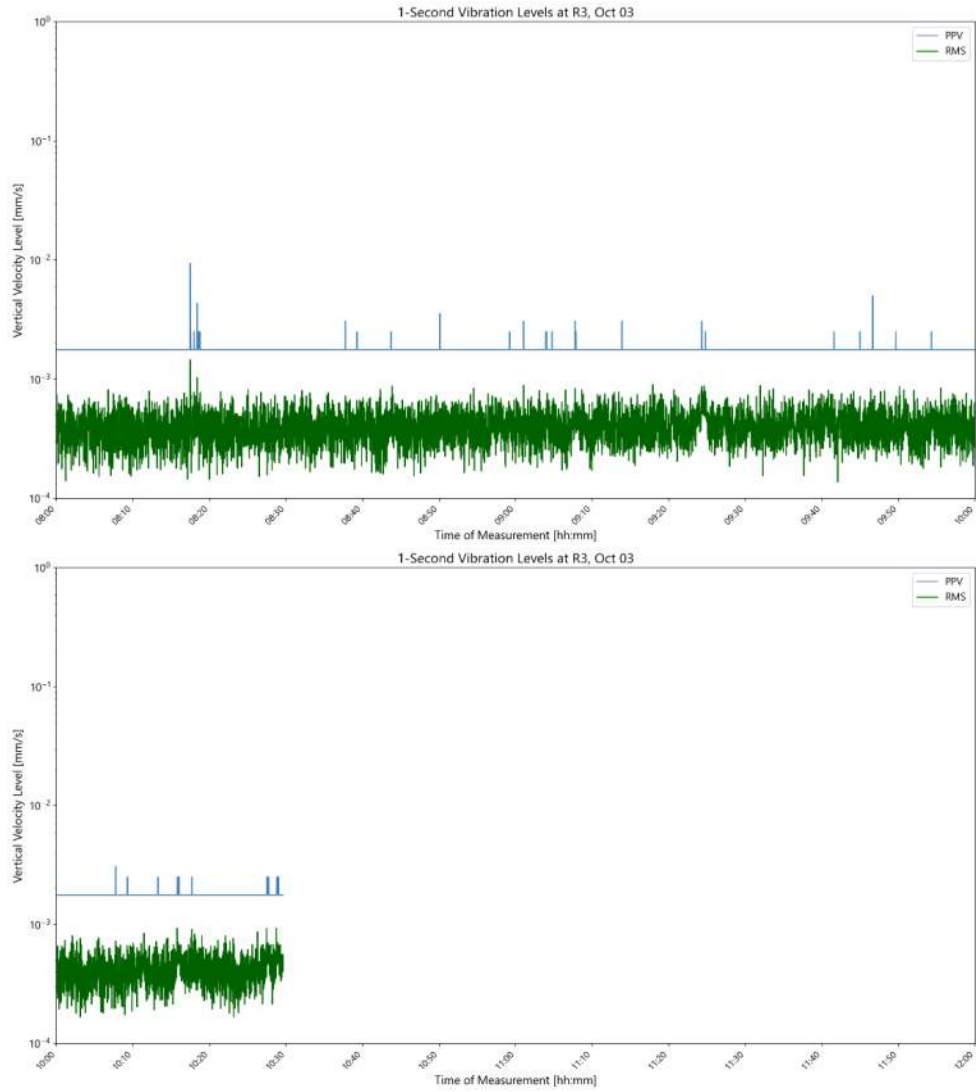


Figure D-19: R3 1-Second Velocity History

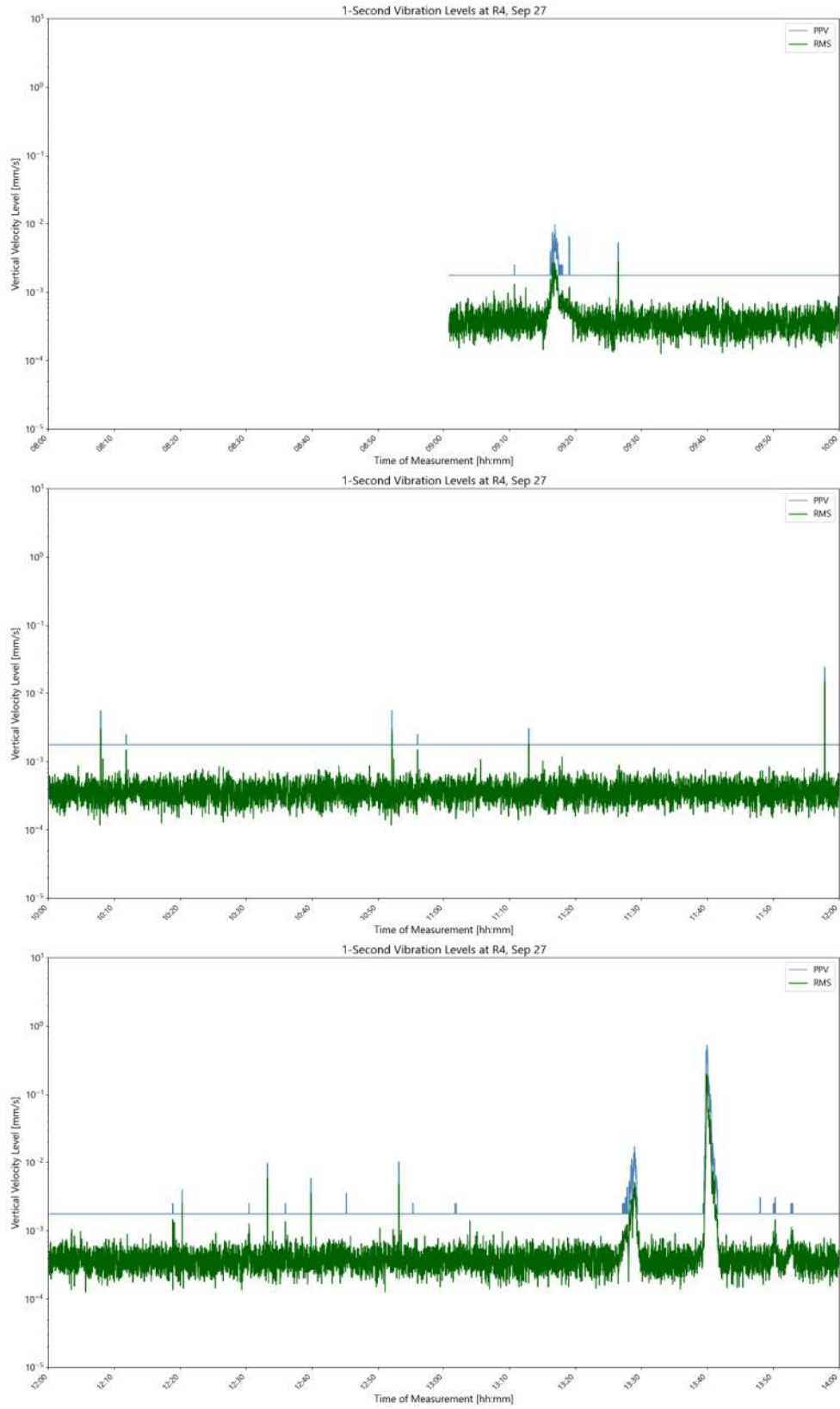


Figure D-20: R4 1-Second Velocity History

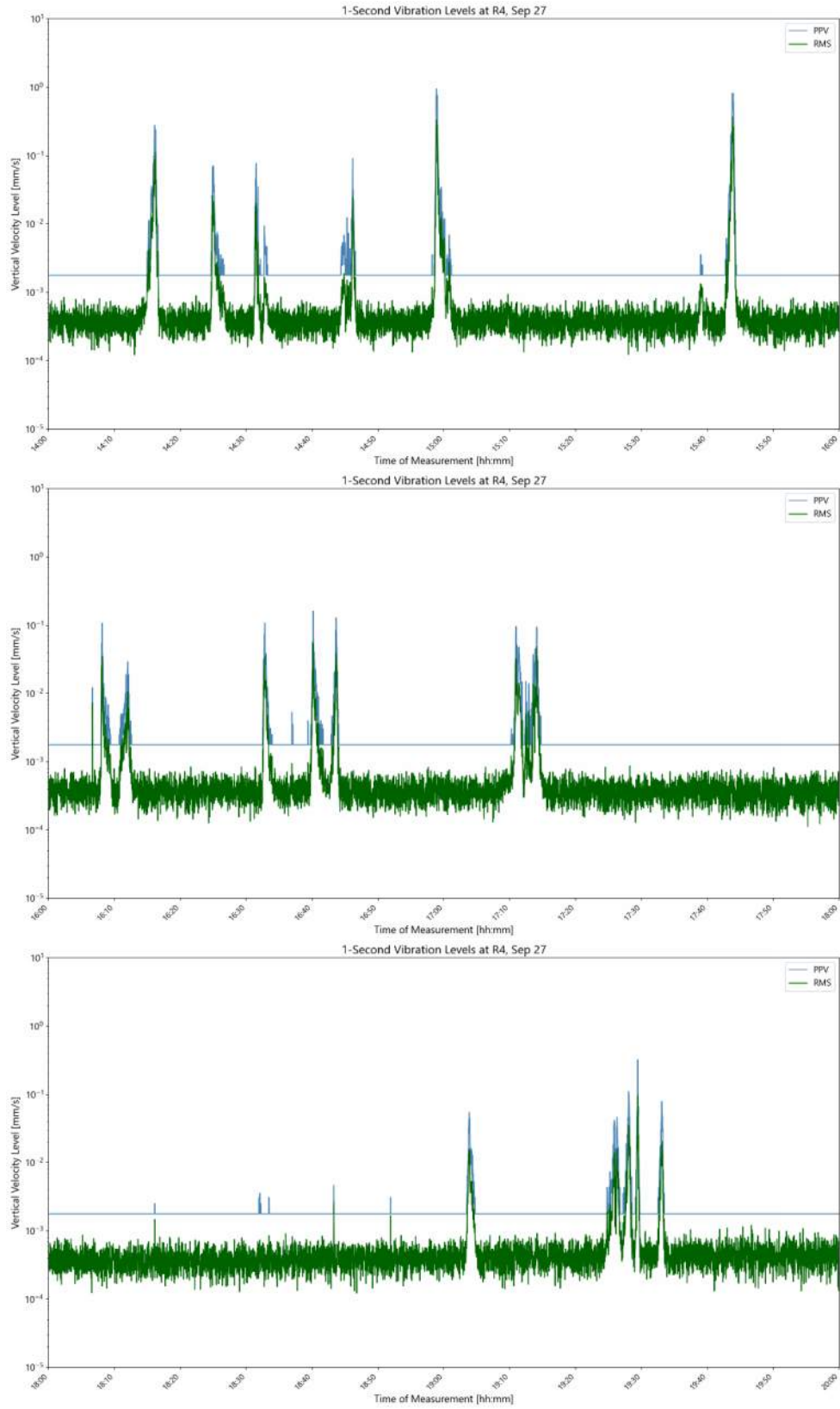


Figure D-21: R4 1-Second Velocity History

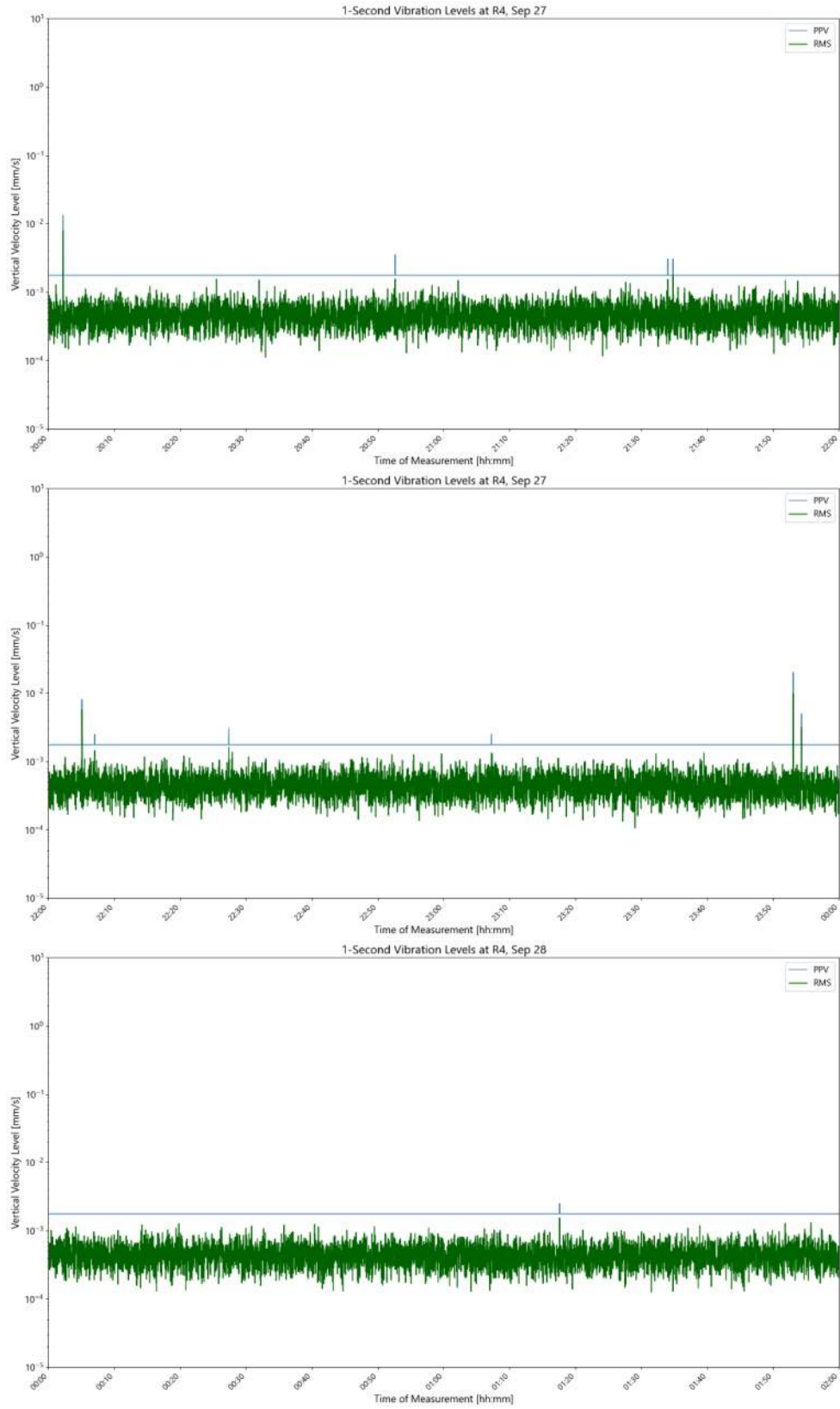


Figure D-22: R4 1-Second Velocity History

