APPENDIX

O

INLAND RAIL

Noise and Vibration (construction, fixed infrastructure and operational road noise) Technical Report

Part 1 of 2

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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Inland Rail Helidon to Calvert EIS

Appendix O – Noise and Vibration (Construction, Fixed Infrastructure and Operational Road Noise) Technical Report

Australian Rail Track Corporation

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Abbreviations

Abbreviation	Explanation
ANZEC	Australian and New Zealand Environment Council
ARTC	Australian Rail Track Corporation
C2K	Calvert to Kagaru section of the Inland Rail Project
CEMP	Construction Environmental Management Plan
CIA	Cumulative Impact Assessment
CoP Vol 1	*Road Traffic Noise Management: Code of Practice – Volume 1* (DTMR 2013)
CoP Vol 2	*Road Traffic* Noise *Management: Code of Practice – Volume 2* (DTMR 2013)
DEC	Department of Environment and Conservation
DEHP	Department of Environment and Heritage Protection (now Department of Environment and Science)
DES	Department of Environment and Science
Draft Outline EMP	Draft Outline Environmental Management Plan
DTMR	Department of Transport and Main Roads
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1994* (Qld)
EPP(Noise)	*Environment Protection (Noise) Policy 2019*
FFL	Finished floor level
G2H	Gowrie to Helidon section of the Inland Rail Project
H2C	Helidon to Calvert section of the Inland Rail Project
Inland Rail	Melbourne to Brisbane Inland Rail Program
km	kilometre
LEP	Longitudinal Egress Passage
m	metre
NCA	Noise Catchment Areas
NSW	New South Wales
PPV	Peak Particle Velocity
QLD	Queensland
RBL	Rating Background Level
RMS	Root Mean Square
SN	Strategy numbers
SWL	Sound power levels
The proponent	Australian Rail Track Corporation
TI Act	*Transport Infrastructure Act 1994* (Qld)
ToR	Terms of Reference

Glossary

Term	Explanation
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Assessment background level	The overall background level for each day, evening and night period for each day of the noise monitoring.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed.
C-Weighted decibel	The C-weighting is a frequency filter applied to measured noise levels, which attenuates very low (<50 Hz) and very high (>5000 Hz) frequencies. It is typically reserved for peak noise measurements and some entertainment noise applications.
Day	The period from 0700 to 1800 Monday to Friday and 0800 to 1300 Saturday.
Decibel [dB]	The measurement unit of sound.
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: ▪ 0 dB(A) Threshold of human hearing ▪ 30 dB(A) A quiet country park ▪ 40 dB(A) Whisper in a library ▪ 50 dB(A) Open office space ▪ 70 dB(A) Inside a car on a freeway ▪ 80 dB(A) Outboard motor ▪ 90 dB(A) Heavy vehicle pass-by ▪ 100 dB(A) Jackhammer/Subway train ▪ 110 dB(A) Rock Concert ▪ 115 dB(A) Limit of sound permitted in industry ▪ 120 dB(A) 747 take off at 250 m.
Disturbance footprint	The disturbance footprint is the areas subject to direct disturbance (both temporary and permanent) associated with the Project.
EIS investigation corridor	The Environmental Impact Statement (EIS) investigation corridor includes the land surrounding the permanent operational and temporary construction disturbance footprint for the Project within a 1 km radius.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receptor experiencing the same amount of sound energy.
Evening	The period from 1800 to 2200 Monday to Friday and 1300 to 2200 Saturday and 0700 to 2200 Sunday and public holidays.
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Chainage	A measure of distance along the rail corridor from Sydney. The nominated values are not exact distances as there are some local adjustments made to reflect progressive changes to the rail as works are progressively implemented to, for example, ease bends.
L_{Max}	The maximum sound pressure level measured over the measurement period.
L_{Min}	The minimum sound pressure level measured over the measurement period.
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.

Term	Explanation
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Night	The period from 2200 to 0700 Sunday to Friday and 2200 to 0800 Saturdays and public holidays.
Noise and vibration study area	The noise and vibration study area covers the land within two kilometres of the Project alignment that will be potentially affected by the noise and vibration from construction.
Peak particle velocity (PPV)	A measure of ground vibration magnitude, PPV is the maximum instantaneous particle velocity at a point during a given time interval in mm/s.
Permanent operational disturbance footprint	The areas of the Project that will be permanently and directly impacted by the operation of the rail line and associated facilities.
Rating background level (RBL)	The overall background level for each day, evening and night period for the entire length of noise monitoring.
Sound power level (SWL)	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Temporary construction disturbance footprint	The areas of the Project that will be directly impacted by the construction of the rail line, lay down areas, borrow pits, and other areas that will only be used during construction and will be rehabilitated prior to operation and will only be used temporarily.

Executive summary

The Helidon to Calvert (H2C) Project (the Project) comprises approximately 47 km of dual gauge track from Helidon to Calvert. The Project would utilise both existing rail corridor and sections of new track. This technical report assesses noise and vibration related to construction activities, operational road traffic noise and the operation of fixed mechanical plant associated with tunnel infrastructure.

The technical report assessment works have been carried out in accordance with the Project Terms of Reference (ToR). Operational railway noise and vibration is reported separately in the Environmental Impact Statement (EIS) Appendix P: Operational railway noise and vibration technical report.

The technical report assessment works have been carried out under relevant legislation including the *Transport Infrastructure Act 1994* (Qld) (TI Act) and the *Environmental Protection Act 1994* (Qld) (EP Act).

Within the noise and vibration study area, 5,372 sensitive receptors (e.g. residential and commercial buildings) have been identified. The existing noise and vibration environment has been described by monitoring undertaken at 15 locations. Baseline noise measurements were used to determine applicable construction noise criteria under the Department of Transport and Main Roads (DTMR) *Transport Noise Management Code of Practice Volume 2: Construction Noise and Vibration* (DTMR 2015) (CoP Vol 2).

Reasonable worst-case construction scenarios have been assessed for each of the expected key construction activities. The assessment was undertaken in accordance with the CoP Vol 2. Construction noise and vibration impacts vary with the construction activity undertaken and the time of day in which it occurs. As the current construction methodology does not specify the times of day at which construction activities occur, impacts have been assessed against criteria for all times of day. The worst-case impacts of construction noise and vibration against the most stringent criterion are summarised in Table 1.

A desktop assessment of the operational road traffic noise associated with the Project has been carried out in accordance with the DTMR *Transport Noise Management Code of Practice: Volume 1 – Road Traffic Noise* (DTMR 2013) (CoP Vol 1) and ToR. Table 1 summarises the findings of the operational road traffic noise assessment.

An assessment of the operational fixed infrastructure noise has been carried out with reference to the *Environmental Protection (Noise) Policy 2019* (EPP (Noise)) acoustic quality objectives at all sensitive receptors. Table 1 summarises the findings of the operational fixed infrastructure assessment.

Table 1 Non-operational noise and vibration impact assessment findings

Impact	Activity (highest impact)	Criterion (most stringent)	Source	Worst-case unmitigated impacts
Construction noise	Earthworks	Non-standard hours: 45 dB(A) $L_{Aeq,\ adj,\ 15\ min}$	CoP Vol 2	Worst-case 15-minute construction noise impacts are predicted to exceed most stringent night-time noise limit at up to 5,200 potentially affected sensitive receptors.
Construction road traffic noise	Construction traffic movements	3 dB(A) increase in the $L_{A10,\ 1hr}$ (due to construction traffic)	CoP Vol 2	16 road sections are predicted to exceed this limit.
Construction vibration	Percussive (impact) piling	Non-standard hours, human comfort lower limit: 0.3 mm/s PPV	CoP Vol 2	Vibration impacts at between 70 (best case) and 1,299 (worst case) vibration sensitive receptors are expected to exceed this limit.
Blasting ground vibration and airblast overpressure	Construction blasting	115 dB (linear) – 9 out of ten blasts 120 dB (linear) – any blast	CoP Vol 2	Blasting charge masses are not known at this stage. Therefore, maximum allowable instantaneous charge masses have been provided at indicative distances to achieve compliance at nearest potentially affected receptor.

Impact	Activity (highest impact)	Criterion (most stringent)	Source	Worst-case unmitigated impacts
Tunnel construction ground-borne noise	Roadheader operation	Resident, non-standard hours: 35 dB(A) L_{ASMax}	CoP Vol 2	Up to 39 residential receptors are predicted to exceed the non-standard hours noise criterion. These exceedances are only predicted while the tunnel boring machine is within a 615 metres distance of the receptors.
Tunnel construction vibration	Roadheader operation	Resident, non-standard hours, human comfort lower limit: 0.3 mm/s PPV	CoP Vol 2	Vibration levels at up to 10 sensitive receptors are predicted to exceed this criterion.
Operational road traffic noise	Traffic movements on roads undergoing works as part of the Project	New roads: Resident, 60 dB(A) $L_{A10,\ 18\ hr}$ Upgrade existing roads: Resident 68 dB(A) $L_{A10,\ 18\ hr}$	CoP Vol 1	Five new roads and three proposed upgrades to roads are predicted to exceed the road traffic noise criterion at one or more existing receptor.
Operational fixed infrastructure noise	Operation of tunnel ventilation fans	Resident indoor, night-time: 30 dB(A) $L_{Aeq,\ 1\ hr}$	EPP (Noise)	Attenuation is recommended for key fixed infrastructure to achieve compliances with adopted noise objectives.

To mitigate construction noise and vibration impacts for potentially affected sensitive receptors, specific noise management and mitigation measures are incorporated in the Noise and Vibration Sub-plan, which is part of the draft Outline Environmental Management Plan (draft Outline EMP). Mitigation measures include the following:

- Ongoing stakeholder consultation – focussing on proposed works and key areas
- Training of construction site workers – in noise friendly work practices
- Use of temporary noise barriers – for fixed activities
- Monitoring – verification, compliance and noise management
- Appropriate selection and maintenance of equipment – including consideration of equipment source control options (suitable muffler and silencers for example)
- Scheduling of work for less sensitive time periods – where possible
- Situating plant in less noise sensitive locations – this includes orientation of plant and equipment
- Construction traffic management – minimising stacking at work site entrances and extended periods of idling
- Respite periods – focusing on intensive construction works.

Based on the construction noise assessment and proposed examples of mitigation, construction noise impacts at approximately 40 per cent of assessed existing potentially affected receptors are not predicted to be reasonably mitigated to below the appropriate criterion. Physical attenuation was found to be an effective mitigation measure. Where further mitigation not reasonable or practicable, residual impacts will need to be appropriately managed. Management of residual impacts will be undertaken in consultation with the community and affected residents. Residual construction noise impacts present after the application of mitigation will be temporary and will cease once construction finishes. It is proposed that residual construction noise impacts be managed through:

- For significantly and materially impacted residential dwellings – consideration of temporary relocation of affected occupants

- Where intensive construction works are known, and within immediate vicinity of existing residential dwellings - respite periods
- In instances where excessive external noise impacts may occur for long term periods – investigate options for existing residential property at-dwelling architectural treatment(s).

Operational noise impacts will be mitigated as required to meet the relevant criteria. Specific acoustics requirements and site-specific noise control measures will be assessed during the detailed design stage. Received noise levels from fixed infrastructure and operational road noise will be managed appropriately.

1 Introduction

1.1 Project background

The Inland Rail Program (Inland Rail) will provide a dedicated rail corridor between Melbourne and Brisbane via regional Victoria, New South Wales (NSW) and Queensland (QLD). The 1,700 kilometre (km) route is being delivered in 13distinct project sections.

The Helidon to Calvert (H2C) Project (the Project) comprises approximately 47 km of dual gauge track from Helidon to Calvert. The Project would utilise both sections of existing rail corridor and new railway constructed for the Project. The noise and vibration associated with the construction and operation of the Project is a potential source of impact to communities aligning the Project. This technical report assesses noise and vibration related to construction activities as well as operational road traffic noise and the operation of fixed mechanical plant associated with tunnel infrastructure.

1.2 Key features of the Project

Key components of the Project include:

- Single track dual gauge rail line with crossing loops to accommodate trains up 3,600 m long, but initially constructed for 1,800 m long trains
- The 850 m (in length) Little Liverpool Range tunnel, bridges and viaducts to accommodate topography and Project crossings of waterways, roads and other infrastructure
- Approximately 34 km of embankments (excluding structures) and approximately 3,600,000 cubic metres (m^3) cuttings along the length of the alignment
- Tie-ins to the existing West Moreton System rail corridor at the Project boundary and other potential intermediate locations (approximately 24 km of parallel length)
- The construction of associated rail infrastructure, including maintenance sidings and signalling infrastructure to support the train control systems
- Ancillary works, including 36 formed and nine unformed public road interfaces (crossing, relocation or diversion/realignment)
- The relocation or protection of existing utility such as gas pipelines, oil pipe, electricity, water/sewer pipes, communication and any others identified throughout the project phases
- Construction of temporary laydowns, storage, workspace and access roads.
- Ancillary work which would include works to level crossings, signalling and communications, signage and fencing, and services and utilities within the Project disturbance footprint.

1.3 Purpose of this report

An Environmental Impact Statements (EIS) has been prepared to assess the potential environmental impacts associated with the construction and operation of the Project. This technical report provides an assessment of noise and vibration impacts related to construction activities, operational road traffic noise and fixed infrastructure of the Project and has been prepared to support the Project EIS.

Addressing the Terms of Reference (ToR) for the EIS along with relevant acoustical Standards, Policies and guidelines, the assessment addresses the specific matters associated with the construction, road traffic noise and the operation of mechanical plant.

An assessment of impacts related to noise and vibration from railway operations has been assessed separately and detailed in Appendix P: Operational railway noise and vibration technical report.

1.4 Scope of this report

The scope of this noise and vibration impact assessment has been to:

- Identify nearby sensitive receptors potentially affected by the Project
- Take baseline noise and vibration measurements
- Establish criteria for noise and vibration with reference to the Department of Transport and Main Road's (DTMR's) document *Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration* (CoP Vol 2)
- Undertake an assessment of potential noise and vibration from the construction works in accordance with the relevant guidelines
- Assess the potential impact resulting from noise and vibration from construction activities and identify reasonable and practicable measures to reduce and control related impacts at nearby sensitive receptors
- Review vibration intensive construction works and recommend minimum working distances and mitigation measures where required
- Establish operational road traffic criteria, and construction road traffic criteria in consideration of DTMR's *Transport Noise Management Code of Practice Volume 1 – Road Traffic* Noise (CoP Vol 1), and CoP Vol 2 respectively
- Assess operational road traffic noise impacts from key areas of road/rail interface along the alignment
- Undertake a noise impact assessment for proposed steady state noise sources (excluding operational rail noise) such as fixed tunnel infrastructure (mechanical plant)
- Recommend indicative noise and vibration mitigation measures (where required).

1.5 Report limitations

The findings of this report are based on the design and may change as the Project progresses. Should the final design/conditions differ from that information, the impact to nearby receptors may differ from the findings presented in this report. Preliminary mitigation measures have been presented in this assessment; however, a final set of mitigation measures will need to be developed by the construction contractor as a component of the Construction Environmental Management Plan (CEMP).

Operational noise and vibration associated with rail operation has been assessed separately in the EIS Appendix P: Operational railway noise and vibration technical report.

2 Assessment requirements for the project

This section details relevant matters required by the ToR to be considered for the assessment of noise and vibration from construction works, road traffic and operation of fixed infrastructure. The requirements stated in the following documentation have been used as the basis of the construction noise and vibration report:

- Terms of reference for an environmental impact statement: Inland Rail – Helidon to Calvert Project (October 2017).
- Relevant Acts, Legislation and guidelines (e.g. DTMR Code of Practice Volume 2 (CoP Vol 2) which outlines documents such as *Environmental Protection Act 1994* (Qld) (EP Act), *Transport Infrastructure Act 1994* (Qld) (TI Act) and *Professional Engineers Act 2002* as legislative framework).

