

# ENVIRONMENTAL MONITORING REPORT

## Document and Revision History

Document Details	
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Client	ARTC – Botany Rail Duplication
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## Revisions

Rev	Date	Description	Prepared by	Reviewed by	Approved by
00	24/03/2023	For Review	Eric Zhang	Rachael Labruyere	Paul Dalziel
01	05/06/2023	Updated in response to comments	Rachael Labruyere	Eric Zhang	Paul Dalziel

## 1 Project Summary

The Botany Line connects Port Botany to the Enfield Intermodal Logistics Centre and is critical to the Sydney Freight Metropolitan network. The Botany Line has several constraints which restrict the capacity of the line, and it is ARTC's intention to alleviate all constraints and increase capacity to meet current and future container freight demand. The Botany Duplication Project forms part of this strategy.

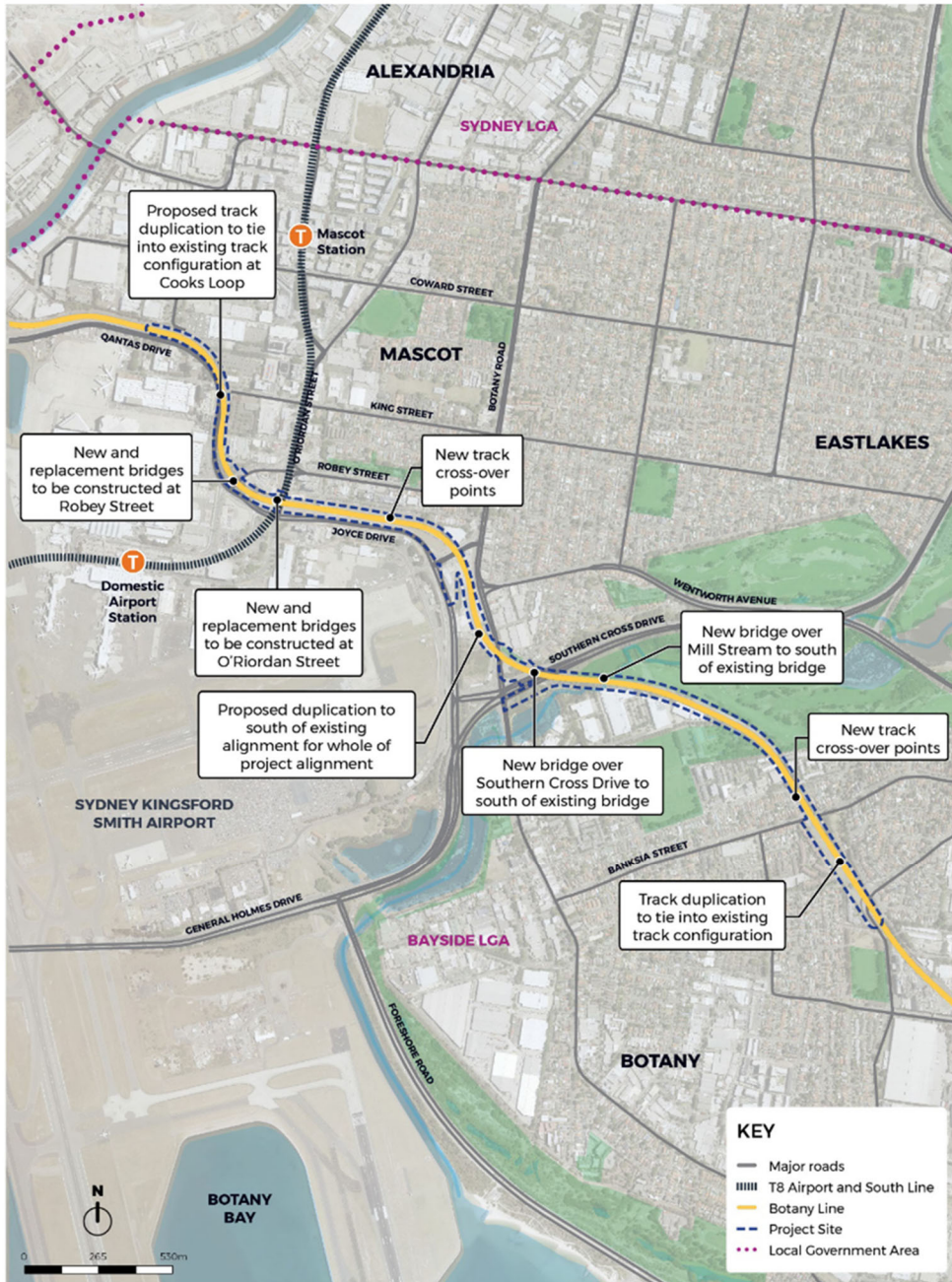


Figure 1: Project Overview

## 2 Construction Noise and Vibration Monitoring Program Requirements

A Construction Noise and Vibration Monitoring Program (the Program) was produced as part of the Construction Noise and Vibration Management Plan (CNVMP) in accordance with CoA C9. The Program defines how John Holland Pty Ltd will monitor potential noise and vibration impacts during construction on the Project.

The following report details environmental monitoring undertaken during this reporting period 12 August 2022 – 12 February 2023 conducted in accordance with the Program and CNVMP.