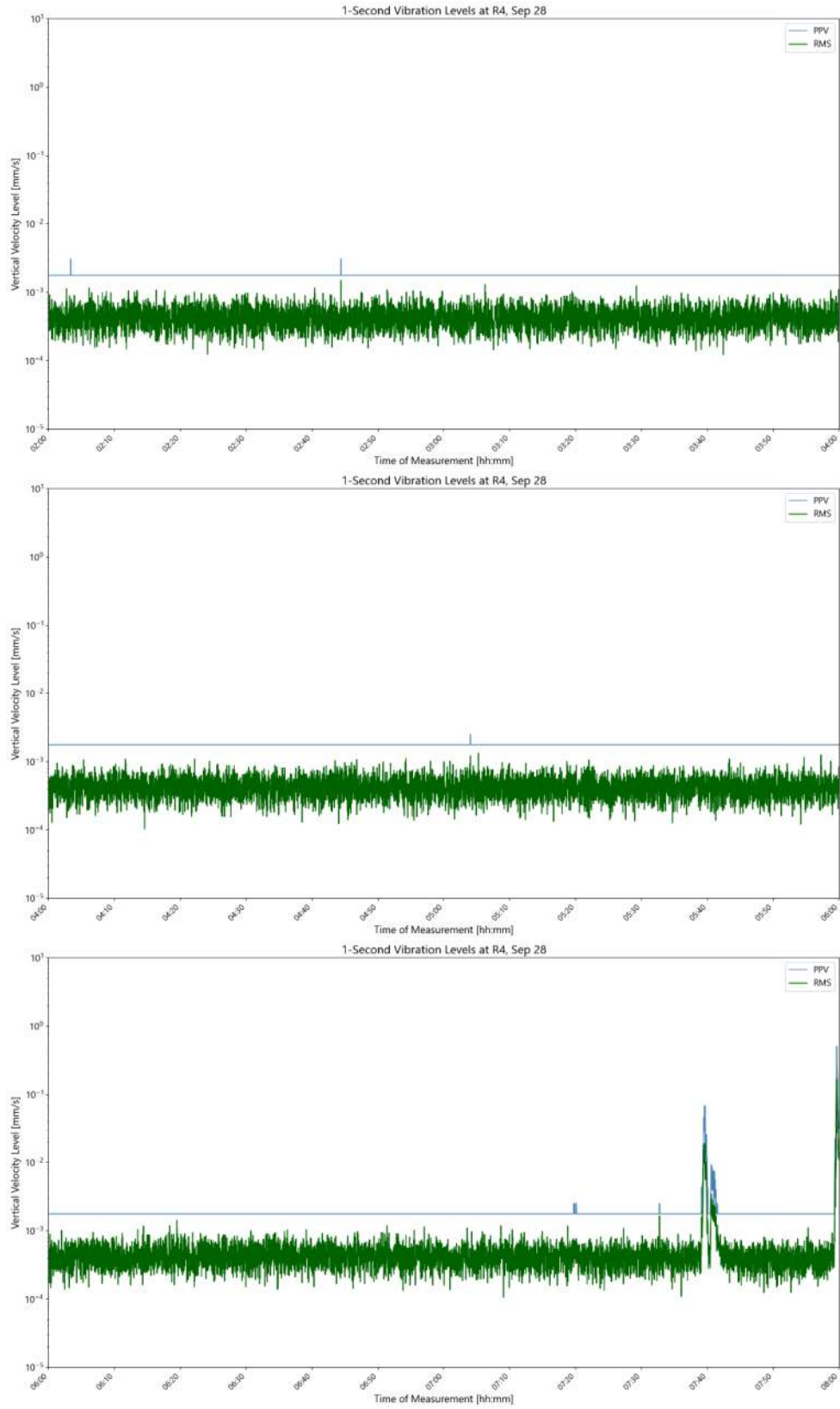


Figure D-23: R4 1-Second Velocity History

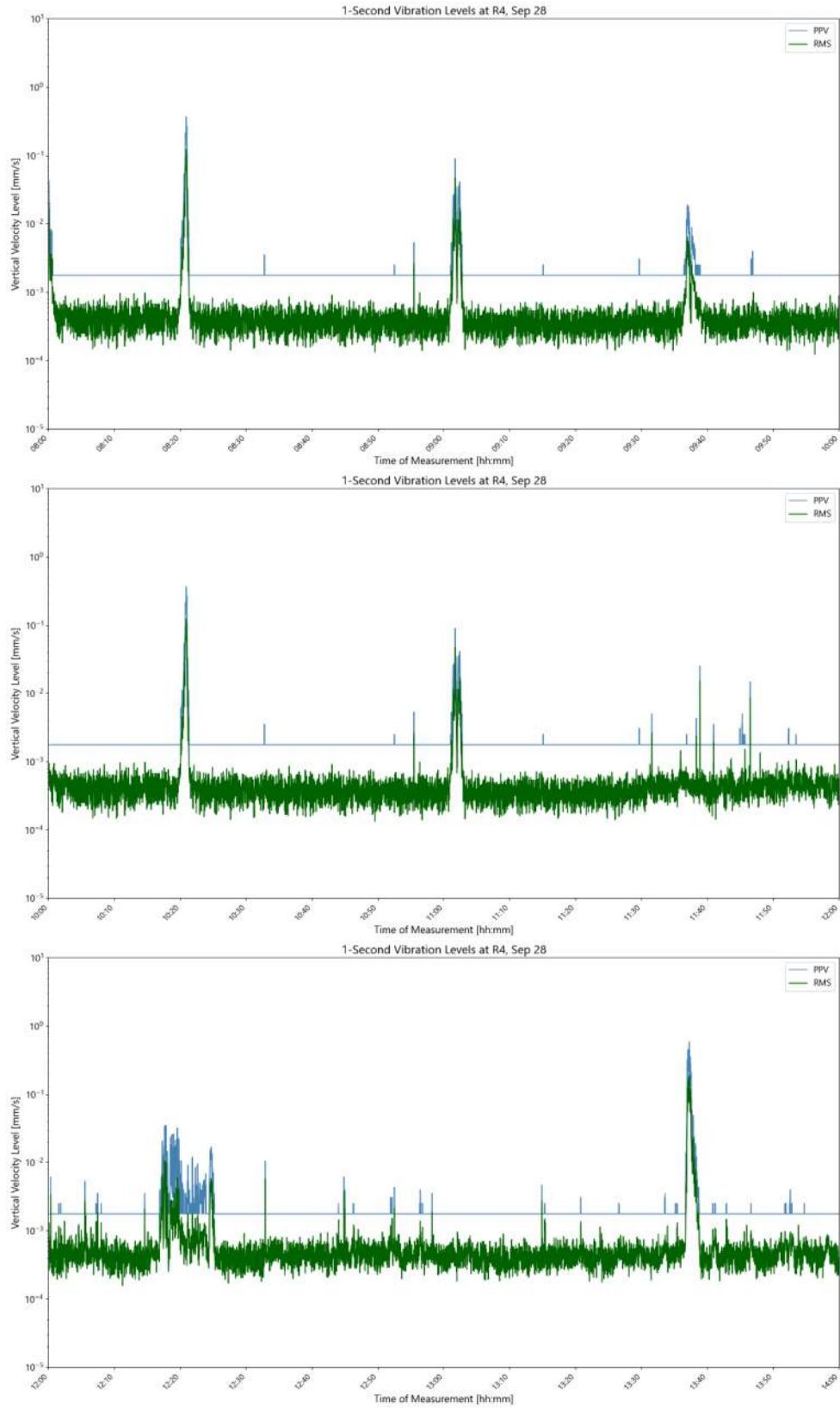


Figure D-24: R4 1-Second Velocity History

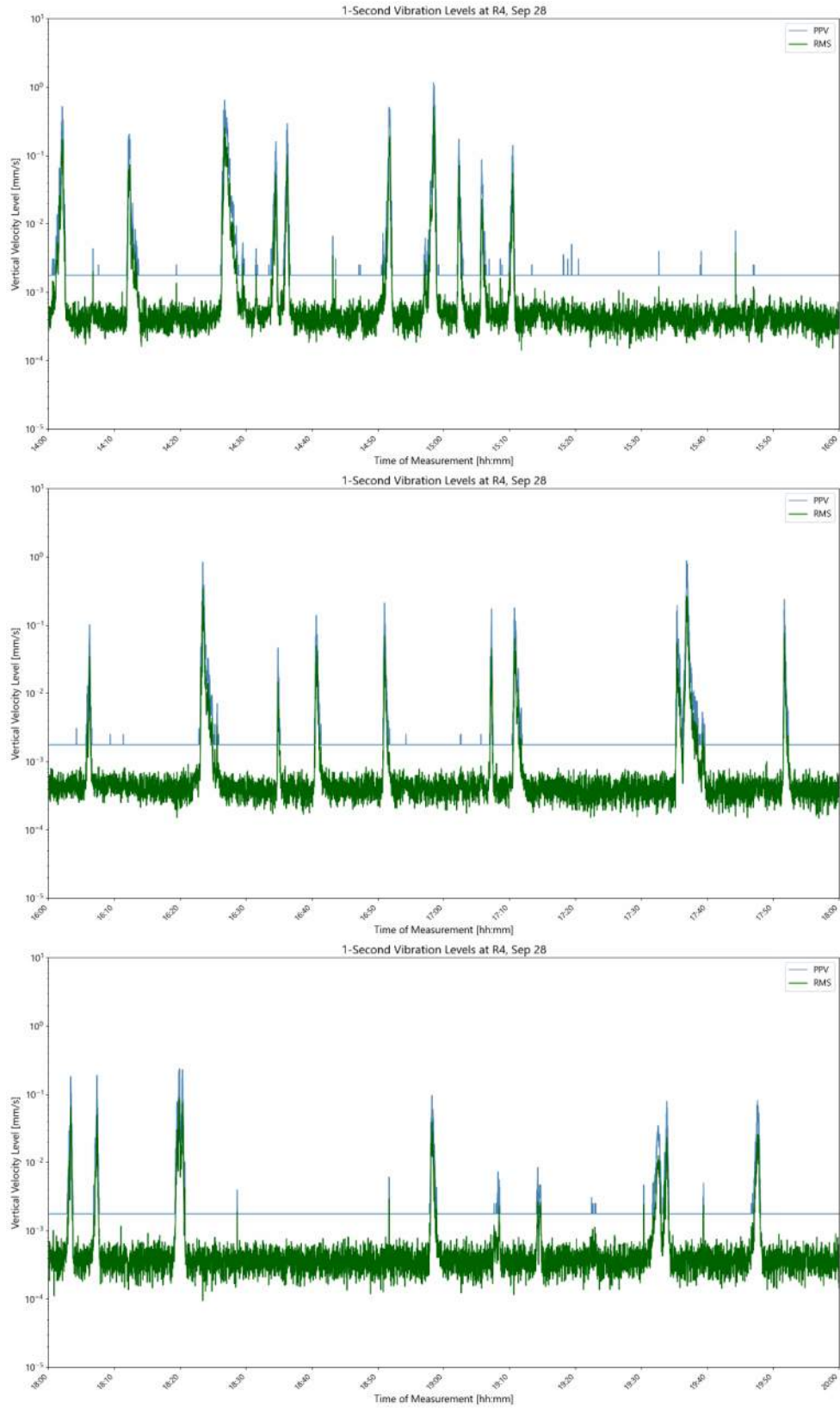


Figure D-25: R4 1-Second Velocity History

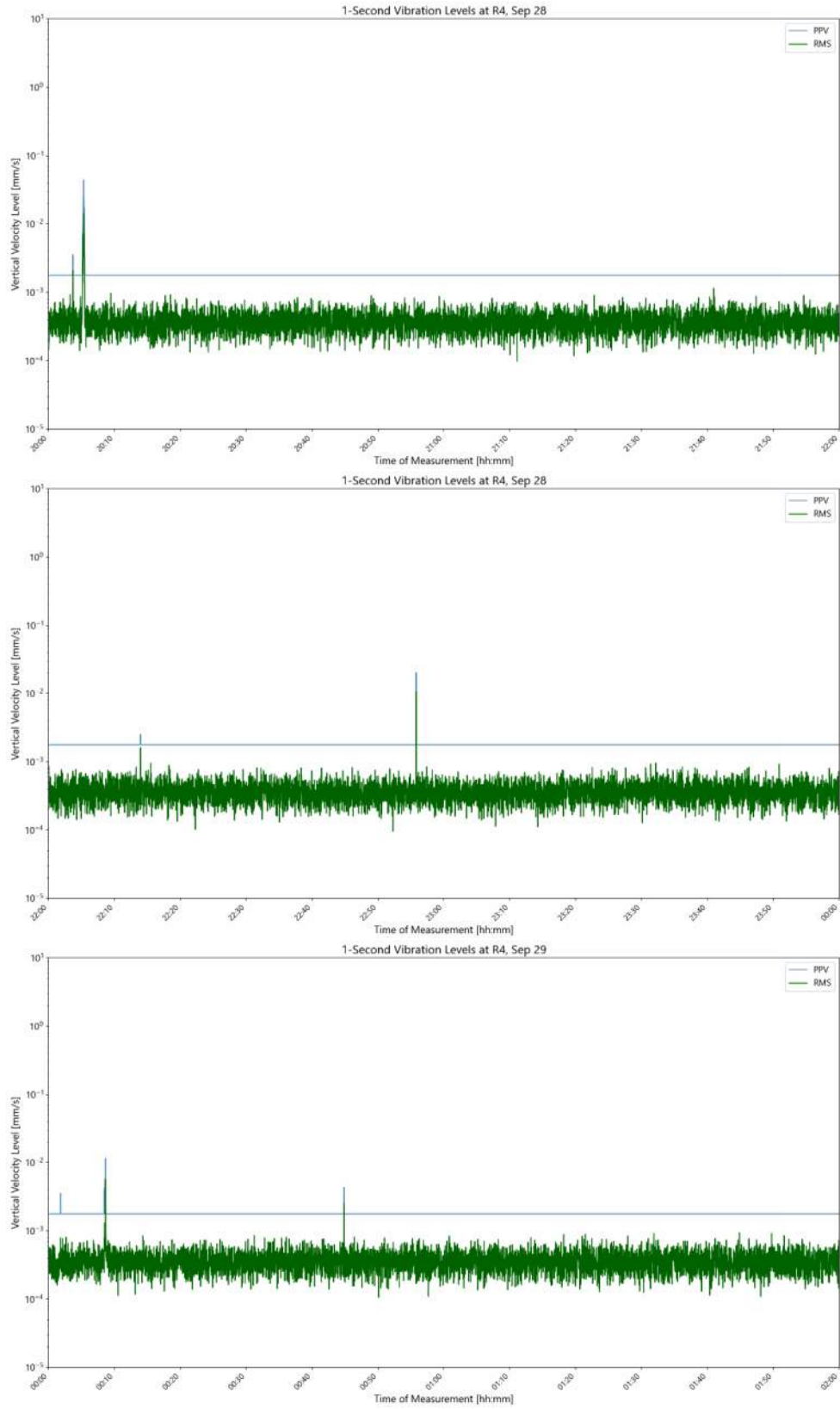


Figure D-26: R4 1-Second Velocity History