2.1 Terms of Reference requirements

The relevant sections of the Terms of Reference (ToR) (Part B, Section 11) associated with noise and vibration from construction works, road traffic and the operation of fixed infrastructure have been reproduced in Table 2.1, alongside the relevant sections of this report which address these requirements.

Table 2.1 Terms of Reference requirements

Terms of Reference requirements	Addressed in report
Existing environment	
11.118. Describe the existing noise and vibration environment that may be affected by the project in the context of the environmental values.	Section 3 Chapter 15, Section 15.6 Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.
11.119. Describe and illustrate on maps at a suitable scale, the location of all sensitive noise and vibration receptors adjacent to all project components and estimate typical background noise and vibration levels based on surveys at representative sites.	Section 3.2 Chapter 15, Section 15.6.1 Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.
11.120. If the proposed project could adversely impact on the noise and vibration environment, undertake baseline monitoring at a selection of sensitive receptors potentially affected by the project. Describe the results of any baseline monitoring.	Section 3.3 Chapter 15, Section 15.6.2 Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.
Impact assessment	
11.121. Describe the characteristics of the noise and vibration sources that would be emitted when carrying out the activity (point source and general emissions). Describe noise and vibration emissions (including fugitive sources) that may occur during construction, commissioning and operation.	Section 5 Chapter 15, Sections 15.7 and 15.8 Conservative construction noise and vibration emissions, operational road traffic noise emissions and operational fixed infrastructure noise emissions are considered as part of this assessment. Any additional fugitive noise and vibration emissions are not expected to materially increase impacts beyond the stated worst-case impacts. Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.

Terms of Reference requirements	Addressed in report
11.122. Predict and map the impacts of the noise and vibration emissions from the construction and operation of the project on the environmental values of the receiving environment, including sensitive receptors. The assessment of impacts on noise and vibration consider, as applicable the following: a) EPP (Noise) 2008, using recognised quality assured methods b) Environmentally Relevant Activities - DEHP Application Requirements for ERAs with noise impacts (Guideline ESR/2015/1838) c) Construction – The DTMR Transport Noise Management Code of Practice: Volume 2 - Construction Noise and Vibration dated March 2016 and gazetted on 29 July 2016 d) Operational noise – The Department of Transport and Main Roads Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure Version 2, 10 May 2013 (Rail noise external criteria contained in Table 3 of the document). e) Operational vibration – British Standard BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting. British Standards Institution, London. f) The Department of Transport and Main Roads Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure Version 2, 10 May 2013 (refer to criteria contained in Table 6 of the document)	Section 5.4 Chapter 15, Sections 15.4, 15.7 and 15.8 Operational rail noise and vibration impacts included in Appendix P: Operational railway noise and vibration technical report. b) No Environmentally Relevant Activities (ERAs) are being sought as part of this approval process (i.e. EIS). Where an ERA is required to be sourced for the Project during detailed design, the required approval process will consider this guideline.
11.123. Discuss separately the key project components likely to present an impact on noise and vibration for the construction and operation phases of the project.	Chapter 15, Sections 15.7 and 15.8 Operational rail noise and vibration is covered in Appendix P: Operational railway noise and vibration technical report. Operational fixed infrastructure noise and operational road traffic noise is included in Section 6. Construction phases impacts are covered in Section 5 of this report.
11.124. Taking into account the practices and procedures that would be used to avoid or minimise impacts, the impact prediction must address the: a) activity's consistency with the objectives of documentation referenced in 11.122 b) cumulative impact of the noise and vibration with other known emissions of noise associated with existing major projects and/or developments and those which are progressing through planning and approval processes publicly available c) potential impacts of any low-frequency (<200 Hz) noise emissions.	Cumulative impacts are addressed in Section 7. Chapter 15, Sections 15.8, 15.9 and 15.10 Low frequency noise impacts from construction noise and vibration are discussed in Section 4.1. Low frequency noise from operational rail impacts are assessed separately in Appendix P: Operational railway noise and vibration technical report.
Mitigation measures	
11.125. Describe how the proposed project and, in particular, the key project components described above, would be managed to be consistent with best practice environmental management for the activity. Where a government plan is relevant to the activity, or the site where the activity is proposed, describe the activity's consistency with that plan.	Section 8 Chapter 15, Section 15.9 Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.
11.126. Describe any expected exceedances of noise and vibration goals or criteria following the provision or application of mitigation measures and how any residual impacts would be addressed.	Section 8.3 Chapter 15, Section 15.9.3 Operational rail noise and vibration impacts covered in Appendix P: Operational railway noise and vibration technical report.
11.127. Describe how the achievement of the objectives would be monitored and audited, and how corrective actions would be managed.	Section 8 Chapter 15, Section 15.9.2 Operational rail noise and vibration is included in Appendix P: Operational railway noise and vibration technical report.

Terms of Reference requirements	Addressed in report
11.166. Describe the climate patterns with particular regard to discharges to water and air and the propagation of noise related to the project.	The noise predictions in Section 5 include specific parameters for local weather conditions. Chapter 15, Section 15.1

2.2 Legislation

QLD legislation which defines requirements for the noise and vibration assessment and environmental approval processes for this project includes:

- TI Act
- EP Act.

The TI Act requires that the construction, maintenance and operation of government supported infrastructure is carried out according to standards published by the Chief Executive administering the TI Act. The CoP Vol 1 is a standard under the TI Act.

The EP Act regulates activities which cause or have the potential to cause environmental harm and includes a requirement for a person to comply with the general environmental duty, which requires a person to take all 'reasonable and practicable measures' to prevent or minimise environmental harm. Schedule 1 Part 1 of the EP Act excludes noise from the ordinary use of rail transport infrastructure as constituting unlawful environmental nuisance or unlawful contravention of a noise standard.

Specific documents are gazetted under the EP Act to assess impacts. The CoP Vol 2 is an approved code of practice made under the EP Act and is a means of demonstrating compliance with the General Environmental Duty under the EP Act. CoP Vol 2 is an applicable noise guideline in the ToR.

The EPP (Noise) supports the operation of the EP Act by identifying environmental values to be enhanced or protected, stating acoustic quality objectives for enhancing or protecting environmental values and providing a framework for consistent, equitable and informed decisions about the acoustic environment. Environmental values that are to be enhanced or protected under the EPP (Noise) policy include the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems, human health and wellbeing and protecting the amenity of the community. Schedule 1 of the EPP (Noise) includes acoustic quality objectives for sensitive receptors and those environmental values that are to be enhanced or protected under the policy. The EPP (Noise) is an applicable policy in the ToR.

2.3 Relevant guidelines and policies

Queensland legislation which defines requirements for the noise and vibration assessment and environmental approval processes for this Project includes:

- *Transport Infrastructure Act 1994* (TI Act)
- *Environmental Protection Act 1994* (EP Act)
- Environmental Protection (Noise) Policy 2019, (EPP(Noise)), subordinate to the EP Act.

Legislation of relevance to noise and vibration aspects of the Project are discussed in Chapter 3: Project approvals.

The TI Act requires the construction, operation and maintenance of all government supported infrastructure to be carried out according to standards published by the Chief Executive. DTMR's document *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* (CoP Vol 1) is implemented as a legislative requirement under the TI Act and identifies the requirements for road traffic noise associated with completion of the Project.

DTMR's document *Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration* (CoP Vol 2) has been gazetted under s318E of the EP Act. It is also named as an applicable guideline within the ToR. The CoP Vol 2 has requirements for various stages of projects and is a means of demonstrating compliance with the General Environmental Duty under the EP Act. By complying with relevant legislation, and government plans, policies, standards and guidelines (such as the CoP Vol 1 and CoP Vol 2), the Project will be consistent with the principles of best practice environmental management.

All policies, guidelines and plans of relevance to this assessment are presented in Table 2.2. No other government plans were considered relevant for this assessment.

Table 2.2 Policies, standards and guidelines applicable to the assessment of noise and vibration

Policy, standard or guideline	Relevance to the Project
Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (CoP Vol 1) (DTMR, 2013a)	The CoP Vol 1 is a standard under the TI Act. It identifies the requirements for road traffic noise associated with completion of the Project. Applicable criteria and assessment methodologies are included within this document to adequately assess noise associated with road traffic noise.
Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration (CoP Vol 2) (DTMR, 2016d)	The CoP Vol 2 is gazetted under the EP Act. It identifies the requirements for construction activities for the transport infrastructure. Applicable criteria and potential mitigation measures are included within this document to adequately assess noise and vibration associated with construction works.
Operational Railway Noise and Vibration Interim Guideline – Government Supported Transport Infrastructure (DTMR, 2019a)	The Interim Guideline identifies the noise and vibration requirements for railway transport infrastructure. Applicable criteria and potential mitigation measures are included within this document to adequately assess noise and vibration associated with rolling stock operations.
German Standard DIN 4150: Part 3 1999 *Structural Vibration in Buildings - Effects on Structures* (Deutsches Institut für Normung, 1999)	This standard is prescribed by CoP Vol 2. It provides recommended maximum levels of vibration that reduce the likelihood of building damage caused. These recommended maximum levels have been used as vibration criteria.
Australian Standard AS 1055-2018 – *Acoustics – Description and measurement of environmental noise*, 2018	The CoP Vol 2 prescribes that noise measurement and reporting should be conducted in accordance with the construction and ambient noise provisions included in AS 1055-2018.
Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, (ANZEC 1990)	The CoP Vol 2 references the blasting vibration criteria contained within this document. This document also provides suggested mitigation measures for blasting noise and vibration impacts.
Australian Standard 2187.2-2006 *Explosives - Storage and Use Part 2: Use of Explosives* – Appendix J.	The CoP Vol 2 recommends the use of AS 2187.2 with respect to blasting vibration criteria for human comfort and structural damage. These ground vibration criteria have been adopted for this assessment.
DEHP Guideline – *Noise and Vibration from Blasting* (DEHP, 2016)	The CoP Vol 2 adopts the criteria to minimise annoyance from airblast resulting from blasting.
DES *Application requirements for activities with noise impacts*, (DES 2017a)	This guideline under the EP Act provides guidance on the requirements for assessments of noise impacts, including the requirement for supplementary approvals for ERAs. Approval for ERAs that may be required by the Project will be sought separately to the approval being sought through the EIS process. Appropriate noise and vibration assessments, as required, will be undertaken at a later date to inform the necessary development approval application(s).
British Standard BS 5228.2-2009 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (British Standards, 2009b)	This standard is referenced for guidelines on vibration analysis and values for the management of building damage.
British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* (British Standards, 2008)	The ToR requires the use of BS 6472 with respect to vibration criteria for human comfort and structural damage. These ground vibration criteria have been adopted for this assessment.

Policy, standard or guideline	Relevance to the Project
Policy for Development of Land Affected by Environmental Emission Transport and Transport Infrastructure Version 2 (DTMR, 2013d)	This policy identifies the applicable criteria and assessment requirements where environmental noise and vibration from transport infrastructure has the potential to impact the development of land.

3 Existing noise environment

3.1 Project description

The Project is located adjacent to the Warrego Highway a major connecting route to Toowoomba and large western QLD towns. There are both existing brownfield locations with existing rail infrastructure and proposed greenfield locations along the Project alignment. The Project also passes through Range Crescent in Laidley which includes mountainous terrain. The EIS investigation corridor includes the land surrounding the permanent operational and temporary construction disturbance footprint for the Project within a 1 km radius. This noise and vibration study area covers the land within 2 km of the Project alignment that will be potentially affected by noise and vibration from construction.

3.2 Sensitive receptors

The land around the EIS investigation corridor is predominantly disturbed rural land. The Project alignment crosses a number of local and private roads, townships, creeks and privately-owned properties. There are several towns located along the Project alignment including Helidon, Gatton, Forrest Hill, Laidley, Grandchester and Calvert. In addition, there are a number of scattered rural residential properties.

Sensitive receptors applicable to the Project have been identified throughout the noise and vibration study area. The CoP Vol 2 and EPP Noise define the sensitive land uses (receptors) that could potentially be impacted by construction noise and vibration.

Sensitive receptors to be considered for this assessment include a:

- Dwelling (detached or attached) including house, townhouse, unit, reformatory institution, caravan park or retirement village
- Library, childcare centre, kindergarten, school, school playground, college, university, museum, art gallery or other educational institution, hospital, respite care facility, nursing home, aged care facility, surgery or other medical centre
- Community building including a place of public worship
- Court of law
- Hotel, motel or other premises which provides accommodation for the public
- Commercial (office) or retail facility
- Protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest under the *Nature Conservation Act 1992*
- Outdoor recreational area (such as public park or gardens open to the public, whether or not on payment of a fee, for passive recreation other than for sport or organised entertainment) or a private open space
- Industrial land usage (these are only classified as vibration sensitive and as such are not included as a sensitive receptor for the assessment of construction noise impacts).

Each sensitive receptor within the noise and vibration study area was identified using a combination of QLD land property information and investigation of aerial imagery to capture any additional sensitive receptors.

Due to the large number of sensitive receptors within the noise and vibration study area these localities form six Noise Catchment Areas (NCA), one for each of the localities listed and an additional NCA covering the remaining more isolated receptors within the noise and vibration study area, The number of construction noise sensitive receptors within each of these NCAs are included in Table 3.1 and the extent of each NCA is included in Appendix A.

Table 3.1 Project noise catchment areas

NCA	Locality/urban areas	Number of construction noise sensitive receptors
NCA_01	Helidon	336
NCA_02	Placid Hills	263
NCA_03	Gatton	2497
NCA_04	Forrest Hill	278
NCA_05	Laidley	1202
NCA_06	Reminder within study area	753

Within all the NCAs a total of 5,329 noise sensitive receptors were identified. In addition to these there are 107 locations identified as being used for industrial purposes which are only classified as vibration sensitive receptors for vibration and blasting assessments.

3.2.1 Heritage structures

There were 42 receptors identified as being sites of special value or significance, determined within Appendix S: Non-Indigenous cultural heritage technical report. These sites include residential buildings, hotels, an office building and a retail receptor. Each of these are classified as noise sensitive and the applicable criteria for each is outlined in Section 4.1.1. The remaining heritage structures are not classified as noise sensitive but are included in the vibration assessment. These have been included within the totals in Table 3.1.

3.3 Noise and vibration monitoring

A survey of existing environmental noise and vibration levels was conducted to quantify and characterise the existing environment at the sensitive receptors communities alignment the Project.

Baseline noise monitoring was conducted at 15 locations within the noise and vibration study area during November and December 2018. The survey included long term continuous monitoring of ambient noise levels with noise loggers to define the daily noise levels supported by short term (attended) noise measurements to provide additional information about the existing noise environment and any significant noise sources.

Attended surface vibration measurements were completed in July 2019 to investigate the existing vibration levels.

3.3.1 Instrumentation

3.3.1.1 Noise instrumentation

Details of the equipment used for unattended long-term noise monitoring are presented in Table 3.2. The noise monitoring locations are shown within the Project overview map included in Appendix A.

All acoustic instrumentation used for the assessment comply with the requirements of AS IEC 61672.1-2004 *Electroacoustics – Sound level meters – Specifications* (Australian standards 2004) and were calibrated before and after monitoring sessions with a drift in calibration not exceeding ± 0.5 dB.

All instruments used were within their current calibration period. All calibration certificates have been included within Appendix B.