A summary of the program and requirements is provided in Table 1 below, the full program and CNVMP can be found by following the link on the ARTC website: [Botany rail duplication - Botany Rail Duplication \(artc.com.au\)](http://artc.com.au/Botany_rail_duplication_-_Botany_Rail_Duplication).

Table 1: BRD Monitoring Requirements

CoA No.	Condition of Approval Requirement	CNVMP Details	Monitoring Report Reference
C10(c)	Details of all monitoring of the project to be undertaken	A5.1 Activity based monitoring	Section 3.0
		A5.2 Plant and equipment noise audits	Section 3.1
		A5.3 Groundborne noise monitoring	Section 3.2
		A6 Vibration Monitoring	Section 3.3

### 3.0 Activity Based Noise Monitoring

Activity based noise monitoring was carried out at the start of new activities during representative day, evening and night periods as well as periodically during Out of Hours works and in response to complaints. Tables N1 to N6 provide details of noise monitoring results, works, compliance against predictions and performance requirements (which includes all reasonable and feasible mitigation measures such as respite and community notification) applied to the works.

During the reporting period, measured noise levels associated with the construction works were found to be compliant or below the predicted noise levels. Dominant noise sources measured during the monitoring periods included traffic, train and airport noise, which contributed to overall measured LAeq levels above predictions during measurement periods. Where feasible, noise contributions from the works were based on periods where construction noise was discernible from the ambient noise levels to determine compliance with predictions as detailed in Tables N1 to N6.

Mitigation measures which have been implemented, associated with the BRD works include:

- \* Working with nearby and sensitive receptors to schedule/carry out works during less sensitive periods
- \* Use of noise blankets and barriers for localised noisy works
- \* Sequencing works to avoid cumulative noise impacts
- \* Choosing less noisy equipment or construction methods (where available and feasible).

**Table N1: August 2022 Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
08/08/22	McBurney Avenue	BRD04	SCD Eastern Abutment	Piling (Drilling)	Attended	Night	50	53	Levels below predictions, noise from passing vehicles	Community notification.
11/08/22	McBurney Avenue	BRD04	SCD Eastern Abutment	Piling (Drilling)	Attended	Night	48	53	Levels below predictions, noise dominated by passing vehicles	Community notification
13/08/22	Morgan Street	NCA08	Track Recon	Mobilisation	Attended	Night	56	61	Levels below predictions, noise dominated by aircraft and traffic noise	Community notification
13/08/22	Ocean Street	NCA07	Track Recon	Rail Cutting	Attended	Night	74 <sup>1</sup>	79	Levels below predictions, Lmax recorded during rail cutting (77dBA)	Community notification
13/08/22	Ocean Street	NCA07	Track Recon	Lifting of sleepers	Attended	Night	68	79	Levels below predictions, noise dominated by construction vehicles	Community notification
14/08/22	Ocean Street	NCA07	Track Recon	Rail Cutting	Attended	Night	73 <sup>1</sup>	79	Levels below predictions, noise monitoring dominated by rail cutting activities	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in August 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

**Table N2: September 2022 Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
09/09/22	McBurney Ave	BRD04	SCD Western Abutment	Drilling	Attended	Night	55	53	Levels dominated by traffic (Botany Road/SCD). Noise from works below predicted noise levels.	Community notification
10/09/22	McBurney Ave	BRD04	SCD Western Abutment	Drilling	Attended	Night	56	53	Levels dominated by traffic (Botany Road/SCD). Noise from works below predicted noise levels.	Community notification
12/09/22	McBurney Ave	BRD04	SCD Western Abutment	Concrete Pour	Attended	Night	64	53	Levels dominated by traffic (Botany Road/SCD) and generator on Botany Road. Noise from works below predicted noise levels.	Community notification
13/09/22	McBurney Ave	BRD04	SCD Western Abutment	Concrete Pour	Attended	Night	66	53	Levels dominated by traffic (Botany Road/SCD). Drilling works not discernible.	Community notification
23/09/22	McBurney Ave	BRD04	SCD Western Abutment	Drilling/Case Installation	Attended	Night	63	64	Noise levels below predictions, noise dominated by drilling works.	Community notification
23/09/22	McBurney Ave	BRD04	SCD Western Abutment	Drilling	Attended	Night	56	64	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD).	Community notification
26/09/22	McBurney Ave	BRD04	SCD Western Abutment	Drilling	Attended	Night	57	64	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD).	Community notification
27/09/22	McBurney Ave	BRD04	SCD Western Abutment	Cage installation	Attended	Night	61	64	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD) and train pass-by.	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in September 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

**Table N3: October 2022 Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
10/10/22	McBurney Avenue	BRD04	SCD Central Pier	Site Mobilisation	Attended	Night	49	52	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD).	Community notification
11/10/22	McBurney Avenue	BRD04	SCD Central Pier	Site Mobilisation	Attended	Night	60	63	Noise levels below predictions, noise dominated by drilling works.	Community notification
12/10/22	McBurney Avenue	BRD04	SCD Central Pier	Crane Lift	Attended	Night	49	63	5min measurement during crane lift. Noise levels below predictions.	Community notification
17/10/22	McBurney Avenue	BRD04	SCD Central Pier	Deliveries	Attended	Night	50	51	Levels below predictions, noise dominated by aircraft noise	Community notification
18/10/22	McBurney Avenue	BRD04	SCD Central Pier	Deliveries	Attended	Night	51	51	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD).	Community notification
20/10/22	McBurney Avenue	BRD04	SCD Central Pier	Drilling	Attended	Night	62	64	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD). Wind impacted noise measurement.	Community notification
25/10/22	McBurney Avenue	BRD04	SCD Central Pier	Drilling/Case Installation	Attended	Night	52	63	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD). Higher noise levels noted during bucket shake-off.	Community notification