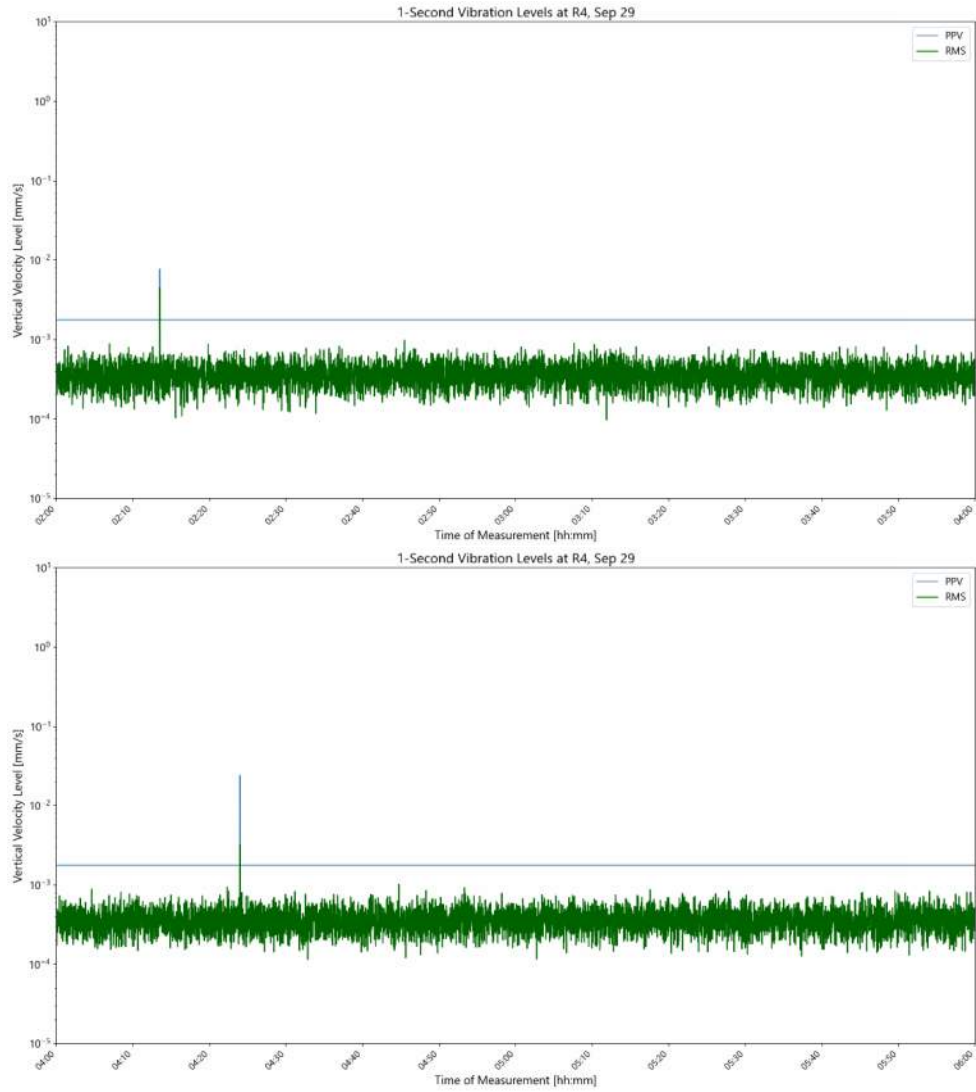


Figure D-27: R4 1-Second Velocity History

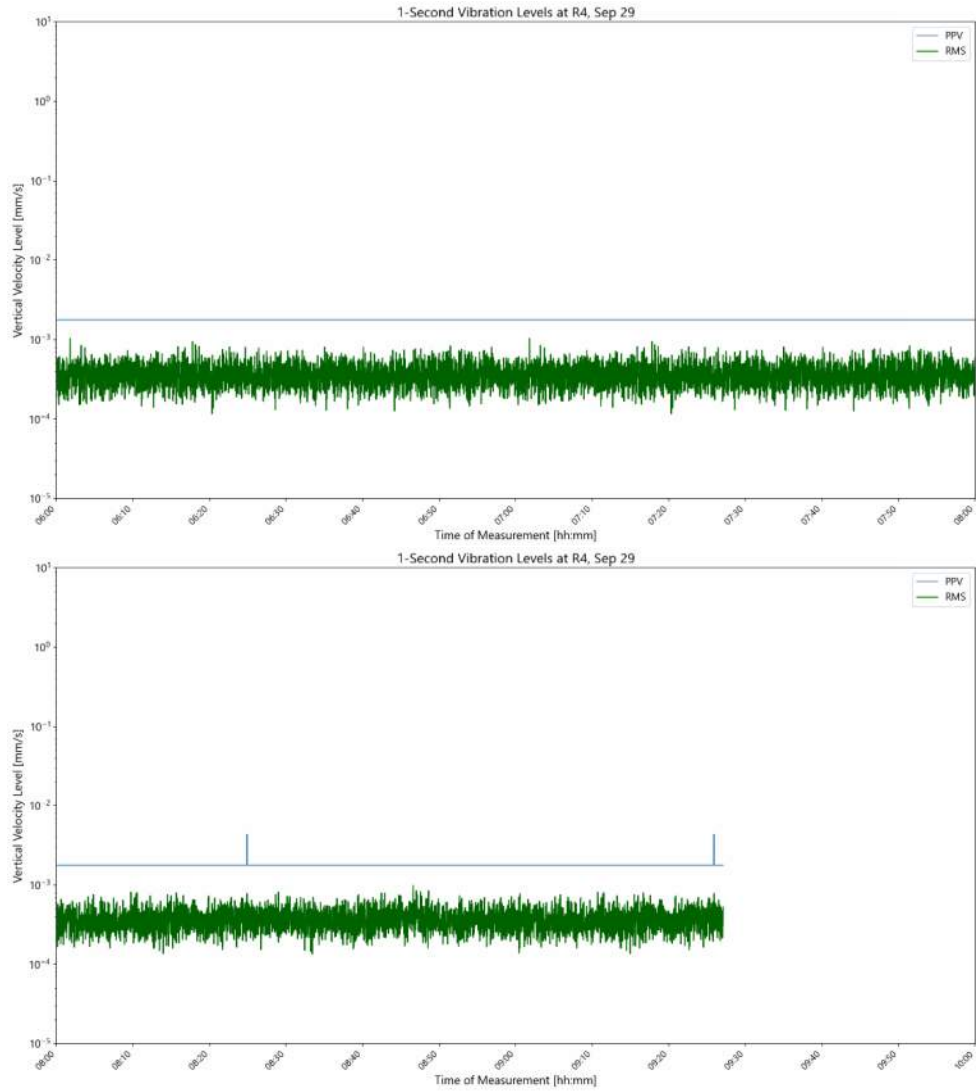


Figure D-28: R4 1-Second Velocity History



wood.

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
 - a. The Standard Terms and Conditions which form a part of our Professional Services Contract;
 - b. The Scope of Services;
 - c. Time and Budgetary limitations as described in our Contract; and
 - d. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Site and attendant structures. Our conclusions cannot and are not extended to include those portions of the Site or structures, which are not reasonably available, in Wood's opinion, for direct observation.
4. The environmental conditions at the Site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the Site with any applicable local, provincial or federal bylaws, orders-in-council, legislative enactments and regulations was not performed.
5. The Site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on-site and may be revealed by different or other testing not provided for in our contract.
7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, Wood must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
8. The utilization of Wood's services during the implementation of any remedial measures will allow Wood to observe compliance with the conclusions and recommendations contained in the report. Wood's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report, or anything set out therein.
10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of Wood.
11. Provided that the report is still reliable, and less than 12 months old, Wood will issue a third-party reliance letter to parties that the client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on Wood's report, by such reliance agree to be bound by our proposal and Wood's standard reliance letter. Wood's standard reliance letter indicates that in no event shall Wood be liable for any damages, howsoever arising, relating to third-party reliance on Wood's report. No reliance by any party is permitted without such agreement.