Table 3.2 Unattended noise monitoring details

Monitor ID	Address	Start date	End date	Logger type	Serial number
H2C_01	565 Connors Road, Helidon, QLD, 4344	29/11/2018	6/12/2018	01 dB Cube	12602
H2C_02	108 Seventeen Mile Road, Helidon, QLD, 4344	29/11/2018	6/12/2018	01 dB Cube	10824
H2C_03	150 Brigalow Street, Placid Hills, QLD, 4343	29/11/2018	6/12/2018	01 dB Cube	11100
H2C_04	14 East Street, Wandoan, QLD, 4419.	29/11/2018	6/12/2018	01 dB DUO	12608
H2C_05	1 Old College Road, Gatton, QLD, 4343	6/12/2018	18/12/2018	Rion NL-52	01265386
H2C_06	4 Ford Street, Gatton, QLD, 4343	28/11/2018	7/12/2018	Larson Davis 831	1620
H2C_07	Golf Links Dr & Woodlands Road, Gatton, QLD, 4343	29/11/2018	6/12/2018	01 dB Cube	11096
H2C_08	1 Hunt Street, Forrest Hill, QLD, 4342	30/11/2018	7/12/2018	01 dB Cube	11107
H2C_09	52 Victoria Street, Forrest Hill, QLD, 4342	30/11/2018	7/12/2018	01 dB DUO	12605
H2C_10	88 Douglas McInnes Drive, Laidley, QLD, 4341	30/11/2018	7/12/2018	01 dB DUO	12604
H2C_11	11 Tyrell Court, Laidley, QLD, 4341.	28/11/2018	7/12/2018	Rion NL-52	00175550
H2C_12	40 School Road, Grandchester, QLD, 4340	28/11/2018	5/12/2018	01 dB DUO	12601
H2C_13	5 Long Gully Road, Grandchester, QLD, 4340	28/11/2018	5/12/2018	01 dB DUO	12609
H2C_14	11 Hall Road, Grandchester, QLD, 4340	30/11/2018	7/12/2018	01 dB DUO	12606
H2C_15	52 Mountain road, Laidley, QLD, 4341	13/12/2018	20/12/2018	Larson Davis 831	3339

The sound level meters used to conduct attended noise measurements are presented in Table 3.3.

Table 3.3 Attended measurement monitoring details

Monitor ID	Attended Measurement 1 Date	Logger type	Serial number	Attended Measurement 2 Date	Logger type	Serial number
H2C_01	29/11/2018	NTI-XL2	A2A-09320-E0	6/12/2018	SVAN 957	27537
H2C_02	29/11/2018	SVAN 957	27537	6/12/2018	SVAN 957	27537
H2C_03	29/11/2018	SVAN 957	27537	6/12/2018	SVAN 957	27537
H2C_04	29/11/2018	NTI-XL2	A2A-09320-E0	6/12/2018	NTI-XL2	A2A-09320-E0
H2C_05	6/12/2018	NTI-XL2	A2A-09320-E0	18/12/2018	NTI-XA	A2A-09320-E0
H2C_06	28/11/2018	SVAN 957	27537	7/12/2018	SVAN 957	27537
H2C_07	29/11/2018	SVAN 957	27537	6/12/2018	SVAN 957	27537
H2C_08	30/11/2018	SVAN 957	27537	7/12/2018	SVAN 957	27537
H2C_09	30/11/2018	NTI-XL2	A2A-09320-E0	7/12/2018	NTI-XA	A2A-09320-E0
H2C_10	30/11/2018	SVAN 957	27537	7/12/2018	NTI-XA	A2A-09320-E0
H2C_11	28/11/2018	SVAN 957	27537	7/12/2018	NTI-XA	A2A-09320-E0
H2C_12	28/11/2018	SVAN 957	27551	5/12/5018	SVAN 957	27537
H2C_13	28/11/2018	NTI-XL2	A2A-09320-E0	5/12/2018	SVAN 957	27537
H2C_14	30/11/2018	NTI-XL2	A2A-09320-E0	7/12/2018	NTI-XA	A2A-09320-E0
H2C_15	13/12/2018	SVAN 957	27551	20/12/2018	SVAN 957	27537

3.3.1.2 Vibration instrumentation

Details of the equipment used for attended vibration monitoring are presented in Table 3.4.

Table 3.4 Vibration monitoring details

Monitor ID	Address	Date	Equipment type	Serial number	Calibration date
H2C_V01	Chadwick Road, Gatton, QLD, 4343	04/07/2019	Instatel Minimate Plus	14070	10/05/19
			Instatel Standard Triaxial Geophone	BT2091	10/05/19
H2C_V02	Railway Street, Forest Hill, QLD, 4342	03/07/2019	Instatel Minimate Plus	14070	10/05/19
			Instatel Standard Triaxial Geophone	BT2091	10/05/19
H2C_V03	Dutton Street, Laidley, QLD, 4341	03/07/019	Instatel Minimate Plus	14070	10/05/19
			Instatel Standard Triaxial Geophone	BT2091	10/05/19

3.3.2 Unattended noise monitoring results

The noise loggers measured the noise level over the sample period and the noise levels were quantified using a range of noise metrics; L_{A1}, L_{A10}, L_{A90}, and L_{Aeq}.

The ambient background levels are established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual background noise levels determined over the entire monitoring duration. The RBL is representative of the average minimum background sound level, or simply the rating background level.

A summary of the RBL noise levels is presented in Table 3.5. Detailed reports including graphical representations of the logging results, a summary of the results and the measurement locations are provided in Appendix B.

Table 3.5 Measured long term background levels

Monitoring location	RBL, dB(A)		
	Day[1]	Evening[1]	Night[1]
H2C_01	39	34	26
H2C_02	38	37	35
H2C_03	44	42	31
H2C_04	38	36	29
H2C_05	38	38	31
H2C_06	39	36	29
H2C_07	48	43	33
H2C_08	39	35	32
H2C_09	40	40	38
H2C_10	32	33	32
H2C_11	31	29	21
H2C_12	33	28	22
H2C_13	34	38	36

Monitoring location	RBL, dB(A)		
	Day[1]	Evening[1]	Night[1]
H2C_14	38	40	35
H2C_15	35	34	25

Table notes:

1 In accordance with the CoP Vol 2, time of day is defined as follows:
- Day – the period from 7.00 am to 6.00 pm Monday to Friday or 8.00 am to 1.00 pm on Saturday
- Evening – the period from 6.00 pm to 10.00 pm Monday to Friday, 1.00 pm to 10.00 pm on Saturday, 7.00 am to 10.00 pm on Sunday
- Night – Monday to Sunday10.00 pm to 7.00 am and Saturday 10.00 pm to 8.00am.

Monitoring location H2C_09, H2C_13 and H2C_14 was influenced by steady state noise such as refrigeration units. Notwithstanding, the monitored noise levels were below the default minimum requirements in CoP Vol 2 and the measurements are considered valid for this study.

3.3.3 Attended noise monitoring results

Attended noise monitoring was conducted at all unattended monitoring locations between November and December 2018. Each measurement was conducted over a 15-minute period. Weather conditions were clear during the period of monitoring, with minimal wind unless stated otherwise. The monitoring results from the attended measurements are presented in Table 3.6.

The key noise sources within the surround environments were distant road traffic noise, infrequent vehicle pass-by events on local roads and natural sources from flora and fauna. An individual train passby events was measured at locations H2C_10 and H2C_12, whilst the train passby on the existing West Moreton System influenced the localised noise measurements, the single passby was not sufficient to quantify existing daily railway noise levels at the monitoring locations.

Table 3.6 Measured attended noise monitoring results

Monitoring location	Date	Time	Summary of observations	$L_{Amax, 15min}$, dB(A)	$L_{A10, 15min}$, dB(A)	$L_{A90, 15min}$, dB(A)	$L_{Aeq, 15min}$, dB(A)
H2C_01	29/11/18	14:15	Trucks 46-56 dB(A), Distant road traffic noise 41-49 dB(A), Train pass-by 45-57 dB(A), Train horn 68 dB(A)	70	50	43	48
	06/12/18	11:00	Wind gust 53-55 dB(A), Impact noise 81 dB(A), Truck 63 dB(A), Distant road traffic noise 40-46 dB(A)	83	47	41	50
H2C_02	29/11/18	14:30	Truck 55-57 dB(A), Car pass-by 40 dB(A), Wind gust 44 dB(A), Bird 50-55dB(A)	70	50	42	49
	06/12/18	12:45	Truck 56-58dB(A), Bird 48 dB(A), Distant road traffic noise 42-46 dB(A)	69	53	43	50
H2C_03	29/11/18	11:30	Distant traffic from Warrego Highway 60-69 dB(A), Wind gusts 53-62 dB(A)	69	57	49	55
	06/12/18	9:30	Impact noise 61 dB(A), Birds 56 dB(A), Truck on Warrego Highway 73 dB(A), Dog barking nearby 101 dB(A), Distant traffic from Warrego Highway 51-55 dB(A)	101	59	51	77
H2C_04	29/11/18	12:00	Lawn mower 42-47 dB(A), Truck on local road 59 dB(A), Wind gust 50 dB(A), Motorbike 48 dB(A), Car on local road 47 dB(A)	65	49	42	47
	06/12/18	10:15	Car on local road 45-55 dB(A), Distant road traffic noise 40-42 dB(A), Birds 46-54 dB(A)	73	52	42	52

Monitoring location	Date	Time	Summary of observations	$L_{Amax, 15min}$, dB(A)	$L_{A10, 15min}$, dB(A)	$L_{A90, 15min}$, dB(A)	$L_{Aeq, 15min}$, dB(A)
H2C_05	06/12/18	9:15	Car on local road 53-58 dB(A), Truck 60 dB(A), Distant road traffic noise 51 dB(A)	86	57	49	57
	18/12/18	16:30	Car on local road 46-60 dB(A), Truck pass-by 55 dB(A), Insects 46 dB(A), Train pass-by 64-70 dB(A)	70	54	40	52
H2C_06	28/11/18	16:30	Strong wind gusts during measurement 55-64 dB(A), Impact noise 74 dB(A)	75	57	49	55
	07/12/18	7:45	Distant road traffic noise 49-53 dB(A), Dog barking 65 dB(A), Birds 54-62 dB(A)	65	53	46	50
H2C_07	29/11/18	17:00	Birds at 71 dB(A), Trucks 56-62 dB(A), Train pass-by 55-59 dB(A), Distant road traffic noise 50-53 dB(A)	72	58	50	56
	06/12/18	7:45	Distant road traffic noise 48-54 dB(A), Birds 62-72 dB(A), Truck 57-61 dB(A)	73	58	51	55
H2C_08	30/11/18	10:45	Tractor 48 dB(A), Truck 50 dB(A), Train pass-by 60-81 dB(A), Distant road traffic noise 37 dB(A)	81	57	37	63
	07/12/18	9:00	Cars on local road 64-70 dB(A), Trucks 58-67 dB(A), Impact noise 66 dB(A), Construction truck 62 dB(A)	70	60	45	56
H2C_09	30/11/18	12:00	Car 50-58 dB(A), Birds 42-64 dB(A), Trucks 56-65 dB(A), Ambient noise level 47 dB(A) in absence of road traffic	66	53	44	50
	07/12/18	9:30	Maintenance machine dominating measurement, Dogs 64 dB(A), Trucks 54-67 dB(A), Cars 63 dB(A)	71	62	58	61
H2C_10	30/11/18	9:30	Ambient noise level 32 dB(A) in absence of road traffic, Car pass-by 44-62 dB(A), Truck on local road 44-60 dB(A), Cows 40-48 dB(A)	69	45	32	45
	07/12/18	8:45	Birds 40-48 dB(A), Train pass-by 47-78 dB(A), Insects 40 dB(A), Ambient noise level 38-40 dB(A) in absence of road traffic	79	48	36	57
H2C_11	30/11/18	12:45	Distant road traffic noise 35-40 dB(A), Dog barking 91 dB(A), Local neighbourhood noise 42-44 dB(A)	93	45	34	63
	07/12/18	10:30	Aeroplane 58 dB(A), Truck 55 dB(A), Impact noise 55 dB(A), Dog barking 65-83 dB(A), Ambient noise level 32-39 dB(A) in absence of road traffic	86	65	33	67
H2C_12	28/11/18	12:45	Strong wind gusts dominated the measurement, Train pass-by at 61 dB(A)	75	64	58	61
	07/12/18	11:30	Ambient noise level 40 dB(A) in absence of road traffic, Bird noise 45-51dB(A), Insects 40 dB(A)	55	45	38	42
H2C_13	13/12/18	14:00	Insect noise 37-56 dB(A), Birds at 50-71 dB(A)	71	57	37	53
	20/12/18	12:45	Cars 55-57 dB(A), Aeroplane 53 dB(A), Insects 37-56 dB(A)	60	55	39	49
H2C_14	28/11/18	16:45	Distant road traffic noise 49-52 dB(A), Car pass-by 52-55 dB(A), Bird noise 56-73 dB(A), Truck 55-60 dB(A), Residence 57 dB(A)	73	56	49	54
	05/12/18	14:45	Car passby 51-55 dB(A), Truck 58-67 dB(A), Bird 72 dB(A), Distant road traffic noise 47 dB(A)	73	57	46	54

Monitoring location	Date	Time	Summary of observations	$L_{Amax, 15min}$, dB(A)	$L_{A10, 15min}$, dB(A)	$L_{A90, 15min}$, dB(A)	$L_{Aeq, 15min}$, dB(A)
H2C_15	28/11/18	12:45	Bird noise 50-52 dB(A), Ambient noise level 40 dB(A) in absence of road traffic, Mechanical noise 41-49 dB(A)	73	65	56	62
	05/12/18	12:00	Background noise dominated by wind blowing trees, Local car pass-by 64 dB(A)	65	48	41	45

3.3.4 Vibration monitoring results

Table 3.7 contains the surface vibration measurement site summary showing the Peak Particle Velocity (PPV) vibration levels from the monitoring period. The PPV level is typically used to represent levels where structural damage would occur to buildings and infrastructure. Sources of existing background vibration include vehicle movements, wind gusts, and nearby fauna.

Each attended vibration measurement was taken over a minimum period of 15 minutes. Three representative locations along the H2C alignment were used as measurement locations to provide baseline levels for a rural environment. Each measurement was taken with a triaxial geophone and the sum of each vector is presented in Table 3.7.

These measurements highlight that the outdoor baseline surface vibration levels are low without dominant vibrating sources. The measurements are expected for a rural environment where the main source of vibration is from vehicle passby and natural sources.

Table 3.7 Background vibration measurements

Site[1]	Location	Date	Time	PPV, mm/s
H2C_V01	Chadwick Road, Gatton, QLD	04/07/2019	07:05 – 07:26	0.13
H2C_V02	Railway Street, Forrest Hill, QLD	03/07/2019	16:55 - 17:12	0.09
H2C_V03	Dutton Street, Laidley, QLD	03/07/019	15:25 – 15:57	0.10

4 Assessment criteria

4.1 Construction noise criteria

4.1.1 External construction airborne noise criteria

The CoP Vol 2 includes noise criteria for the assessment of potential impacts associated with noise and vibration levels from construction. For dwellings (including hotels and motels), noise emissions associated with construction activities were assessed using the noise criteria in Table 4.1. For commercial and retail activities required to be assessed in the Project, the upper values in the table were utilised.

The limits are for the noise contribution from construction only (component limit) and are defined as external façade corrected noise levels at 1.5 m above floor level. The external noise level is determined based on the measured RBL at representative locations within the noise and vibration study area.

The definition of standard and non-standard hours is presented in Table 4.2. Table 4.3 outlines the adjustment factors that should be applied to the analysis. The DTMR CoP Vol 2 construction noise limits for non-standard hours have been adopted as part of this assessment. In assessing non-standard hours, potential sleep disturbance impacts, such as; awakening, disrupted sleep or a general reduction to the quality of sleep over time are factors that will be considered during construction.

Table 4.1 External construction noise criteria

Work period		**External noise level $L_{Aeq,adj,15min}$[4,5], dB(A)**	
		Lower limit	**Upper limit[6]**
Standard hours		RBL + 10[1,2,3]	75 where RBL >55
			70 where 40< RBL ≤55
			65 where RBL ≤40
Non-standard hours	Evening	RBL + 5	RBL + 5
	Night-time		

Source: CoP Vol 2

Table notes:

1 RBL + 5 dB(A) will be considered where a facility, equipment and long-term earthworks are required in an area for greater than six months

2 Where the lower limit value exceeds the upper limit value, the lower limit value is taken to equal the upper limit value

3 Minimum lower limit is 50 dB(A) for Standard hours and 45 dB(A) for Non-Standard Hours. A maximum lower limit of 75 dB(A) applies to Non-Standard Hours

4 Noise contribution from construction activity determined as the component level

5 The noise level from construction includes adjustment factors in Table 4 3 (for example, low frequency noise, impulsivity, tonality, intermittency and modulation)

6 For a single short event in a 24-hour period, the upper limit may be increased by:

- a. for Standard Hours
  - i. 2 dB(A) for event of 6 minutes to 15 minutes
  - ii. 10 dB(A) for event of 1.5 minutes to 6 minutes
  - iii. 15 dB(A) for event of less than 1.5 minutes
- b. for Non-Standard Hours
  - i. 5 dB(A) for event of less than 1.5 minutes

The single short event adjustment is designed to account for unusual and one-off events and does not apply to regular high-noise levels that occur more frequently than once per day.