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
26/10/22	McBurney Avenue	BRD04	SCD Central Pier	Cage lifting	Attended	Night	52	63	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD).	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in October 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

**Table N1: December 2022 Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
10/12/22	McBurney Avenue	BRD04	SCD Shutter Install	Barrier and Shutter Removal of SCD East	Attended	Night	50	51	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD). Rain impacted noise measurement	Community notification.
10/12/22	McBurney Avenue	BRD04	SCD Shutter Install	Barrier and Shutter Removal of SCD East	Attended	Night	47	51	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD). Rain impacted noise measurement	Community notification
16/12/22	Baxter Road	BRD03	Material Disposal	Load out material crane pad	Attended	Night	64	45	Noise levels below predictions, noise dominated by traffic (Botany Road/SCD). Rain impacted noise measurement	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in August 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

**Table N4: January 2023 Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
14/01/23	Banksia Street	BRD08	WE29	Track Reconditioning	Attended	Night	70 <sup>1</sup>	83	Noise levels below predictions, noise dominated by rail cutting and construction vehicle movements	Community notification
14/01/23	Banksia Street	BRD08	WE29	Track Reconditioning,	Attended	Night	68 <sup>1</sup>	72	Noise levels below predictions, noise dominated by rail dragging and construction vehicle movements	Community notification
14/01/23	Banksia Street	BRD08	WE29	Track Reconditioning	Attended	Night	72	83	Noise levels below predictions, noise dominated by ballast loading and construction vehicle movements	Community notification
14/01/23	Ocean Street	NCA07	WE29	NDD/Excavation	Attended	Night	70	64	Levels elevated due to passing traffic, noise. Construction works within predicted noise levels.	Community notification
14/01/23	Ocean Street	NCA07	WE29	NDD/Excavation	Attended	Night	59	64	Noise levels dominated by passing traffic. Construction works within predicted noise levels.	Community notification
14/01/23	Morgan Street	NCA08	WE29	Rail Cutting	Attended	Night	56 <sup>1</sup>	83	Noise levels below predictions, noise dominated by distant traffic with intermittent rail cutting.	Community notification



Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
15/01/23	Ocean Street	NCA07	WE29	Excavation	Attended	Night	56	64	Noise levels below predictions, noise environment dominated by local traffic	Community notification
15/01/23	Ocean Street	NCA07	WE29	Excavation and ballast deliveries	Attended	Night	60	64	Construction noise not discernible. Noise measurement dominated by industrial factory noise.	Community notification
15/01/23	Banksia Street	BRD08	WE29	Tamping	Attended	Night	80 <sup>1</sup>	82	Noise levels below predictions, construction noise dominated by tamping activities	Community notification
15/01/23	Banksia Street	BRD08	WE29	Tamping and welding	Attended	Night	67 <sup>1</sup>	82	Noise levels below predictions, construction noise dominated by tamping activities	Community notification
17/01/23	Robey Street	BRD03	Track Repairs	Rail grinding	Attended	Night	50	48	Levels elevated due to vehicles passing. Works not discernible.	Community notification
18/01/23	Robey Street	BRD03	Track Repairs	Rail welding and cutting of track	Attended	Night	57	48	Levels elevated due to local traffic. Works not discernible.	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in January 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

**Table N6: February Noise Monitoring Data**

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
03/02/23	Banksia Street	BRD08	WE 32	Saw cutting and NDD excavation	Attended	Day	67 <sup>1</sup>	85	Intermittent saw cutting during measurement. Noise levels below predictions, noise dominated by local traffic.	Community notification.
03/02/23	Banksia Compound	BRD08	WE32	Excavation and ballast removal	Attended	Night	58	67	Noise levels within predictions, construction noise dominated by ballast removal activities.	Community notification
03/02/23	Banksia Compound	BRD08	WE32	Delivery	Attended	Night	64	67	Noise levels within predictions, construction noise dominated by site deliveries	Community notification
04/02/2023	Baxter Road	BRD03	WE32	Demolition	Attended	Night	63	53.2	Levels elevated due to local traffic and aircraft noise. Works not discernible.	Community notification
04/02/2023	Robey Street	BRD03	WE32	Demolition	Attended	Night	59	32	Levels elevated due to local traffic and train passby. Works not discernible.	Community notification
04/02/23	Banksia Street	BRD08	WE32	Saw cutting and ballast delivery	Attended	Day	68	67	Noise elevated due local traffic. Saw cutting noise levels within predicted levels.	Community notification
04/02/23	Banksia Street	BRD08	WE32	Ballast delivery	Attended	Night	68	68	Noise elevated due local traffic. Noise levels from ballast deliveries within predicted levels.	Community notification
04/02/23	Banksia Compound	BRD08	WE32	Trench compaction	Attended	Night	56	67	Trench compaction activities below	Community notification

Date	Monitoring Location	NCA	Works	Activity	Monitoring Type	Time	Measured LAeq dB(A)	Predicted Noise Levels dB(A)	Compliance Assessment	Performance Requirements
									predicted noise levels. Noise environment dominated by site vehicle movements.	
04/02/23	Banksia Compound	BRD08	WE32	Compaction of trench	Attended	Night	60	67	Trench compaction activities below predicted noise levels. Noise environment dominated by site vehicle movements.	Community notification
05/02/23	Mcburney Ave	BRD04	WE32	Drainage works	Attended	Night	57	56	Noise levels elevated due to traffic noise (SCD and Botany Road). Works not discernible.	Community notification
07/02/23	Mcburney Ave	BRD04	WE32	Backfill, Compaction	Attended	Night	49	56	Noise levels elevated due to traffic noise (SCD and Botany Road). Works not discernible.	Community notification

Note: Noise monitoring equipment is detailed in Section 4.0, all noise monitoring in February 2022 used John Holland Equipment

Note 1: Predictions and noise measurements include 5dBA correction for 'annoying' noise characteristics

### 3.1 Plant and Equipment Noise Audits

Plant/ equipment noise audits were carried out for noise intensive plant and equipment to ensure compliance with the noise levels for construction equipment assumed in the noise model.

The audits during this monitoring period included, equipment monitoring of new equipment/methodologies prior to implementation on-site and additional activities required to improve accuracy of the Gatewave Modelling Results of the noise audits are presented in Table NA1.

**Table NA1: Noise Audit Monitoring Results**

Location	Plant/Activity	Calculated Overall Sound Power Level (dBA)	Calculated LAmax Sound Power Level	Measured LAeq (dBA)	Comments
Sydney Metro West, Rosehill site	RTG RG16T Vibratory Sheet Piling Rig with MR145V Silent Vibro Attachment	109	118	-	Noise levels included in Gatewave model
Rail Line near Qantas Service Rd adjacent to Qantas Dr.	Rail deliveries	109 (+5)	129	-	Noise levels included in Gatewave model

### 3.2 Plant and Equipment Vibration Trials

Plant/ equipment vibration audits were carried out for vibration intensive plant and equipment to ensure compliance with the vibration levels for construction equipment assumed in the vibration model.

The audits consisted of equipment monitoring prior to delivery to site as well as spot checks during construction. Audits have been carried out as required on a case-by-case basis, such as changes in methodology or in response to a plant/equipment specific noise related complaint or during noise and vibration assessment validation monitoring. Results of the vibration audits are presented in Table VA1.

**Table VA1: Vibration Audit Monitoring Results**

Location	Plant	Monitoring Requirement	Distance from source	Calculated eVDV	Maximum PPV	Comments
UTS Tech Lab at Lord Street	12t smooth drum roller	Cosmetic damage / Human Comfort	8-15m	0.16	0.61	On static mode
			8-15m	1.45	5.33	On low vibratory mode
			8-15m	1.85	5.66	On high vibratory mode
Rail corridor adjacent to Ellis Street	Front-end Loader	Cosmetic Damage	3m	-	0.57	-
			4m	-	0.28	
			5m	-	0.16	
	13t-excavator (bucket attachment)	Cosmetic Damage	3m	-	3.04	-
			4m	-	1.86	
			6m	-	2.28	
			7m	-	1.21	
			8m	-	1.16	
			9m	-	1.18	
	Rail corridor adjacent to Bay Street and Ellis Street	12T smooth drum roller	Cosmetic damage / Human comfort	2m	-	1.01
2m				-	9.29	On low vibratory mode
2m				-	11.19	On high vibratory mode
7m				-	0.72	On static mode
7m				-	6.41	On low vibratory mode
7m				-	9.14	On high vibratory mode
22m				-	0.3	On static mode
22m				-	2.76	On low vibratory mode
22m				-	3.1	On high vibratory mode

### 3.4 Groundborne Noise Monitoring

No construction works occurred during the monitoring period predicted to result in groundborne noise or resulted in groundborne noise complaints requiring monitoring.

### 3.4 Vibration Monitoring

Vibration monitoring was undertaken in the following circumstances:

- At the commencement of construction for each plant or activity on-site where the vibration screening criteria is likely to be exceed,
- Where vibration generating activities have the potential to impact on heritage items
- To confirm minimum working distances
- Where there is risk of potential cosmetic damage to buildings and structures
- In response to vibration related complaints

Vibration monitoring results have been compared to the vibration goals outlined in the CNVMP based on the relevant Construction Noise and Vibration Guidelines, British Standard BS7385 Part 2-1993 and German Standard DIN 4150: Part 3 – 2016, these goals include:

- Vibration dose value (VDV) for human comfort
- Peak Component Particle Velocity (PPV) for cosmetic damage

Likely vibration impact was initially determined using screening tests as detailed in the CNVMP.

Vibration monitoring included in this report uses the estimated vibration dose value determined by the acoustic consultants for human comfort and the acoustic consultants analysis of the building

structure, vibration source, dominant frequencies and dynamic characteristics of the structure within the PPV goals for cosmetic damage.