Table 4.2 CoP Vol 2 work periods for construction activities

Work period	General construction and construction traffic	Blasting
Standard hours	Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm	Monday to Friday 9.00 am to 5.00 pm Saturday 9.00 am to 1.00 pm
Non-Standard Hours – day/evening	Monday to Friday 6.00 pm to 10.00 pm Saturday 1.00 pm to 10.00 pm Sunday 7.00 am to 10.00 pm	Generally, blasting is not to be conducted outside Standard Hours. Any blasting outside of Standard Hours must be approved by DTMR prior to blasting. It is noted that reduced limits may be required to be achieved.
Non-Standard Hours – night time	Monday to Sunday 10.00 pm to 7.00 am	

Source: (CoP Vol 2)

Table 4.3 outlines the adjustment factors that should be applied to the analysis in order to consider noise characteristics as per the CoP Vol 2.

Table 4.3 CoP Vol 2 adjustment factors

Factor	Assessment/ measurement	When to apply	Correction	Comments
Tonal noise	1/3 octave or narrow band analysis	Level of 1/3 octave band exceeds the level of the adjacent bands on both sides by: ▪ 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz. ▪ 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive ▪ 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB	Narrow-band frequency analysis may be required to precisely detect presence of tonality.
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A frequency weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB	C-weighting is designed to be more responsive to low-frequency noise. All noise energy down to 10 Hz will be considered.
Impulsive noise	A-weighted fast response and impulse (I) response or C-weighted for low frequency noise	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB. If difference in C-weighted maximum noise levels between fast response and impulse response is greater than 2 dB for low frequency noise.	Apply difference in measured levels as the correction, up to a maximum of 5 dB	Impulse response is defined by a short rise time of 35 milliseconds (ms) and decay time of 1.5 seconds (s).
Intermittent/ modulating noise	Measurement of difference between LA10 and LA90, average difference between short term samples, or subjectively assessed	▪ Difference between LA10 and LA90 exceeds 5 dB repeatedly for a characteristic averaging period (for example, 10 seconds) for intermittent sources. ▪ Average difference between measured LAeq levels exceeds 5 dB for a characteristic sampling frequency (for example, 10 Hz) for rapidly varying source. Subjectively annoying for a combination not easily characterised.	5 dB	Adjustment to be applied for night-time only.

Factor	Assessment/ measurement	When to apply	Correction	Comments
Maximum adjustment	Refer to individual modifying factors	Where two or more adjustment factors are indicated	Maximum correction of 10 dB(A)	-

Source: CoP Vol 2

The only applicable adjustment factor to the Project is the penalty due to impulsive noise. This adjustment is applied to the construction works required for structures which includes impact piling.

The RBL for each NCA is the lowest RBL value from the corresponding noise monitoring locations within the NCA. The noise monitoring surveys determined the existing RBLs adjacent to the alignment are below the lower limit and the lower limit would be the primary objective for maintaining amenity during construction works.

The applicable RBL levels and resultant upper and lower noise limits is presented in Table 4.4.

Table 4.4 Noise catchment area construction working criteria

NCA	Period	RBL L_{A90} dB(A)	External noise level $L_{Aeq,adj,15\ min}$ dB(A)[1]	
			Lower limit	Upper limit
NCA_01	Standard hours (day)	39	50	65
	Non-standard hours (evening)	34	45	45
	Non-standard hours (night)	26	45	45
NCA_02	Standard hours (day)	44	54	70
	Non-standard hours (evening)	42	47	47
	Non-standard hours (night)	31	47	47
NCA_03	Standard hours (day)	38	50	65
	Non-standard hours (evening)	36	45	45
	Non-standard hours (night)	29	45	45
NCA_04	Standard hours (day)	35	50	65
	Non-standard hours (evening)	32	45	45
	Non-standard hours (night)	31	45	45
NCA_05	Standard hours (day)	31	50	65
	Non-standard hours (evening)	29	45	45
	Non-standard hours (night)	21	45	45
NCA_06	Standard hours (day)	35	50	65
	Non-standard hours (evening)	34	45	45
	Non-standard hours (night)	25	45	45

Table notes:

1 In accordance with CoP Vol 2, a minimum lower limit of 50 dB(A) for standard hours and 45 dB(A) for non-standard hours has been adopted
2 Where the lower limit value exceeds the upper limit value, the lower limit value is taken to equal the upper limit value
3 Time of work period included in Table 4.2.

4.1.2 Noise criteria for critical facilities

CoP Vol 2 defines internal noise criteria for critical facilities, which are to be met where reasonable and practicable, and which applies for the operational hours of the facility. These are presented in Table 4.5.

Table 4.5 CoP Vol 2 internal construction noise criteria for critical facilities

Type of occupancy/activity	Internal noise level $L_{Aeq,adj,15min}$, dB(A)	Applicable facilities
Medical/health buildings (wards, surgeries, operating theatres, consulting rooms)	40	Laidley Hospital, Gatton Hospital, Tabeel Aged Care, Tabeel Retirement living, Blue Care Lockyer Community Care, Regis Gatton, Alara, Carinity Karinya Place.
Educational/research facilities (rooms designated for teaching/research purposes)	45	Laidley District High School, C&K Laidley Kindergarten, Free Range Kids, Laidley District State School, Kate's Place Early Education and, Child Care Centre, Helidon State School, Little Angels, Forest Hill State School, Lockyer District High School, Gatton State School, Lockyer Valley Early Education Centre, Peace Lutheran Primary School, Scouts Queensland: Gatton Scouts Group, Goodstart Early Learning, Gatton Kindergarten, Grandchester School, Groove and Move Dance School, Our Lady of Good Counsel School, Faith Lutheran College, The University of Queensland Gatton Campus.
Community buildings (libraries, places of worship)	45	Laidley Police Station, Laidley Library and Customer Service Centre, Gatton Church of Christ, Christian Life Centre Gatton, St Peter's Catholic Church, Laidley Seventh Day Adventist Church, Rural Fire Brigade, Laidley Fire and Rescue Station, Queensland Ambulance Service Laidley, St Joseph's Church, Anglican, Church of Australia, Helidon Fire Station, St Joseph's Church, Presbyterian Church, Laidley Baptist Church, Laidley Seventh Day, Adventist Church, New Hope Church, Gatton Fire Station, Saint Mary's Catholic Church, Gatton Baptist Church, Gatton Seventh Day Adventist Church, Anuha, Kingdom Hall of Jehovah's Witnesses, St Alban's Anglican Parish of Gatton, Gatton Ambulance Station, Lockyer Uniting Church, Peace Lutheran Church.

Source: CoP Vol 2 (Critical facilities classes and criteria only)

4.1.3 Construction road traffic noise criteria

Haulage/transportation associated with construction activities on public roads has the potential to be a source of noise impact existing sensitive receptors. CoP Vol 2 specifies the following criterion to manage the potential noise levels, and associated impacts, from construction traffic:

- Construction traffic should not increase the pre-construction traffic noise level $L_{A10,\ 1\ hour}$ by more than 3 dB(A).

4.1.4 Construction ground-borne noise criteria

Ground-borne noise can occur where ground-borne vibration from works such as the tunnel construction and roadheader activity is reradiated within sensitive receptor buildings. Generally, ground-borne noise is only a source of potential impact where the airborne noise levels within the receiving room are low and the ground-borne noise component becomes perceptible.

The construction ground-borne noise investigation criteria set out in the CoP Vol 2 are applicable for this Project and are presented in Table 4.6.

Table 4.6 **Construction ground-borne noise investigation limits**

Building	Ground-borne noise limit	
	Work period[1]	L_{ASMax}, dB(A)
Dwellings (including hotels and motels)	(Standard hours - day)	40
	(Non-standard hours – day/evening)	35
	(Non-standard hours - night)	35
Commercial (offices)	While in use	40

Source: CoP Vol 2

Table notes:

1 Standard hours (Day): Monday to Friday 7.00 am to 6.00 pm, Saturday 8.00 am to 1.00 pm. Non-standard hours (Evening): Monday to Friday 6.00 pm to 10.00 pm, Saturday 1.00 pm to10.00 pm, Sunday 7.00 am to 10.00 pm. Non-standard hours (Night) Monday to Sunday 10.00 pm to 7.00 am
2 There is no applicable ground-borne noise limit for industrial buildings
3 If the limits are predicted to be exceeded, practicable mitigation options will be investigated.

4.2 Ground vibration criteria

The effects of ground vibration from construction activities are consider upon human comfort (disturbance) and structural damage to buildings. The following guidelines were referenced to inform the assessment:

- Human comfort – disturbance to building occupants, arising from vibration which inconveniences or possibly disturbs the occupants or users of the building. The vibration criteria are based on the requirements of British Standard BS 5228-2:2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2 Vibration* (BS 5228.2) (British standards 2009b).
- Building damage – vibration which may compromise the integrity of the building structure itself. The vibration criteria are based on the requirements of German Standard DIN 4150 - Part 3 - *Structural Vibration in Buildings - Effects on Structures 1999* (DIN 4150.3) (Deutsches Institut für Normung 1999).

4.2.1 Human comfort

In order to minimise annoyance due to ground-borne construction vibration, CoP Vol 2 adopts the vibration levels in Table 4.7. This approach, based on BS 5228-2:2009, assesses vibration impacts using the PPV descriptor with a lower and upper limit. The vibration levels at the lower limits are generally considered to be just perceptible if exceeded. The upper limits are the lower threshold with the potential to cause significant annoyance.

The CoP Vol 2 requires that exceedance of the upper limit requires immediate action and extensive community consultation to determine further mitigation measures.

For this assessment, only the criteria for 'dwellings (including hotels and motels)', 'Medical/health buildings (wards, surgeries, operating theatres, consulting rooms)', 'Educational facilities (rooms designated for teaching purposes)', 'community buildings (libraries, places of worship)' and 'commercial (offices) and retail areas' apply.

Table 4.7 **Human comfort vibration limits to minimise annoyance**

Building	Work period	Resultant PPV, mm/s at all frequencies	
		Lower limit	Upper limit
Dwellings (including hotels and motels)	Standard hours	1.0	2.0
	Non-standard hours – evening	0.3	1.0
	Non-standard hours – night	0.3	1.0
Medical/health buildings (wards, surgeries, operating theatres, consulting rooms)	All	0.3	1.0

Building	Work period	Resultant PPV, mm/s at all frequencies	
		Lower limit	Upper limit
Educational facilities (rooms designated for teaching purposes)	While in use		
Court of Law (Court rooms)			
Court of Law (Court reporting and transcript areas, Judges' chambers)			
Community buildings (libraries, places of worship)	While in use	1.0	2.0
Commercial (offices) and retail areas			

Source: CoP Vol 2

4.2.2 Building/structural damage

CoP Vol 2 refers to the use of DIN4150.3 and BS5228.2 for the assessment of vibration impacts to buildings (structural damage). DIN 4150 provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 4.8. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage.

Table 4.8 DIN 4150.3 Structural damage 'safe limits' for building vibration

Group	Type of structure	PPV in mm/s		
		At foundation at a frequency of		
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz[1]
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or use (i.e. residential)	5	5 to 15	15 to 20
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. heritage-listed)	3	3 to 8	8 to 10

Source: (DIN 4150.3)

Table note:

1 For frequencies above 100 Hz, the higher values in the 50 to 100 Hz column will be used.

'Damage' is defined by DIN 4150.3 to include even minor non-structural (cosmetic) effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load-bearing walls. DIN 4150.3 also states that when vibrations higher than the 'safe limits' are present; it does not necessarily follow that damage will occur. For long-term vibration works, such as use of the roadheader for tunnelling works, the 'safe limits' on structures are presented in Table 4.9.

Table 4.9 DIN 4150.3 Structural damage 'safe limits' for long-term building vibration

Group	Type of structure	PPV in mm/s of vibration in horizontal plane of highest floor, at all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	10
2	Dwellings and buildings of similar design and/or use (i.e. residential)	5
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. heritage-listed)	2.5

DIN 4150.3 also provides guideline values for evaluating the effects of vibration on buried pipework, summarised in Table 4.10. Short-term vibration is defined in DIN 4150.3 as vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance in the structure being evaluated.

Table 4.10 DIN 4150.3 guideline values for evaluating the effects of short-term vibration on buried pipework

Line	Pipe material	Guideline values for velocity measured on the pipe in mm/s[1]
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Source: DIN 4150.3

Table note:

1 When assessing long-term vibration impacts the values presented are to be divided by two.

4.3 Blasting criteria

Controlled blasting is anticipated to be used to excavate material along some sections of the Project alignment. Construction blasting can result in two adverse environmental effects – airblast overpressure and ground vibration. The airblast overpressure and ground vibration produced may cause human discomfort and may have the potential to cause damage to structures, architectural elements and services.

The CoP Vol 2 includes four documents in relation to airblast overpressure, these documents have been referenced to inform the calculation and assessment of blasting emissions:

- Australian and New Zealand Environment Council Guidelines – Technical Basis for Guidelines (ANZEC 1990) to Minimise Annoyance due to Blasting Overpressure and Ground Vibration
- Australian Standard 2187.2-2006 Explosives - Storage and Use Part 2: Use of Explosives – Appendix J (Australian standards 2006)
- Environmental Protection Act 1994 Section 440ZB
- DEHP Guideline – *Noise and Vibration from Blasting* (DEHP 2016).

The DEHP guideline – *Noise and vibration from blasting* (2016) is adopted by the CoP Vol 2 to minimise annoyance and discomfort to persons at noise sensitive land uses as a result of blasting. The CoP Vol 2 also recommends the use of AS 2187.2 (Australian standard 2006) with respect to criteria for human comfort and structural damage. This includes consideration of different types of structures such as more sensitive masonry and plasterboard buildings and less sensitive reinforced concrete buildings.

4.3.1 Blasting criteria

In relation to airblast overpressure, the following criteria have been adopted from the DEHP Guideline – *Noise and vibration from Blasting* (2016). This criterion was used to assess the annoyance from airblast to sensitive land uses:

- Not more than 115 dB (linear) for 9 out of any 10 consecutive blasts
- Not more than 120 dB (linear) for any blasts.

For the purposes of the Project, the AS 2187.2 (Australian standard 2006) ground vibration criteria for structural/building damage have been considered as included within the assessment framework of CoP Vol 2 and are summarised in Table 4.11.

Table 4.11 Blasting ground vibration for structural/building damage summary

Category	Human comfort	Structural damage[1]
Sensitive structures (e.g. residential, theatres, schools etc.)	5 mm/s for 95% blasts per year 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply[2]	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Occupied non-sensitive structures of reinforced concrete or steel construction (e.g. factories and commercial premises)	25 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacture's specifications or levels that can be shown to adversely affect the equipment operation.	50 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Occupied non-sensitive structures that include masonry, plaster and plasterboard in their construction (e.g. factories and commercial premises)	25 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacture's specifications or levels that can be shown to adversely affect the equipment operation.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Unoccupied non-sensitive structures of reinforced concrete or steel construction (e.g. factories and commercial premises)	N/A	50 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Unoccupied non-sensitive structures that include masonry, plaster and plasterboard in their construction	N/A	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Source: AS 2187.2 (Australian standard 2006)

Table notes:

1 The values above are less stringent than those in DIN 4150. This is because DIN 4150 considers resonance in buildings from continuous vibration. Due to the short duration of blasting events the propensity for resonance within buildings is minimal, giving rise to higher criteria

2 It should be noted that the human comfort limits should be based off the values presented above from the DEHP guideline as per the CoP Vol 2.