The vibration intensive activities identified during the monitoring period include:

- Impact driving of pile casings as part of the Botany Road Bridge piling works
- Vibro driving of pile casings as part of the Robey Street piling works
- Jack hammering/breaking activities
- Vibratory rolling activities

Tables V1 to V6 provide details of vibration monitoring results, works and compliance against the established vibration criterion.

Vibration monitoring found levels for cosmetic damage were below the vibration criterion at all locations.

Human comfort levels were found to be generally below the vibration dose value goals, where vibration levels were measured above this dose value for an eight hour shift, operational times were reduced in the vicinity of the properties to reduce the impacts as well as changing to less vibration intensive modes on equipment such as static or low vibration mode on the vibratory roller.

**Table V1: August Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured VDV (m/s <sup>1.75</sup> )	VDV Goal (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Goal (mm/s)	Compliance Assessment
11/08/22 – 18/08/22	General Holmes Drive	Ausgrid	CFA Piling Works	Type 1 Signal Analyser (Soundbook-1 & 2) Accelerometer (Endevco 61C13)	Unattended	Cosmetic Damage	NA	NA	1.18	20	Vibration monitoring were below the established vibration goal for cosmetic damage
26/08/22	Bay Street	Residential	Vibratory rolling works	Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13)	Attended	Cosmetic Damage / Human Comfort	1.97	0.4	1.68	7.5	Vibration monitoring were below the established vibration goal for cosmetic damage, additional mitigations measures to be implemented including limiting on-time of vibration mode for human comfort

**Table V2: September Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured/ Calculated VDV (m/s <sup>1.75</sup> )	VDV Goal (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Goal (mm/s)	Compliance Assessment
02/09/22	O'Riordan Street	Gateway Building	Piling Works	Type 1 Signal Analyser (Soundbook-2) Accelerometer (PCB 393B12)	Unattended	Cosmetic Damage / Human Comfort	0.39	0.8	1.77	7.5	Vibration monitoring were below the established vibration goal for cosmetic damage & human comfort
6/09/22 – 08/09/22	O'Riordan Street	Stamford Hotel (Stamford Hotel Room)	Piling Works	Type 1 Signal Analyser (Soundbook-1) Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Attended	Human Comfort	0.44	0.40	NA	NA	Additional mitigations measures to be implemented including limiting required impact force and duration of impact piling for human comfort
6/09/22 – 08/09/22	O'Riordan Street	Stamford Hotel (Stamford Hotel Façade)	Piling Works	Type 1 Signal Analyser (Soundbook-1) Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Attended	Cosmetic Damage	NA	NA	13.53	25	Vibration monitoring levels were below the established vibration goal for cosmetic damage

Note: Vibration Dose Value/Human Comfort (VDV) and Peak Particle Velocity/Cosmetic Damage (PPV)

Note 1: Calculated values for eight hours of operation



**Table V3: October Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured/ Calculated VDV (m/s <sup>1.75</sup> )	VDV Goal (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Target (mm/s)	Compliance Assessment
20/10/22	Botany Road bridge	Rail Bridge P1	Impact Piling	Type 1 Signal Analyser (Soundbook-1) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Attended	Cosmetic Damage	NA	NA	4.86	7.5	Vibration levels recorded were below the established vibration goals for cosmetic damage
20/10/22	McBurney Ave	Residential	Impact Piling	Type 1 Signal Analyser (Soundbook-1) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Attended	Cosmetic Damage/ Human Comfort	0.57	0.4	3.18	7.5	Vibration monitoring were below the established vibration goal for cosmetic damage, additional mitigations measures to be implemented including limiting required impact force for human comfort
25/10/23	McBurney Ave	Residential	Piling Works	Triaxial Transducers (Sigicom C22)	Unattended	Cosmetic Damage	NA	NA	<2	7.5	Vibration levels recorded were below the established vibration goals for cosmetic damage

Note: Vibration Dose Value/Human Comfort (VDV) and Peak Particle Velocity/Cosmetic Damage (PPV)

**Table V4: November Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured/ Calculated VDV (m/s <sup>1.75</sup> )	VDV Target (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Target (mm/s)	Compliance Assessment
04/11/22	O'Riordan Street	Gateway Office	Jack hammering works	Triaxial Transducers (Sigicom C22)	Attended	Cosmetic Damage	NA	NA	<4	7.5	Vibration levels recorded were below the established vibration goals for cosmetic damage

Note: Vibration Dose Value/Human Comfort (VDV) and Peak Particle Velocity/Cosmetic Damage (PPV)

**Table V5: January Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured/ Calculated VDV (m/s <sup>1.75</sup> )	VDV Target (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Target (mm/s)	Compliance Assessment
10/01/23 – 18/01/23	King Street	Ausgrid & Jemena	WE29	Triaxial Transducers (Sigicom C22)	Unattended	Cosmetic Damage	NA	NA	<12	20	Vibration monitoring were below the established vibration goal for the Jemena Pipeline & Ausgrid cable. Results based on unattended monitoring.
13/01/23 – 16/01/23	Bay Street	APA	WE29	Type 1 Signal Analyser (Sinus Soundbook) Accelerometer (PCB 393B12)	Unattended	Cosmetic Damage	NA	NA	<8	20	Vibration monitoring were below the established vibration goal for APA pipe. Results based on unattended monitoring.
13/01/23 – 16/01/23	O'Riordan Street	Jemena	WE29	Type 1 Signal Analyser (Sinus Soundbook) Accelerometer (PCB 393B12)	Unattended	Cosmetic Damage	NA	NA	<4	20	Vibration monitoring were below the established vibration goal for the Jemena Pipeline. Results based on unattended monitoring.
15/01/23	Banksia Street Compound	Banksia Street	WE29 (Rail Tamping)	Type 1 Signal Analyser (Sinus Soundbook) Accelerometer (PCB 393B12)	Attended	Human Comfort	0.25	0.39	NA	NA	Vibration levels recorded were below the established vibration goals for human comfort

Note: Vibration Dose Value/Human Comfort (VDV) and Peak Particle Velocity/Cosmetic Damage (PPV)

**Table V6: February Vibration Monitoring Data**

Monitoring Date	Location	Receiver	Works	Monitoring Equipment	Monitoring Type	Monitoring Requirement	Measured/ Calculated VDV (m/s <sup>1.75</sup> )	VDV Target (m/s <sup>1.75</sup> )	Measured PPV (mm/s)	PPV Target (mm/s)	Compliance Assessment
03/02/23 – 08/02/23	Robey Street	Jemena Pipeline (Coleman)	WE32	Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Unattended	Cosmetic Damage	NA	NA	<8	20	Vibration monitoring were below the established vibration goal for the Jemena Pipeline. Results based on unattended monitoring.
03/02/23 – 08/02/23	Robey Street	Jemena Pipeline (Qantas Drive)	WE32	Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Unattended	Cosmetic Damage	NA	NA	<8	20	Vibration monitoring were below the established vibration goal for the Jemena Pipeline. Results based on unattended monitoring.
03/02/23	Robey Street	Gateway Building	bridge abutment breakback works	Type 1 Signal Analyser (Soundbook-2) Accelerometer (Endevco 61C13) Accelerometer (PCB 393B12)	Attended	Cosmetic Damage/Human Comfort	0.0923	0.26	0.65	7.5	Vibration monitoring were below the established vibration goals for cosmetic damage and human comfort

Note: Vibration Dose Value/Human Comfort (VDV) and Peak Particle Velocity/Cosmetic Damage (PPV)

## 4.0 Equipment and Calibration

Monitoring during the period has been carried out internally by John Holland as well as by the Project Noise and Vibration consultants. All equipment used for the monitoring was calibrated and in date with records maintained electronically on the John Holland system. Table C1 provides details of the calibration dates and equipment used for the monitoring with calibration certificates contained in Appendix A.

Owner	Instrument	Make	Model	Serial Number	External Calibration Date	Place of Calibration	Calibration Certificate
Renzo Tonin & Associates	Type 1 Signal Analyser	Sinus	Soundbook Expander 1	#09194	01/02/2023	Sinus	Sinus Production Test For Device 2023-02-01
Renzo Tonin & Associates	Type 1 Signal Analyser	Sinus	Soundbook Expander 2	#07039	11/11/2022	Natacoustic	2022 11 11 SINUS manufacturers test 3234_001
Renzo Tonin & Associates	Accelerometer	Endevco	61C13	#10764	21/04/2021	Natacoustic	RB880F07 ENDEVCO ACCELEROMETER 61C13 #10764 #1 (r1)
Renzo Tonin & Associates	Accelerometer	Endevco	61C13	#10703	21/04/2021	Natacoustic	RB880F09 ENDEVCO ACCELEROMETER 61C13 #10703 #3 (r1)
Renzo Tonin & Associates	Triaxial Transducers	Sigicom	C22	#102477	2/05/2022	Natacoustic	RB969F03 Sigicom C22 #102477 #001 (r3)
Renzo Tonin & Associates	Accelerometer	PCB	393B12	#32172	20/04/2021	Natacoustic	RB880F00 PCB ACCELEROMETER 393B12 #32172 #1 (r1)
Renzo Tonin & Associates	Accelerometer	PCB	393B12	#32173	20/04/2021	Natacoustic	RB880F01 PCB ACCELEROMETER 393B12 #32173 #2 (r1)
Renzo Tonin & Associates	Accelerometer	PCB	393B12	#32174	20/04/2021	Natacoustic	RB880F02 PCB ACCELEROMETER 393B12 #32174 #3 (r1)
Renzo Tonin & Associates	Type 1 Sound Level Meter	NTi	XL2	A2A-19156-D1	10/03/2022	Natacoustic	RB963F00
Renzo Tonin & Associates	Type 1 Sound Level Meter Calibrator	B&K	4231	3027924	04/04/2022	Natacoustic	RB963F00

## **Appendix A: Equipment Calibration Certificates**



SINUS Messtechnik GmbH  
Föpplstrasse 13  
D-04347 Leipzig, Germany  
☎ +49 341 24429 0  
☎ +49 341 24429 99  
🌐 <http://www.sinusmess.de>

# Production Test for Device

SINUS Expander\_71

Serial Number: #07039

This device was tested according ISO 61672, ISO 60651 and the internal test specifications of the SINUS Messtechnik GmbH.

Date:	11-Nov-2022
Recommended Interval:	24 months
Next Production Test:	Nov-2024
Operator:	TUL

Signature:

.....  