These requirements do not cover buildings with long span floors, specialist structures such as reservoirs, dams and hospitals, or buildings housing equipment sensitive to vibration. Buildings and structures of this nature require special considerations, which may necessitate taking additional measurements on the structure itself. As part of the EIS process sensitive receptors such as hospitals and residential buildings have been identified and included in Table 4.5.

4.3.2 Blasting work periods

The CoP Vol 2 defines the working periods for blasting activities as follows:

- Blasting will generally only be permitted during the hours of 9.00 am to 5.00 pm Monday to Friday and Saturday 9.00 am to 1.00 pm with no blasting on Sundays or public holidays.
- Generally blasting is not to be conducted outside standard hours. Any blasting outside of standard hours must be approved by DTMR prior to blasting. It is noted that reduced limits may be required to be achieved.

4.4 Operational noise criteria

Local road traffic conditions have the potential to change as result of reconfiguration to some existing roads and roads that will be newly constructed with the Project. The CoP Vol 1 was referenced to assess noise from the road traffic associated with the Project.

CoP Vol 1 categorises noise criteria for road traffic noise and provides definitions for road categories. Table 4.12 provides definitions of these road categories.

Table 4.12 CoP Vol 1 road category definitions

Road category	CoP Vol 1 definition
New road	A new access controlled road in a proposed or existing unused corridor adjacent to existing residences or in a proposed corridor where formal approval by a local government or other statutory authority for adjacent land development is current at the date of acquisition, even if the development is not yet in existence. A new road may include the upgrading of a road (State or local government) to one of a higher functional road hierarchy where there is an increase in the contribution to road traffic noise exposure of at least 3 dB(A). The higher functional road hierarchy must be an access controlled road of at least a collector/distributor function. Also, a new road is applicable to the situation where land acquisition (resumption) is taken beside an existing corridor and all State-controlled road lanes fall outside the existing corridor.
Upgrading existing road	A substantial upgrading such as duplication or additional through lanes within some portion of the existing road corridor. Some additional lanes may fall outside the existing road corridor where land acquisition (resumption) is required.

4.4.1 Operational road traffic noise criteria – proposed new roads

There are seven new roads proposed within the noise and vibration study area as part of the Project.

Table 4.13 presents the applicable CoP Vol 1 assessment criteria for different noise sensitive land uses with potential to be affected by traffic from new roads. The external criteria are assessed 1 m from the façade at a height of 1.5 m from finished floor level (FFL) or mid window height, whichever is the higher. Outdoor educational and passive recreational areas are assessed in the free field.

The surveys of existing noise levels identified that existing $L_{A10(18hr)}$ noise levels are generally below the 55dB(A) noise criterion; as such the criteria of 60 $L_{A10(18h)}$, dB(A) has been adopted to assess road traffic noise at residences.

Table 4.13 Road traffic assessment criteria for new roads

Category	Criteria		
	Existing residences (façade corrected)	**Educational, community and health buildings (façade corrected)**	**Outdoor educational and passive recreational areas (including parks) (free field)**
New road – Access controlled	63 L_{A10} (18h), existing level > 55 L_{A10} (18h) 60 L_{A10} (18h), existing level ≤ 55 L_{A10} (18h)	58 L_{A10} (1h)	63 L_{A10} (12h)

Source: CoP Vol 1

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through reasonable and practicable measures to meet the assessment criteria.

4.4.2 Operational road traffic noise criteria – upgraded roads

The upgrade of seventeen roads is proposed within the noise and vibration study area as part of the Project.

Table 4.14 presents the applicable CoP Vol 1 assessment criteria for sensitive land uses with potential to be affected by upgraded roads. The external criteria are assessed 1 m from the façade at a height of 1.5 m from FFL or approximate mid window height, whichever is the higher.

Table 4.14 Airborne noise criteria for upgraded roads

Description	Criteria		
	Existing residences (façade corrected)	Educational, community and health buildings (façade corrected)	Outdoor educational and passive recreational areas (including parks) (free field)
Upgrading existing road	68 L_{A10} (18h)	65 L_{A10} (1h)	63 L_{A10} (12h)

Source: CoP Vol 1

4.4.3 Fixed infrastructure airborne noise objectives

Noise from fixed infrastructure such as tunnel ventilation fans, pumps and transformers has been assessed with reference to the EPP(Noise). As maintenance operations can occur during any period during a 24-hour span, the more stringent night-time (10.00 pm to 7.00 am) objective has been adopted for a conservative assessment of noise impacts. The following acoustic quality objectives from the EPP (Noise) have been used to assess appropriate noise level emissions from fixed infrastructure. These are shown in Table 4.15.

Table 4.15 Acoustic Quality Objectives (EPP (Noise) 2019)

Sensitive receptor	$L_{Aeq,1hr}$, dB	$L_{A10,1hr}$, dB	$L_{A1,1hr}$, dB
Residential (indoors - night-time)	30	35	40

Source: EPP (Noise)

No adjustment factors have been applied for the assessment of fixed infrastructure.

To predict the noise levels inside a property:

- Noise levels due to simultaneous operation of the fan systems were predicted at the façade of the nearest noise sensitive property
- 7 dB was subtracted from the predicted value, corresponding to the indicative outside to inside noise reduction of an open window as a conservative assumption.

5 Construction noise and vibration assessment

5.1 Construction activities

Construction activities to be carried out as part of the Project are outlined in Table 5.1. For the assessment of noise and vibration, the construction work has been grouped into seven distinct construction stages based on indicative construction activities specific to this Project.

Table 5.1 Construction stages and proposed equipment

Construction stage	Activities	Duration (weeks)	Plant and equipment
Site setup/ laydown areas	Establishment of site compounds/laydown areas, site facilities	8	Grader, truck, dump truck, 40 tonne (t) excavator, scraper, water cart
	Construction of concrete batch plant sites	6	
	Haul road and access roads construction	8	
	Haul road maintenance	168	
Earthworks[1]	Clearing and grubbing/topsoil stripping	45	Dozer, 40 t excavator, trucks, scraper, water cart, scraper, front end loader, padfoot roller, compactor, grader, 15 t roller, mulcher
	Cut to fill – Scraper Crew	16	
	Compaction Crew – Scraper matched	16	
	Cut to fill – Excavator and Truck Crew (Peaking at 4 crews total)	81	
	Compaction Crew – Excavator matched	63	
	Import structural fill	67	
	Place structural fill	67	
Tunnel construction	Excavation and primary lining	44	Drill rig, excavator fitted with rock breaker, front end loader, forklift, dump truck, shotcrete machine and roadheader
	Secondary lining and internal structure	68	
Structures	Substructure/foundations construction	122	40 t excavator, impact piling rig, concrete truck, crane
	Pier construction	121	
	Superstructure construction	112	
Drainage	Install cross drainage	89	Backhoe, 30 t excavator, worktruck (hiab), compactor, concrete truck, concrete pump, franna crane
Rail civil works	Capping material import	54	Tamper, regulator, 20 t excavator, water cart, trucks, dozer, 40 t excavator, 15 t roller, compactor, grader, 20 t excavator, smooth drum roller, ballast train
	Capping material placement	54	
	Bottom ballast	17	
	Sleeper installation	11	
	Rail installation	3	
	Top ballast	3	
	Track tamping and regulating	11	
	Rail stressing	3	
Road civil works	Road works	164	Grader, 30 t excavator, compactor, water cart, trucks

Construction stage	Activities	Duration (weeks)	Plant and equipment
Concrete batching	Preparation, mixing and discharging of concrete		Concrete batching plant
Flash butt welding	Track welding		Generator for welding, welder

Table notes:

1. The mulcher is expected to only typically operate during standard working hours and as such two scenarios have been assessed to represent typical conditions during standard and non-standard hours.

Hours of works required for the range of construction activities is included in Table 5.2. These are based on the anticipated construction works, the location of the proposed works, and the likely construction activities to be conducted. These hours are independent of the hours at which construction noise criteria apply given in Table 4.2.

The hours of work for construction activities within the rail corridors are likely to be constrained by rail possession orders and the safety requirements associated with working within an active railway corridor.

Table 5.2 Proposed hours of works

<table>
<tr><th>Description of works</th><th colspan="2">Hours of works</th></tr>
<tr><td>Surface works (other than works set out below)</td><td>Monday to Friday
6.30 am to 6.00 pm
Saturday
6.30 am to 1.00 pm
No work on Sundays or public holidays</td><td>Monday to Friday
6.00 pm to 10.00 pm
Saturday
1.00 to 5.00 pm
Only if the construction works comply with the Performance Criteria in the Draft Outline EMP.
No work on Sundays or public holidays</td></tr>
<tr><td>Tunnelling activities</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Spoil haulage</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Transport, assembly or decommissioning of oversized plant, equipment, components or structures</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Delivery of ‘in time’ materials such as concrete, hazardous materials, large components and machinery</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Materials and equipment delivery</td><td colspan="2">24 hours a day, 7 days a week</td></tr>
<tr><td>Works in a rail corridor (track possessions)</td><td colspan="2">24 hours a day, 7 days a week and in accordance with the hours of work prescribed by the rail infrastructure manager.</td></tr>
<tr><td>Works in a road</td><td colspan="2">In accordance with the hours of work prescribed by the road authority or if no hours of work are prescribed, then works may be undertaken Monday to Saturday (not public holidays) 6.00 am to 6.00 pm.</td></tr>
<tr><td>Works carried out in an emergency to avoid the loss of life, damage to property or to prevent environmental harm</td><td colspan="2">At any time</td></tr>
<tr><td>Blasting</td><td colspan="2">Monday to Friday
7.30 am to 4.30 pm
Saturday
7.30 am to 1.00 pm
No blasting on Sundays or public holidays</td></tr>
</table>

5.2 Noise modelling methodology

5.2.1 Airborne noise –construction

Noise levels from the construction activities shown in Table 5.1 were predicted at nearby noise sensitive receptors using SoundPLAN (v8.0) noise modelling software. The CONCAWE methodology within SoundPLAN was used, as it is suited to predicting noise propagation over large distances and accounts for a range of environmental factors that can influence noise levels over larger distances.

The noise model was created to represent worst-case periods of noise intensive construction work as per the CoP Vol 2. The noise levels were assessed using the L_{Aeq} noise metric over a 15-minute period. The predictions assumed there is one of each plant type operating concurrently during the 15-minute assessment period.

The following features were included in the noise model:

- Ground topography with elevation interval of 1 m prior to Project works
- Ground absorption and reflection
- Sensitive receptors (refer Section 3.2)
- Source noise emissions levels for construction plant and equipment (refer Section 5.2.2)
- Local meteorological conditions representative of the weather during the daytime, evening and night-time periods. (refer Section 5.2.2.2).

The following assumptions were made in modelling the construction noise scenarios to evaluate potential worst-case impacts and inform the recommendation for potential management and mitigation measures:

- All equipment would be operating simultaneously at the adopted sound power level as per Table 5.3. In practice, there will be periods when all equipment will not be required to operate at the same time.
- Equipment was assumed to be operating at the closest point in the noise and vibration study area to each receptor, in order to represent the worst-case scenario. In practice the equipment would only be at the closest point to each receptor for a limited period. The equipment locations are detailed in Section 5.2.2.1.
- All dwellings are modelled at two storeys, 4.6 m above ground level. This is a conservative assumption as noise impacts on the second storey are generally higher than results predicted at the ground level.

5.2.2 Airborne noise emission sources

Table 5.3 presents a summary of the typical sound power levels (SWL) of the construction equipment to be used for each construction stage. These sound power levels are typical values taken from British Standard BS5228-1:2009 (British standard 2009a)

Table 5.3 Noise emission sources octave band data of construction equipment

Source	Overall SWL dB(A)	Octave band noise levels, dB(Lin)						
		63 Hz	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz
Backhoe	**116**	114	108	106	105	109	111	110
Ballast Train	**111**	106	105	105	108	107	104	101
Compactor	**108**	98	106	107	100	105	96	94
Concrete batching plant	**108**	BS 5228.1 does not specify spectral sound power levels for this noise source.						
Concrete Pump	**110**	111	109	106	107	105	102	99
Concrete Truck	**108**	111	102	94	97	98	106	88
Crane	**99**	96	99	96	90	94	94	83
Dozer	**108**	117	118	109	101	102	98	96

Source	Overall SWL dB(A)	Octave band noise levels, dB(Lin)						
		63 Hz	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz
Dump Truck	**115**	114	107	107	107	107	112	97
Excavator – 20 t[2]	**103**	100	99	102	101	97	94	91
Excavator – 30 t	**103**	100	99	102	101	97	94	91
Excavator – 40 t	**107**	113	106	105	105	101	99	96
Franna Crane	**94**	94	95	88	89	90	89	78
Front end loader	**83**	88	81	77	80	79	76	71
Grader	**114**	116	115	111	107	112	106	102
Generator	**101**	103	100	95	96	98	94	90
Mulcher	**125**	104	113	105	111	119	121	117
Padfoot Roller	**109**	111	105	105	104	104	103	96
Impact Piling Rig[1]	**117**	110	110	110	117	111	106	103
Regulator	**116**	114	108	106	105	109	111	110
Roller – 15 t	**101**	108	103	105	100	95	90	82
Scraper	**114**	116	115	111	107	112	106	102
Smooth drum roller	**101**	108	103	105	100	95	90	82
Tamper	**114**	116	115	111	107	112	106	102
Truck	**118**	127	123	115	114	112	111	105
Water Cart	**116**	109	107	107	111	112	109	104
Welder	**101**	95	96	97	96	97	94	89
Worktruck (hiab)	**107**	109	110	95	100	99	102	101

Source: BS5228-2 (British standard 2009b)

Table notes:

1 Impact piling has been assumed as part of a worst-case assessment
2 BS5228-2 does not include a 20 t Excavator as such the 30 t Excavator levels have been used as a conservative assumption.

5.2.2.1 Equipment locations

The locations of the equipment may change as the design develops; however, the model has used the most appropriate locations available at the time of this assessment. The noise and vibration study area provides the boundary of works for the following construction activities:

- Earthworks
- Drainage
- Rail civil works.

The disturbance footprints for laydown areas, structures and road civil works, flash butt welding facilities and potential concrete batching plants were also provided from the construction team as the activities are proposed within specific locations of the noise and vibration study area.

During detailed design, local site conditions and changes in work practices may cause some variation in the equipment used. This approach used ensures that impacts are not under predicted and appropriate noise management and mitigation measures are considered early in the Project.

5.2.2.2 Meteorological conditions

The meteorological conditions applied to the model of construction noise impacts are summarised in Table 5.4. The adopted conditions align with the guidance in CoP Vol 2.

Table 5.4 Meteorological conditions for use in noise modelling

Time	Temperature, °C	Humidity, %	Wind speed, m/s	Wind direction	Temperature lapse rate	Pasquil Stability Class (implied by Temperature Laps Rate)
Day	20	70	3	All	0 degrees C/100m	E
Evening	15	70	2	Drainage flow	+3 degrees C/100	F
Night	15	70	None	None	+3 degrees C/100m	F

Long-term annual wind speed and direction data was requested from Bureau of Meteorology (BoM) for the University of Queensland (UQ) Gatton, Toowoomba Airport, and Amberley AMO stations. Wind roses for each of these stations for the most recent years with available data were used to assess localised conditions. The wind roses show the following:

- The predominant wind directions recorded at Amberley AMO over the period 2008 to 2017 are easterly and east-north-easterly. The proportion of calm conditions is 5 per cent.
- The predominant wind direction at UQ Gatton is westerly, however easterly winds are more prevalent during warmer seasons. The proportion of calm conditions is 5 per cent.
- The dominant wind direction at Toowoomba is easterly, with very little variation recorded in different seasons. The proportion of calm conditions is 0.2 per cent.

Overall, analysis of the annual wind roses shows that the wind speed and directions at each monitoring station varies significantly. This variation is due to the influence of terrain and land use on local scale winds. These conditions result in Meteorological category 5 and 6 (adverse, as defined by CONCAWE).