# NATAcoustic

Acoustic Calibration & Testing Laboratory

Level 1, 418A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA  
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au  
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer

Calibration Date 20/04/2021

Operator AH

Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD

Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010

### Test Item

Manufacturer PCB

Serial No #32172 (#1)

Instrument Model 393B12

#### Applicable Work Instruction:

WiTC-99 Accelerometer and Geophone Calibration

#### Reference Standards:

International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 14837-1:2005 Mechanical vibration Ground-borne noise and vibration arising from rail systems - Part 1: General guidance  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer  
British Standard BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting  
British Standard BS7385-2:1993 Evaluation and measurement for vibration in buildings  
German Standard DIN 4150-3:2016 Vibrations in buildings - Part 3: Effects on structures  
International Society of Explosives Engineers ISEE Performance Specifications for Blasting Seismographs 2017

#### Laboratory Equipment :

Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

#### Traceability:

The results of the tests and measurements included in this document are traceable via the test methods described in the applicable work instruction which references the listed international standards.  
And by the use of the above lab equipment, which has been calibrated where required using reference equipment calibrated by NATA accredited calibration facilities.  
This document shall not be reproduced, except in full.

#### Scope:

This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

#### Calibration Notes:

#### Calibration Checked and Approved:

Print Name: Ariel Michael

Date: 18/05/2021







# NATAcoustic

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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer

Calibration Date 20/04/2021

Operator AH

Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD

Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010

### Test Item

Manufacturer PCB

Serial No #32173 #2

Instrument Model 393B12

#### Applicable Work Instruction:

WiTC-99 Accelerometer and Geophone Calibration

#### Reference Standards:

International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 14837-1:2005 Mechanical vibration Ground-borne noise and vibration arising from rail systems - Part 1: General guidance  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer  
British Standard BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting  
British Standard BS7385-2:1993 Evaluation and measurement for vibration in buildings  
German Standard DIN 4150-3:2016 Vibrations in buildings - Part 3: Effects on structures  
International Society of Explosives Engineers ISEE Performance Specifications for Blasting Seismographs 2017

#### Laboratory Equipment :

Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

#### Traceability:

The results of the tests and measurements included in this document are traceable via the test methods described in the applicable work instruction which references the listed international standards.  
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This document shall not be reproduced, except in full.

#### Scope:

This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

#### Calibration Notes:

#### Calibration Checked and Approved:

Print Name: Ariel Michael

Date: 18/05/2021





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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer

Calibration Date 20/04/2021

Operator AH

Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD

Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010

### Test Item

Manufacturer PCB

Serial No #32174 #3

Instrument Model 393B12

#### Applicable Work Instruction:

WiTC-99 Accelerometer and Geophone Calibration

#### Reference Standards:

International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 14837-1:2005 Mechanical vibration Ground-borne noise and vibration arising from rail systems - Part 1: General guidance  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer  
British Standard BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting  
British Standard BS7385-2:1993 Evaluation and measurement for vibration in buildings  
German Standard DIN 4150-3:2016 Vibrations in buildings - Part 3: Effects on structures  
International Society of Explosives Engineers ISEE Performance Specifications for Blasting Seismographs 2017

#### Laboratory Equipment :

Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

#### Traceability:

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#### Scope:

This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

#### Calibration Notes:

#### Calibration Checked and Approved:

Print Name: Ariel Michael

Date: 18/05/2021





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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer

Calibration Date 21/04/2021

Operator AH

Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD

Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010

### Test Item

Manufacturer Endevco

Serial No #10764 #1

Instrument Model 61C13

#### Applicable Work Instruction:

WiTC-99 Accelerometer and Geophone Calibration

#### Reference Standards:

International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 14837-1:2005 Mechanical vibration Ground-borne noise and vibration arising from rail systems - Part 1: General guidance  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer  
British Standard BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting  
British Standard BS7385-2:1993 Evaluation and measurement for vibration in buildings  
German Standard DIN 4150-3:2016 Vibrations in buildings - Part 3: Effects on structures  
International Society of Explosives Engineers ISEE Performance Specifications for Blasting Seismographs 2017

#### Laboratory Equipment :

Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

#### Traceability:

The results of the tests and measurements included in this document are traceable via the test methods described in the applicable work instruction which references the listed international standards.  
And by the use of the above lab equipment, which has been calibrated where required using reference equipment calibrated by NATA accredited calibration facilities.  
This document shall not be reproduced, except in full.

#### Scope:

This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

#### Calibration Notes:

#### Calibration Checked and Approved:

Print Name: Ariel Michael

Date: 18/05/2021





# NATAcoustic

Acoustic Calibration & Testing Laboratory

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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer

<b>Calibration Date</b> 21/04/2021	<b>Operator</b> AH
<b>Client Name</b> RENZO TONIN & ASSOCIATES (NSW) PTY LTD	
<b>Client Address</b> LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010	

### Test Item

<b>Manufacturer</b> Endevco	<b>Serial No</b> #10703 #3
<b>Instrument Model</b> 61C13	

**Applicable Work Instruction:**  
WiTC-99 Accelerometer and Geophone Calibration

**Reference Standards:**  
International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 14837-1:2005 Mechanical vibration Ground-borne noise and vibration arising from rail systems - Part 1: General guidance  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer  
British Standard BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting  
British Standard BS7385-2:1993 Evaluation and measurement for vibration in buildings  
German Standard DIN 4150-3:2016 Vibrations in buildings - Part 3: Effects on structures  
International Society of Explosives Engineers ISEE Performance Specifications for Blasting Seismographs 2017


**Laboratory Equipment :**  
Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

**Traceability:**  
The results of the tests and measurements included in this document are traceable via the test methods described in the applicable work instruction which references the listed international standards.  
And by the use of the above lab equipment, which has been calibrated where required using reference equipment calibrated by NATA accredited calibration facilities.  
This document shall not be reproduced, except in full.

**Scope:**  
This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

**Calibration Notes:**

**Calibration Checked and Approved:**



Print Name: Ariel Michael Date: 18/05/2021





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Acoustic Calibration & Testing Laboratory

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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

## Certificate of Calibration Accelerometer / Vibration Monitor

<b>Calibration Date</b> 2/05/2022	<b>Operator</b> AH
<b>Client Name</b> RENZO TONIN & ASSOCIATES (NSW) PTY LTD	
<b>Client Address</b> LEVEL 1, 418A, ELIZABETH ST, SURRY HILLS, NSW, 2010	

### Test Item

<b>Manufacturer</b> Sigicom	<b>Serial No</b> #102477
<b>Instrument Model</b> Infra c22	

**Applicable Work Instruction:**  
WiTC-100 Sigicom Calibration

**Reference Standards:**  
International Standard ISO8041:2005 Human response to vibration -Measuring instrumentation  
International Standard ISO 16063-1:1998 Methods for the calibration of vibration and shock transducers - Part 1: Basic concepts  
International Standard ISO 16063-21:2003 Methods for the calibration of vibration and shock transducers - Part 21: Vibration calibration by comparison to a reference transducer


**Laboratory Equipment :**  
Electrodynamic shaker - Ground Zero GZNW 18XSPL  
Power Amplifier – Behringer Model NU3000DSP  
Signal generator  
DT 9837A 4-channel data acquisition card  
SpectraPLUS software  
Reference accelerometer

**Traceability:**  
The results of the tests and measurements included in this document are traceable via the test methods described in the applicable work instruction which references the listed international standards.  
And by the use of the above lab equipment, which has been calibrated where required using reference equipment calibrated by NATA accredited calibration facilities.  
This document shall not be reproduced, except in full.

**Scope:**  
This certificate is issued on the basis that the instrument complies with the manufacturer's specification.

**Calibration Notes:**  
Sensitivity of reference accelerometer and measurement chain was verified using a BK 4294 field accelerometer. The measured rms vibration level was within 0.1 dB of the reference level at 1000 rad/s.

**Calibration Checked and Approved:**



Print Name: Ariel Michael Date: 2/05/2022





SINUS Messtechnik GmbH  
Föplstrasse 13  
D-04347 Leipzig, Germany  
☎ +49 341 24429 0  
✉ +49 341 24429 99  
🌐 <http://www.sinusmess.de>

# Production Test for Device

SINUS Expander\_61

Serial Number: #09194

This device was tested according ISO 61672, ISO 60651 and the internal test specifications of the SINUS Messtechnik GmbH.

Date: 01-Feb-2023

Recommended Interval: 24 months

Next Production Test: Jan-2025

Operator: SINUS

Signature:

.....  




# NATAcoustic

## Acoustic Calibration & Testing Laboratory

Level 1, 418A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA  
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au  
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

# Certificate of Calibration Sound Level Calibrator

**Calibration Date** 4/04/2022      **Job No** RB963      **Operator** AH  
**Client Name** RENZO TONIN & ASSOCIATES (NSW) PTY LTD  
**Client Address** LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010

### Test Item

**Calibrator Make** B&K      **Model** 4231      **Serial No** #3027924 #XL2-C  
**Accessories** N/A

**Class (1 or 2)** 1

Environmental Conditions	Measured	
	Start	End
Temperature (degC)	24.4	24.4
Rel. Humidity (%)	47.7	47.8
Air Pressure (kPa)	100.67	100.65

**Applicable Standards:**  
IEC 60942:2017 "Electroacoustics - Sound calibrators"

**Applicable Work Instruction:**  
RWI-08 SLM & Calibrator Verification

**Laboratory Equipment :**  
GRAS Power Module type 12AK SN 1551616  
GRAS 1/2" Pressure Microphone 40AD SN 252620 and preamplifier SN 292045  
B&K4226 Multifunction Acoustic Calibrator SN 2288472  
Agilent Digital Multimeter Model 34401A SN MY41004386  
Audio Tester AUDT30 v3.0 software  
Behringer UCA222 USB Audio Interface U-Control

**Traceability:**  
The results of the tests and measurements included in this document are traceable via the test methods described under each test, and by the use of the above equipment, which has been calibrated by NATA accredited calibration facilities.  
This document shall not be reproduced, except in full.

**Scope:**  
This certificate is issued on the basis that the instrument complies with the manufacturer's specification.  
See "Sound Level Calibrator Verification - Summary of Tests" page for an itemised list of results for each test.

**Uncertainty:**

**Calibration Statement:**  
The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2017.



NATA Accredited Laboratory  
Number 14966

Accredited for compliance with  
ISO/IEC 17025 - Calibration

Authorized Signatory:

Print Name: Ariel Michael

Date: 5/04/2022

Template Document Name: RQT-03 (rev 65) Calibrator Verification