Separate modelling scenarios were run for each period of day, evening and night conditions. The day modelling scenario was used to assess impacts during standard hours and the night conditions were used for predicting impacts during non-standard hours.

5.2.2.3 Absorption

Noise propagation is affected by the type of ground cover between the source and receptor. Most standards use a ‘ground absorption factor’ to evaluate the ground effect. The ground absorption factor ranges from zero (which is applied to hard surfaces such as asphalt and water) to one (which is applied to soft surfaces such as fields and grass); it can be set to any value in between to represent an average of soft and hard ground in the assessment area.

A consistent ground absorption coefficient of 0.5 was applied throughout the entire study area to represent the varying hard and soft ground conditions in the noise and vibration study area. Air absorption is applied within the noise model using the default method for CONCAWE.

5.3 Construction vibration assessment methodology

5.3.1 Groundborne vibration – construction

BS 5228-2 (British standard 2009b) provides formulae to predict vibration levels from compaction activities. These formulae are summarised in Table 5.5 and have been used to predict the vibration impacts and acceptable setback distances for the management of vibration impacts. \

The formulae have a range of parameters, the calculated vibration levels in this report adopted the lower and higher ranges to demonstrate the distribution of potential ground-borne vibration from construction works.

The highest potential vibration impacts from construction activities at any given location will depend on its proximity to each of the construction activities. Additional construction activities such as truck movements have not been included within the assessment as these will not typically generate levels of vibration that may result in exceedance of the criteria.

Table 5.5 Formulae used to predict vibration levels from vibration intensive equipment

Operation	Formula	Parameters	Parameters used
Vibratory piling	$V_{res} = \frac{k_v}{x^\delta}$	V_{res}: predicted vibration level k_v: Scaling factor x: distance measured along ground surface δ: 1.3 (all operations), 1.2 (Start up and run down), 1.4 (steady state operation)	k_v: 266 (5% probability of predicted value being exceeded), 60 (50% probability of predicted value being exceeded) δ: 1.2 (start up and run down), 1.4 (steady state operations)
Percussive piling	$V_{res} \leq k_p \frac{\sqrt{W}}{r^{1.3}}$	V_{res}: predicted vibration level k_p: Scaling factor W: Nominal hammer energy r: slope distance from the pile toe, in meters (m) L: pile toe depth, in meters (m) x: distance measured along ground surface	k_p: 5 (for piles at refusal) $r^2 = L^2 + x^2$ L: 1 - 27 m W: 1500 J – 85000 J
Vibratory compaction (start up and run down)	$V_{res} = k_t\sqrt{n_d}\left[\frac{A^{1.5}}{(x + L_d)^{1.3}}\right]$	V_{res}: predicted vibration level k_t: Scaling factor n_d: number of drums A: maximum amplitude of drum vibration x: distance measured along ground surface L_d: vibrating drum width	k_t: 276 (5% probability of predicted value being exceeded), 75 (50% probability of predicted value being exceeded) L_d: 0.75-2.2 m A: 0.4-1.72 mm n_d: 1-2
Vibratory compactor (steady-state)	$V_{res} = k_s\sqrt{n_d}\left[\frac{A}{x + L_d}\right]^{1.5}$	V_{res}: predicted vibration level k_s: Scaling factor n_d: number of drums A: maximum amplitude of drum vibration x: distance measured along ground surface L_d: vibrating drum width	k_s: 177 (5% probability of predicted value being exceeded), 65 (50% probability of predicted value being exceeded) L_d: 0.75-2.2 m A: 0.4-1.72 mm n_d: 1-2

Source: BS5228-2

5.3.2 Roadheader – tunnel construction

The roadheader source vibration spectrum has been derived from the Melbourne Metro Rail Project[1], which provides peak vibration velocity levels per octave (10 Hz – 500 Hz) at a distance of 5 m. As vibration propagates differently via different substrates, vibration levels were back-calculated to a distance of close proximity to the source, and repropagated through the ground type relevant to the Little Liverpool Range tunnel. The following equation (based on Amick (1999)/Bornitz (1931)) was used to predict propagation of vibration, PPV, through the ground at a distance x:

$$PPV_x = PPV_{ref}\left(\frac{d_{ref}}{d_x}\right)^n e^{-\alpha(d_x - d_{ref})}$$

[1] Melbourne Metro Rail Project Environment Effects Statement Inquiry and Advisory Committee – MMRA Technical Note #042, 19 August 2016.

Where α is the material damping co-efficient, which is frequency dependent;

$$\alpha = \frac{\pi \eta f}{c}$$

The values used in the above equations are provided in Table 5.6.

Table 5.6 Variables used in the roadheader calculation

Symbol	Parameter	Value used (in rock)
PPV_{ref}	PPV at a reference distance	8 mm/s
d_{ref}	Reference distance of PPV	5 m
n	Geometric damping coefficient	1
η	Material loss factor	0.01
c	Longitudinal speed in the ground material	3500 m/s

It has been assumed that the PPV values at each frequency all occur simultaneously resulting in a conservative PPV sum for the purpose of assessment against the nominated criteria. For the roadheader use in rock, it is assumed that the PPV will be 8 mm/s at 5 m. Rock typically has a lower propagation attenuation rate when compared to less compact materials, such as clays and soils.

This equation was fitted to the Melbourne Metro propagation curve, and repropagated through rock. The rock propagation was determined via a literature search and review of the geotechnics technical memorandum (i.e. Koukandowie Formation). The resultant vibration propagation profile has been provided in Figure 5.1 based on rock between the tunnel and the nearest sensitive receptors.

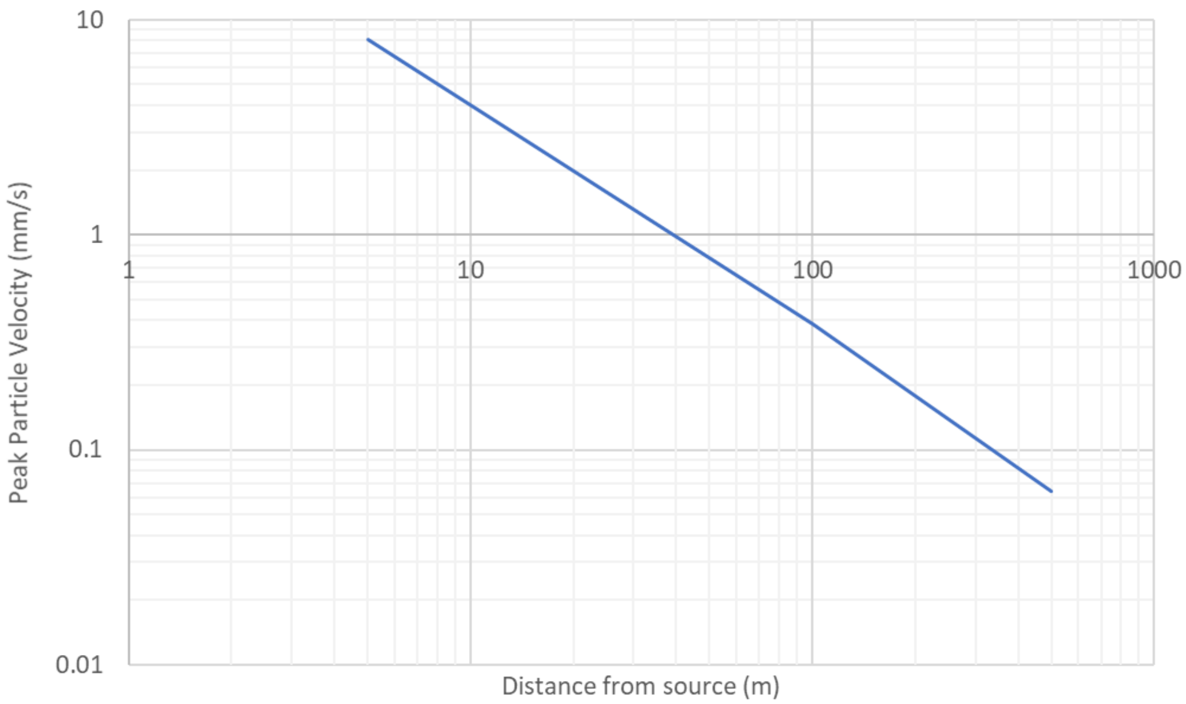

Figure 5.1 Propagation of roadheader peak particle velocity levels through rock

The (diagonal) distance between the source and the building foundation of each sensitive receptor is based on the following horizontal and vertical data for the tunnel:

- LiDAR elevation terrain contours at the sensitive receptor
- Tunnel outer edge
- Rail centreline (vertical and horizontal profile)
- Shortest horizontal distance between the sensitive receptor and rail centreline (typically perpendicular, with the exception of houses near the portals).

The roadheader will be the most vibration-intensive plant equipment will be used for these tunnelling works.

5.3.3 Blasting – tunnel construction

Vibration due to blasting has been calculated using AS 2187.2:2006[2], which states the following equation:

$$V = K_g \left(\frac{R}{\sqrt{Q}} \right)^{-B}$$

where V is the PPV (mm/s), K_g is a site constant, R is the distance between the charge and point of measurement (m), Q is the maximum instantaneous charge (effect change mass per delay, kg) and B is the rock constant. AS2187 (Australian standard 2006) provides site constants when blasting is to be carried out to a free face in average field conditions (with a chance of 50 per cent exceedance). It was noted that the site constants provided in AS 2187 (Australian standard 2006) are not appropriate for this Project, as the blasting criteria is based on the 5th percentile, and as a result, both constants will need to be evaluated with test blasting on site. For the purpose of this assessment, a literature review was conducted and more relevant site constants have been determined.

There are a few different methods of rock breaking using blasting that could be employed by the construction contractor. These include varying the size, depth and covering (burden) of the charge. Other variances would include the number, timing and sequencing of multiple explosive charges used for the same blast. Each of these generate slightly different levels of ground vibration and airblast overpressure. Once the specific blast plan is known the forecast ground vibration and airblast overpressure levels will be determined by the contractor to ensure they meet the Project limits.

5.3.4 Groundborne noise

Once the vibration velocity levels were predicted inside sensitive receptors, the levels were converted to internal A-weighted noise levels (in dBA), the reradiated ground-borne noise levels., using a vibration-to-airborne noise correction as per Chapter 11 of Federal Transit Authority (FTA) *Transit Noise and Vibration Impact Assessment*[3]. As the peak vibration values of the roadheader have been used as the source rather than Root Mean Square (RMS) values, it is assumed that the predicted ground-borne noise levels are a reasonable approximation of the L_{ASMax} levels.

5.3.5 Building losses and corrections

Vibration velocity levels have been predicted at the foundation of each sensitive receptor using the methodology outlined in Section 5.3.2. Losses and corrections have then been applied based on the FTA guidelines are *Melbourne Metro Rail Project*[4] *– Noise and Vibration, Appendix E: Operation: Vibration and ground-borne Noise from Rail*. These are provided in Table 5.7.

Table 5.7 Correction and losses due to buildings

Situation	Octave band centre frequencies, Hz Correction per octave, dBV (ref: 1 μ inch/s)					
	8	**16**	**31.5**	**63**	**125**	**250**
Building floor amplification [1]	6	6	6	5	4	3
Typical residential foundation loss [2]	0	-4	-5	-5	-4	-3

Table notes:

1 As per Melbourne Metro Rail Project, note that the actual amplification will vary depending on the type of construction.

[2] Australian Standards: *AS2187.2 - Explosives – Storage and Use – Use of Explosives*, 2006
[3] Transit Noise and Vibration Impact Assessment – Department of Transportation (Office of Planning and Environment, Federal Transit Authority), May 2006
[4] Melbourne Metro Rail Project – Noise and Vibration, Appendix E: Operation: Vibration and ground-borne Noise from Rail. Doc. Number: MMR-AJM-PWAA-RP-NN-008020

2 As per Transit Noise and Vibration Impact Assessment, pg. 10-11, corresponding with wood frame houses which may be a conservative approach. The general rule is the heavier the building construction, the greater the coupling loss, therefore masonry construction will reduce vibration levels further.

5.4 Predicted impacts

5.4.1 Airborne construction noise impacts

A summary of the predicted construction noise assessment is detailed in this section. The predicted noise levels and assessment of potential impacts is based on conservative assumptions that consider the most intensive periods of construction works, with respect to noise emissions, and apply the assessment criteria from the CoP Vol 2.

In practice, particularly noisy activities, such as piling, are likely to persist for only a portion of the overall construction period. In addition, the predictions use the shortest separation distance to each sensitive receptor, however, distances will vary between plant and sensitive receptors. For works that move along the rail alignment, rather than works located at a construction compound, noise exposure at each receptor would reduce due to increases in distance loss as the works progress along the alignment.

In this regard, the predicted noise levels and noise impacts detailed in the report are not expected to occur throughout the construction program. The construction works will be temporary and transient, as such many communities and sensitive receptors will experience lower noise levels than reported in this section.

Table 5.8 presents the external noise criteria and the number of sensitive receptors that potentially exceed each limit for different construction activities. Both lower and upper criteria exceedances are included for standard and non-standard hours. The number of potential exceedances is broken down for the six different NCAs. It should be noted that due to the low background noise levels measured during non-standard hours of construction the lower and upper limit are both set to the minimal level as per CoP Vol 2.

The difference between the upper and lower (more stringent) construction noise criteria can be up to 15 dBA for works during standard hours. This variation in criteria has a substantial influence on the number of receptors calculated to trigger the noise criteria.

Table 5.8 Predicted construction noise impacts – number of sensitive receptors potentially exceeding

NCA	Standard hours limits		Non-standard hours lower and upper limit[1]	Standard hours exceedances		Non-standard hours exceedances
	Upper limit	Lower limit		Exceeding upper limit	Exceeding lower limit	
Laydown						
NCA_01	65	50	45	12	207	309
NCA_02	70	54	47	0	11	49
NCA_03	65	50	45	303	1583	2268
NCA_04	65	50	45	2	202	252
NCA_05	65	50	45	5	461	1027
NCA_06	65	50	45	90	430	642
Structures						
NCA_01	65	50	45	3	202	328
NCA_02	70	54	47	0	29	101
NCA_03	65	50	45	289	1932	2408
NCA_04	65	50	45	15	235	270
NCA_05	65	50	45	1	513	825
NCA_06	65	50	45	49	480	598

NCA	Standard hours limits		Non-standard hours lower and upper limit[1]	Standard hours exceedances		Non-standard hours exceedances
	Upper limit	Lower limit		Exceeding upper limit	Exceeding lower limit	
Earthworks						
NCA_01	65	50	45	48	308	331
NCA_02	70	54	47	22	212	258
NCA_03	65	50	45	787	2347	2425
NCA_04	65	50	45	201	260	270
NCA_05	65	50	45	179	1136	1182
NCA_06	65	50	45	308	672	734
Drainage						
NCA_01	65	50	45	17	202	298
NCA_02	70	54	47	3	61	220
NCA_03	65	50	45	418	1613	2194
NCA_04	65	50	45	152	225	252
NCA_05	65	50	45	80	625	1069
NCA_06	65	50	45	145	451	625
Rail Civil Works						
NCA_01	65	50	45	28	258	331
NCA_02	70	54	47	8	128	255
NCA_03	65	50	45	518	1966	2422
NCA_04	65	50	45	174	247	270
NCA_05	65	50	45	120	960	1182
NCA_06	65	50	45	205	549	733
Road Civil Works						
NCA_01	65	50	45	15	226	313
NCA_02	70	54	47	2	34	172
NCA_03	65	50	45	273	1807	2409
NCA_04	65	50	45	118	220	254
NCA_05	65	50	45	7	332	782
NCA_06	65	50	45	60	406	535
Flash Butt Welding						
NCA_01	65	50	45	0	0	0
NCA_02	70	54	47	0	0	6
NCA_03	65	50	45	0	66	139
NCA_04	65	50	45	0	0	0
NCA_05	65	50	45	0	0	0
NCA_06	65	50	45	0	0	0
Concrete batching plant						
NCA_01	65	50	45	0	0	0
NCA_02	70	54	47	0	0	2
NCA_03	65	50	45	0	0	0
NCA_04	65	50	45	0	0	0

NCA	Standard hours limits		Non-standard hours lower and upper limit[1]	Standard hours exceedances		Non-standard hours exceedances
	Upper limit	Lower limit		Exceeding upper limit	Exceeding lower limit	
NCA_05	65	50	45	0	8	24
NCA_06	65	50	45	0	3	8

Stringent noise criteria resulting from the low measurements gathered of the existing noise environment are predicted to be exceeded at up to 5,200 sensitive receptors during a worst-case 15-minute period. There is potential for construction works during the night-time to trigger impacts such as sleep disturbance. Individuals will respond to noise differently, and just because noise can be audible does not mean it will cause disturbance or annoyance impacts.

During each construction activity, up to 50 sensitive receptors fall within the disturbance footprint; the area within which construction equipment is expected to operate. It is anticipated that land within the disturbance footprint will either be gazetted as rail corridor (for sensitive receptors within the permanent operational disturbance footprint) or will be temporarily utilised to accommodate construction activities. Consequently, the number of receptors potentially exceeding a criterion does not include these receptors. Specific mitigation measures will need to be developed in consultation with these properties which would likely be respite during the temporary works.

The construction activity that results in the highest number of sensitive receptors predicted to exceed the upper limit standard hours construction criteria is earthworks. The earthworks footprint covers the largest area and has the second highest level of noise emissions. A further breakdown of the sensitive receptors predicted to exceed the upper limit is included in Table 5.9. Conservatively assessing the noise levels; where the upper limit is predicted to be triggered the Project will implement additional mitigation measures, further to the standard construction practices, to control noise impacts.

Table 5.9 Number of potential exceedances (receivers, upper limit, Earthworks construction)

NCA	Number of exceedances above upper limit (standard hours), dB(A)			
	1-2	2-5	5-10	>10
NCA_01	25	8	12	13
NCA_02	2	16	3	2
NCA_03	154	175	117	279
NCA_04	10	24	52	100
NCA_05	38	46	53	51
NCA_06	48	87	81	100

Table note:

Refer Appendix C: Construction noise contours.

An overview of the number of potential exceedances for critical facilities for each construction activity is shown in Table 5.10. Each critical facility has a specific internal construction noise limit discussed in Section 4.1.2. It has been assumed that the attenuation due to the building envelope is 7 dB(A) and has been applied to the predicted noise level. There are no critical facilities predicted to exceed the criteria for concrete batching or flash butt welding.

Table 5.10 Number of potential exceedances for critical facilities

Critical facility	Laydown	Earthworks	Structures	Drainage	Rail civil	Road civil
Community buildings	20	22	26	19	19	17
Educational facilities	12	18	19	15	16	14
Medical facilities	6	8	8	5	8	5

Table note:

Refer Appendix C: Construction noise contours.

Community buildings that are predicted to exceed the critical facilities criteria are buildings used for religious uses, ambulance services and fire brigades. Educational buildings predicted to exceed the criteria include schools, early learning centres and universities. Medical buildings are used for aged care, hospitals and private medical practices. Consultation with each of these facilities will be required to minimise impacts during hours of operation.

Noise will also be expected from maintenance operations (during standard possessions as an example) and this may require short term activities associated with rail grinding and track works. The equipment used during these activities would generate similar noise emissions to those modelled in the Earthworks scenario and the predicted impacts would be comparable to the impacts presented in Table 5.8.

5.4.2 Construction road traffic noise impacts

Construction traffic will be primarily from vehicles on haul routes with the movement of in situ concrete, spoil, precast concrete, quarry, sleepers, water and workers. The number of vehicle movements are dependent on the year and construction phase of the project.

Construction vehicle movements and existing traffic volumes have been based on the traffic assessment undertaken as part of the EIS. Construction traffic movements in this assessment were used to conservatively assess the noise impacts resulting from construction traffic against the base traffic volumes. The traffic volumes used for the basis of this assessment is the relevant peak hour traffic flows for both base volumes and additional construction traffic as part of the Project.

The roads in Table 5.11 are intended to be used to carry construction traffic and the maximum predicted increase in noise level is greater than 3.0 dB(A). Early construction activities require higher volumes of construction traffic and the number of roads shown to exceed the criterion by the third year drops to seven. A number of these roads are in rural locations and the existing base traffic volumes quantities are relatively low; below 1,000 AADT. As such the existing road traffic noise levels are below 50 dB(A) and the construction traffic represents a prominent, but temporary, increase in traffic volumes and associated road traffic noise levels.

The construction traffic noise is predicted to exceed the criteria at sixteen road segments within the noise and vibration study area, with a maximum predicted increase of 21 dB(A). Table 5.11 presents the roads where the increase in the $L_{A10(1hr)}$ triggers the construction road traffic noise criterion.

Table 5.11 Airborne noise level exceedances and construction traffic volumes between 2022-2025

Road name	Road section	Base AADT	AADT with construction	Base $L_{A10(1hr)}$ dB(A)	Construction $L_{A10(1hr)}$ dB(A)	Increase in $L_{A10(1hr)}$ dB(A)
Assessment year – 2022						
Calvert Station Road	Between Rosewood Laidley Road and Gipps Street	476	681	46	52	5
Neumann Road	Full extent	108	158	41	46	5
Burgess Road	Between Old Toowoomba Road and Smithfield Road	86	230	40	49	10
Connors Road	Between Airforce Road and Wrights Road	621	911	49	54	5
Hickey Street	Between Old College Road and Buaraba Street	621	918	49	54	5
Mary McKillop Street	Between Turner Street and Arthur Street	563	727	47	51	5
Paroz Road	Between Summer Street and East of Summer Street	20	325	31	52	21
Philps Road	Between Boxmoor Street and Warrego Highway	20	25	31	36	5

Road name	Road section	Base AADT	AADT with construction	Base $L_{A10(1hr)}$ dB(A)	Construction $L_{A10(1hr)}$ dB(A)	Increase in $L_{A10(1hr)}$ dB(A)
Western Drive	Between Warrego Highway and Tenthill Creek Road	58	281	41	51	10
Assessment year – 2023						
Calvert Station Road	Between Rosewood Laidley Road and Gipps Street	486	691	46	52	5
Hiddenvale Road	Between Gipps Street and Neumann Road	486	630	46	51	4
Neumann Road	Full extent	110	254	41	49	8
School Road	Between Rosewood Laidley Road and Rafters Road	411	556	47	51	4
Thagoona Haigslea Road	Between Karrabin Rosewood Road and Schumanns Road	411	593	47	52	5
Burgess Road	Between Old Toowoomba Road and Smithfield Road	87	232	40	49	9
Connors Road	Between Airforce Road and Wrights Road	634	924	49	54	4
Hickey Street	Between Old College Road and Buaraba Street	634	931	49	54	5
Mary McKillop Street	Between Turner Street and Arthur Street	575	775	47	52	5
Paroz Road	Between Summer Street and East of Summer Street	20	204	31	50	19
Philps Road	Between Boxmoor Street and Warrego Highway	20	32	31	39	8
Railway Street	Between Summer Street and Laidley Plainland Road	243	498	46	52	6
Western Drive	Between Warrego Highway and Tenthill Creek Road	60	282	41	51	10
Assessment year – 2024						
Haigslea Malabar Road	Between Warrego Highway and Mount Marrow Quarry Road	458	757	51	54	4
Neumann Road	Full extent	113	162	41	46	5
Paroz Road	Between Summer Street and East of Summer Street	20	58	31	35	4
Philps Road	Between Boxmoor Street and Warrego Highway	20	50	31	42	11
Railway Street	Between Summer Street and Laidley Plainland Road	248	404	46	51	5
Hampton Street	Between Hursley Road and Rob Street	230	710	45	54	10
Herries Street	Between Dent Street and Water Street North	466	777	49	54	5
Assessment year – 2025						
Neumann Road	Full extent	115	112	39	43	4
Paroz Road	Between Summer Street and East of Summer Street	21	67	28	36	8
Western Drive	Between Warrego Highway and Tenthill Creek Road	62	253	38	43	5

Road name	Road section	Base AADT	AADT with construction	Base $L_{A10(1hr)}$ dB(A)	Construction $L_{A10(1hr)}$ dB(A)	Increase in $L_{A10(1hr)}$ dB(A)
Hampton Street	Between Hursley Road and Rob Street	235	442	42	53	11
Herries Street	Between Dent Street and Water Street North	476	650	46	54	8

Table note:

The Calculation of Road Traffic Noise method is generally limited to traffic flows above 1,000 Average Annual Daily Traffic (AADT). The noise impacts on haul routes have still been calculated to quantify impact levels.

In addition to the local roads assessed within the noise and vibration study area there are State controlled roads used for construction movements related to the Project throughout QLD and NSW. The predicted increase in traffic volumes for these roads are below 20 per cent throughout each year of construction. As such the predicted increase in noise level would be below the 3.0 dB(A) increased road traffic noise level.

5.4.3 Construction vibration impacts

The setback distances at which the construction vibration criteria are predicted to be achieved are provided in Table 5.12. These values have been presented in ranges to highlight the difference in setback distance when using the lower and upper range of calculation variables described in Table 5.5.

Table 5.12 Recommended minimum working distances for vibration intensive equipment

Plant item	Predicted setback distance, meters						
	Human comfort – lower limit (night)	Human comfort – lower limit (day) upper limit (night)	Human comfort – upper limit (day)	Building damage limit (Heritage)	Building damage limit	Buried pipework (masonry, plastic or metal)	Buried pipework (steel)
	0.3 mm/s PPV	1.0 mm/s PPV	2.0 mm/s PPV	2.5 mm/s PPV	5.0 mm/s PPV	50 mm/s PPV	100 mm/s PPV
Vibratory roller – vibration start-up/run down	45-330	20-130	10-70	7-65	5-30	<5	<5
Vibratory roller – steady state	35-200	10-90	6-50	6-50	5-30	<5	<5
Vibratory piling	45-280	20-100	10-60	10-40	5-30	<5	<5
Percussive piling, impact breakers[1]	145-690	60-275	35-160	30-120	20-80	<5	<5

Table note:

1 Impact breakers have been assumed generate similar vibration emissions to percussive piling.

Only the vibration intensive equipment included in BS5228 have been included within Table 5.12. Where multiple plant equipment is operating the most vibration intensive and closest source to sensitive receptors will dominate the resultant vibration levels. Assuming there are no large bumps in the road a construction truck at 10 m would be expected to result in vibration levels under 1 mm/s.

A summary of the total potential exceedances on sensitive receptors for each construction activity is shown in Table 5.13. Detailed results of the construction vibration assessment are provided in Both the upper and lower limit of each calculation parameter have been applied to identify the number of sensitive receptors that may potentially exceed the criteria. This highlights the potential reduction in the number of exceedance if the contractor is to use less vibration intensive equipment.

The structural damage criteria are less stringent than the human comfort criteria. Consequently, there are substantially fewer receptors at which vibration impacts are predicted to exceed structural criteria than human comfort criteria, therefore triggering a review of measures to manage vibration emission to control impacts to building structures.

Table 5.13 Construction vibration assessment against human comfort criterion

Activity	Human comfort – standard hours, number of sensitive receptors predicted to exceed				Human comfort – non-standard hours, number of sensitive receptors predicted to exceed				Structural limit, number of sensitive receptors predicted to exceed	
	Lower limit		Upper limit		Lower limit		Upper limit			
	Best[1]	Worst[2]	Best[1]	Worst[2]	Best[1]	Worst[2]	Best[1]	Worst[2]	Best[1]	Worst[2]
Site setup/Laydown areas										
Vibratory roller – vibration start-up/run down	2	205	0	117	17	587	2	179	0	33
Vibratory roller – steady state vibration	1	144	0	67	12	313	1	136	0	20
Structures										
Vibratory piling – vibration start-up/run down	1	2	0	1	6	17	1	2	0	0
Percussive piling	7	282	2	95	70	1299	7	239	1	11
Earthworks/drainage/rail civil works										
Vibratory roller – vibration start-up/run down	31	560	13	375	90	1093	28	528	2	199
Vibratory roller – steady state vibration	21	428	11	310	63	730	20	402	1	160
Road civil works										
Vibratory roller – vibration start-up/run down	17	253	14	177	49	608	17	234	6	94
Vibratory roller – steady state vibration	14	199	12	141	30	347	14	188	6	75

Table notes:

1 Best case calculation assumes scaling factors and parameters in formulae to produce lowest number of predicted exceedances
2 Worst case calculation assumes scaling factors and parameters in formulae to produce highest number of predicted exceedances.

There are up to 50 sensitive receptors within the temporary construction disturbance footprint. Consistent with the construction noise assessment, these receptors will require specific management and mitigation measures to control potential impacts to receptors in close proximity to the works. There are seven educational facilities predicted to exceed the vibration criteria for human comfort when using the worst-case parameters for vibration equipment. These facilities include:

- Gatton State School
- Endeavour Foundation
- Forest High State School

- Laidley District High School
- Grandchester School
- Gatton Kindergartens
- Peace Lutheran Primary School.

If predictive modelling continues to predict that vibration criteria will be exceeded, these facilities will require community consultation and potential dilapidation surveys undertaken prior to construction works commencing. Mitigation measures to address vibration impacts are discussed in Section 8.

5.4.3.1 Heritage structures

The number of heritage structures predicted to exceed the heritage building criterion is given in Table 5.14. The name of each heritage structure predicted to exceed is also included.

Table 5.14 Construction vibration exceedances – heritage structures

Activity	Number of Exceedances of Structural Damage Criterion	Heritage structure
Site setup/laydown areas		
Vibratory Roller – Steady State Vibration	5	Gatton Railway Station, Royal Hotel, Gatton Station Master's Residence and two residential properties.
Vibratory Roller – Vibration Start Up/Run Down	8	Residential property, Commercial Hotel, Gatton Railway Station, Royal Hotel, Gatton Station Master's Residence, Gatton Post and Telegraph Office, Homestead Complex, Railway Residence
Structures		
Vibratory Piling – Vibration Start Up/Run Down	1	Railway Residence
Earthworks/drainage/rail civil works		
Vibratory Roller – Steady State Vibration	10	Boer War Memorial, Royal Hotel, Railway Platform Building, Forest Hill School of Arts, Former National Bank, Homestead Complex, Four residential properties.
Vibratory Roller – Vibration Start Up/Run Down	15	Boer War Memorial, Commercial Hotel, Royal Hotel, Gatton Post, Telegraph Office, Weeping Mother Memorial, Relocated Railway Platform Building, Forest Hill Hotel, Forest Hill School of Arts, Former National Bank, three residential properties.
Road civil Works		
Vibratory Roller – Steady State Vibration	8	Former National Bank, Forest Hill War Memorial, Lockyer Hotel, House Ruin, three residential properties.
Vibratory Roller – Vibration Start Up/Run Down	9	Forest Hill Hotel, Former National Bank, Forest Hill War Memorial, Lockyer Hotel, House Ruin, four residential properties.

Of the heritage vibration sensitive receptors, 18 of the 42 receptors fall within the temporary construction disturbance footprint of one or more construction activities: the area within which construction equipment is expected to operate. The construction methodology near these receptors will need to be detailed on a case by case basis to accurately assess potential impacts and implement appropriate mitigation measures. These receptors have not been included in Table 5.14. Further investigation at all heritage structures will be required during detailed design to confirm potential impacts. Received vibration levels will be confirmed and verified during construction.

5.4.4 Blasting impacts – earthworks cuttings

There are five locations that have been identified that may require blasting along the Project alignment. Two of these locations are part of the tunnel construction and have been assessed in Section 5.4.7. The other three locations identified for potential blasting are included in Table 5.15. The closest sensitive receptor outside of the temporary construction disturbance footprint has been assessed to identify conservative maximum permissible charge weights for each location. The limits have been calculated using the method outlined in BS5228.2 (British standards 2009b). Further geotechnical investigation will be required to confirm blasting locations and ground variables to calculate these values to a higher level of accuracy.

Table 5.15 Maximum predicted permissible charge weight ranges for indicative blasting locations

Chainage reference	Closest sensitive receptor	Distance from earthworks footprint (m)	Predicted maximum permissible charge weight (kg)			
			Ground vibration - human comfort	Ground vibration - structural damage	Airblast overpressure - human comfort	Airblast overpressure - structural damage
Ch 28.33 km – Ch 29.45 km	RES0372	31	<2	4	<2	<2
Ch 32.91 km – Ch 33.27 km	RES0424	208	45	190	7	520
Ch 59.83 km – Ch 60.65 km	RES4708	184	35	150	5	360

The maximum charge weight has been calculated for the distance to the closest sensitive receptor for each potential blasting location. These limits have been assessed based on worst case assumptions for a confined blast and without any geo-technical information. Once detailed geotechnical information is known these limits may be able to be increased.

The closest sensitive receptor is located 31 m from the temporary construction disturbance footprint as such the permissible charge weight is under 2 kilograms (kg) to comply with the airblast overpressure structural damage limit. This is a low amount of charge mass and other excavation methods such as rockbreaker attached to an excavator to reduce the impacts will be considered.

5.4.5 Roadheader vibration predictions

Vibration and ground-borne noise due to the operation of the roadheader have been calculated using the methodology summarised in Section 5.3.

The conservatively assessed PPV (mm/s) vibration levels at the sensitive receptors in the vicinity of the tunnel, and comparison against the nominated criteria for damage and human comfort, predict potential exceedances against the adopted criteria.

The calculation of predicted levels has been completed to the closest 70 existing sensitive receivers. Properties beyond this distance were found to comply with the adopted criteria.

5.4.5.1 Building damage

The vibration levels predicted at the foundations of sensitive receptors were well below the IDIN 4150.3 long-term vibration building damage criterion for heritage and sensitive buildings (refer Table 4.9). This means that the risk of damage from vibration due to the roadheader works is low.

The eastern tunnel portal is located within 60 m of the existing Queensland Rail line. A PPV of 0.6 mm/s is predicted at the rail line, which is below that of the heritage/sensitive building limit for structural damage, and below that of the long-term plastic/masonry pipe vibration guideline of underground services.

5.4.5.2 Amenity

Vibration levels predicted on the ground floor slab or floors of buildings were found to comply with the *Upper limit for Dwelling during non-standard working hours* criteria in the DTMR CoP Vol 2 (1 mm/s). However, vibration levels are predicted to exceed the *Lower limit for Dwelling during non-standard working hours* (0.3 mm/s) criteria at up to 10 properties.

Where the construction works can be managed to be within the adopted lower limit, daytime, evening and night-time limits are expected to be achieved at the majority of receptors.

5.4.5.3 Underground infrastructure

The DIN 4150-3 *Long-term vibration guideline values for velocity measured on the pipe – Masonry, plastic* criteria of 25 mm/s have been applied. Compliance with this criterion is predicted when the roadheader is at least 5 m from the pipework. Vibration measurements will be undertaken on site to confirm that these predictions are representative of the vibration levels on site.

The minimum setback distance of 5 m will be observed between the roadheader and all buried services. Buried services may include gas pipelines, oil pipes, utilities, electricity, power lines, water pipes, sewer gravity main, communication cables and unknown pipelines. Setback distances are to be confirmed post-EIS.

5.4.6 Groundborne construction noise impacts

The predictions undertaken are based on conservative assumptions i.e. propagation through rock, no impedance changes at below-ground formation change, foundation types and use of peak velocity values to determine L_{ASMax} noise levels. The 3D vector distance from the tunnel edge to the sensitive receptor foundation has been used to calculate predicted groundborne noise levels.

Groundborne noise due to the roadheader has been predicted to exceed the ground-borne noise criteria defined in the CoP Vol 2. Each receptor predicted to exceed the groundborne noise criteria has been presented in Appendix C with their respective predicted level labelled. It was found that:

- Properties within an approximate diagonal distance of 430 m from the works may exceed the *Dwellings – Standard hours* criteria of 40 $dBL_{ASMax.}$ There are up to 29 sensitive receptors predicted to exceed this criteria.
- Properties within an approximate distance of 615 m may exceed the *Dwellings – Non-standard hours* criteria of 35 dBL_{ASMax}. There are up to 39 sensitive receptors predicted to exceed this criteria.

Mitigation measures to manage groundborne construction noise exceedances are included in Section 8.

5.4.7 Blasting vibration predictions from tunnelling construction

Vibration due to blasting is predicted based upon several variables, with the site constant and instantaneous charge size (in kg) the dominant variables in the prediction model. The site-specific constants for the noise and vibration study area are not known at this stage so the assessment has focused on the recommendation of blasting parameters to achieve the assessment criteria.

A range of site constants were assessed against a range of instantaneous charge sizes and are presented in Table 5.16. The predicted PPV levels at various distances for different site constants and charge sizes are presented in Figure 5.2.

Table 5.16 Instantaneous charge size (kg) and site constants

Plot shading in Figure 5.2	Instantaneous charge size (kg)	Site constant (K_g)	Rock constant (B)	Source of site constant
Red	500	1140	1.60	AS2187.2
		2062	1.60	Average from literature search quoting no more than 5% of blasts should exceed assessment's criterion
		3724 /2550	1.72 /1.60	Maximum predicted 5th percentile PPV from literature search Note
Blue	100	1140	1.60	AS2187.2
		3099	1.60	Average from literature search quoting no more than 5% of blasts should exceed assessment's criterion
		3724 /2550	1.72 /1.60	Maximum predicted 5th percentile PPV from literature search Note
Green	10	1140	1.60	AS2187.2
		3099	1.60	Average from literature search quoting no more than 5% of blasts should exceed assessment's criterion
		3724 /2550	1.72 /1.60	Maximum predicted 5th percentile PPV from literature search Note
Yellow	1	1140	1.60	AS2187.2
		3099	1.60	Average from literature search quoting no more than 5% of blasts should exceed assessment's criterion
		3724 /2550	1.72 /1.60	Maximum predicted 5th percentile PPV from literature search Note

Sources: AS2187.2, Bulga Optimisation Project, Melbourne Metro Rail Project, Muswellbrook Coal Company No.1 Open Cut Extension, Tipathy G.R. *et al.*

Table notes:

K_g = 3724 and B = 1.72 will predicted a higher PPV for a specific charge size closer to the receiver, and K_g = 2550 and B = 1.6 will predicted higher PPV for the same charge size but at further distances. Distance depends on charge size.

Figure 5.2 shows a significant range in PPV values when using different site constants and charge sizes. Because of this large range in predicted PPV, small scale site-specific blast testing will occur before major blasting works to determine the 'true' site constants in order to understand the potential impacts.

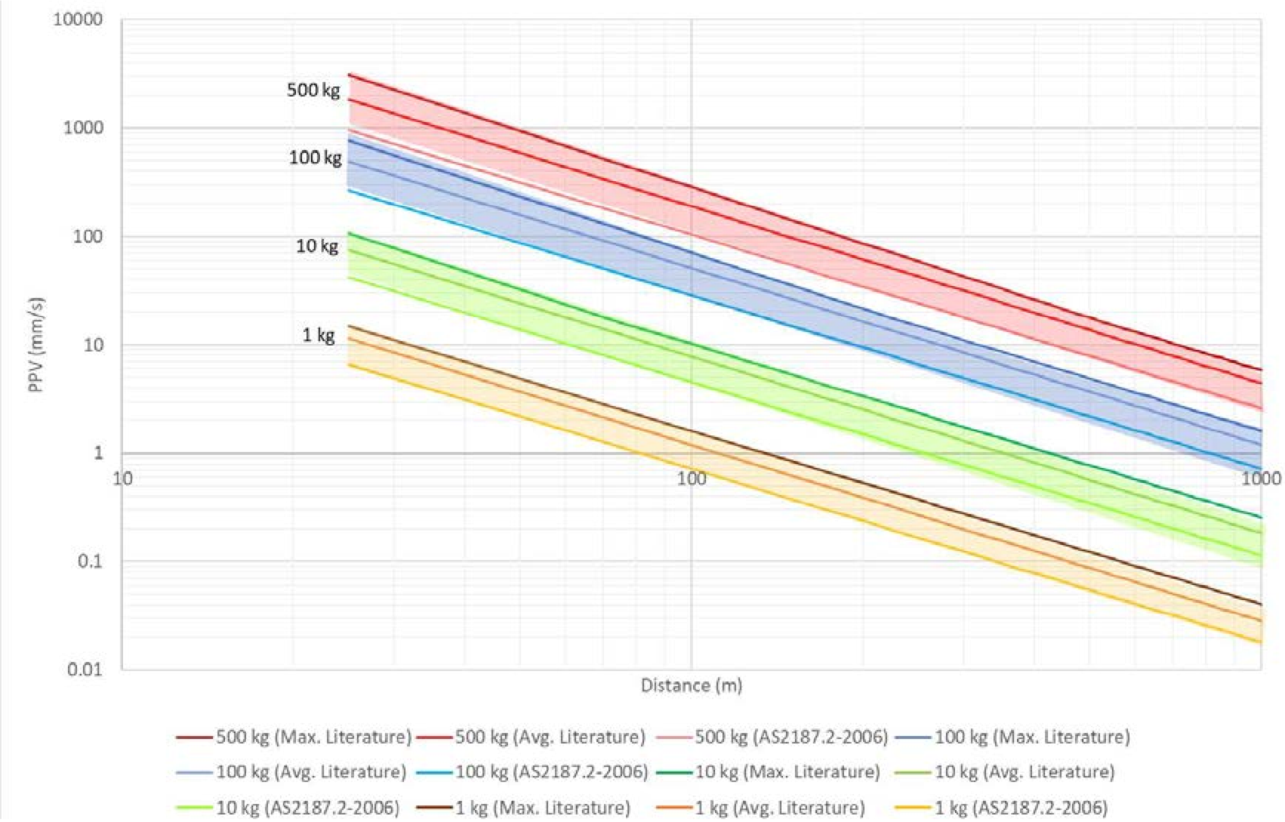

Figure 5.2 Predicted PPV (mm/s) at a distance (m) based on instantaneous charge size (kg) and site constants

Vibration from blasting has been assessed at a distance equivalent to the closest property to the alignment. This property is approximately 55 m from the outer tunnel dimension. Using a site and rock constants of 3724 and 1.72 (the value that results in the highest PPVs, as the tunnel site is presumed to be 100 per cent rock formation and thus minimal damping), it was found that the instantaneous charge size should be no more than 1.39 kg to achieve the human comfort criteria of 5 mm/s at this property, however, charge size will need to be assessed for ’true’ site constants based on site-specific (much smaller) test charges.

Vibration due to blasting will also be assessed for underground services once true site constants have been determined.

There are no explicit criteria in regard to sleep disturbance from blasting. The DTMR CoP Vol 2 states ’Generally, blasting is not to be conducted outside standard hours. Any blasting outside of standard hours must be approved by DTMR prior to blasting. It is noted that reduced limits may be required to be achieved’.

6 Operational noise assessment

6.1 Methodology

At this stage no operational fixed infrastructure within the Project area other than that associated with the operation of the tunnel has been identified. Should additional fixed infrastructure be added through the Project area it will be designed to meet the noise objectives identified in Section 4.4.3, including mitigation measures such as enclosures and attenuators as necessary.

6.1.1 Fixed infrastructure

6.1.1.1 Assessment approach

The following approach has been used to assess airborne noise due to operation of fixed infrastructure associated with the tunnel:

- Identification of closest sensitive receptor and occupancy type
- Derivation of empirical sound power level of fans based on tunnel specifications
- Prediction of airborne noise levels at the sensitive receptors
- Comparison of the predicted internal airborne noise levels with the acoustic quality objectives
- Development of acoustic mitigation options to meet the environmental noise objectives.

6.1.1.2 Operational scenarios

Noise levels associated with the following operational scenarios have been assessed:

- Maintenance operations: includes running one maintenance fan (either eastern or western end), and one Longitudinal egress passage (LEP) fan at each end of the tunnel

  Predictions are based on one maintenance fan and one LEP fan in operation at each end of the tunnel
- Degraded: includes running two maintenance fans (either eastern or western end), and one LEP fan at each end of the tunnel
- Emergency operations: includes running two maintenance fans (either eastern or western end), and one LEP fan at each end of the tunnel.

Predictions are based upon the two maintenance fans and one LEP fan in operation at each end of the tunnel for the entire hour assessment period.

6.1.1.3 Identification of receptors

For the Little Liverpool Range tunnel, two noise sensitive receptors were identified (one at each portal/ventilation station). The sensitive receptors are at the following distances from each ventilation station:

- Eastern Portal: Approximately 285 m from the indicative ventilation station layout
  - 23A Old Grandchester Road, Grandchester (Receptor ID: RES4820)
- Western Portal: Approximately 130 m from the indicative ventilation station layout
  - 4 Kessling Drive, Laidley (Receptor ID: RES4835).

Other sensitive receptors within the noise and vibration study area are further from the above receptors and if compliance can be achieved at these receptors, it follows that it will be achieved at these further receptors.

6.1.1.4 Prediction methodology

Calculations of fan noise emissions were undertaken using the computational software SoundPLAN (v8.0) using the propagation methodology in ISO 9613-2[5]. Terrain data (in increments of 5 m elevation contours) was used in the assessment methodology.

6.1.1.5 Limitations and assumptions

The following limitations and assumptions apply:

- 100 per cent ground factor was used in the tunnel ventilation assessment due to the vegetation between the portals and the receivers.
- Ventilation design to date is at schematic stage with this noise assessment assessing feasibility of the schematic ventilation system to acoustic objectives (a detailed design acoustic assessment will be undertaken post-EIS).
- Because the fixed infrastructure will be operating simultaneously at a steady-state, compliance with the continuous $L_{Aeq,1hr}$ criterion is also expected to achieve compliance with the $L_{A10,1hr}$ and $L_{A1,1hr}$ criteria.
- As fans are yet to be selected, fan sound power levels have been empirically derived and may vary from noise levels of the final plant selection. Noise associated with the final fan selections will need to be assessed for compliance with the environmental noise objectives (and mitigation may need to be refined).
- Attenuators are to be custom made and data is not readily available. Indicative insertion loss and pressure drops have therefore been derived based on extrapolation of ‘off-the-shelf’ attenuator data. The custom-made attenuators will need to be tested to ensure that they comply with the final silencer specification.
- As specific ductwork is not finalised, the locations of fan exhaust/intake locations in the tunnel have been assessed at the portal. This is a conservative approach as additional ductwork is expected to provide some attenuation.
- Fans are assumed to be designed to not result in tonal noise emission characteristics, and therefore it is assumed that ‘beating’ will not occur.
- At the time of this assessment, additional plant equipment from nearby water treatment plants and transformers is not yet selected. Noise emission from these items should be in the order of 10 dB(A) below the predicted noise level of the ventilation equipment at the properties.
- It is assumed that the façade noise breakout is below that of the ventilation exhaust locations, and therefore negligible.
- No buildings, aside from the ventilation station, were included in the model.
- Other fixed infrastructure noise sources, such as pumps and transformers, will be located at the eastern and western tunnel portals for the Project. While noise from these sources are not yet known, nominal mitigation strategies (such as attenuators, solid barriers and enclosures) would typically be implemented, and if required, will be designed to meet appropriate noise level emissions.

6.2 Operational tunnel infrastructure

6.2.1 Predictions

Fan SWL were empirically derived[6] based on fan specifications of the tunnel ventilation design and are provided in Table 6.1.

[5] ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation
[6] ASHRAE Handbook

Table 6.1 Sound Power Levels of indicative fans

Fan	Octave Band Centre Frequency, Hz In-duct Sound Power Level, dB(Lin)								Total in-duct SWL dB(A)
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Maintenance	122	122	126	123	119	117	114	114	125
LEP	101	101	105	102	98	96	93	93	104

In the Project ventilation stations, the maintenance fans are to be installed in parallel. Large plenums are included in the design between the fans and the outlet to the environment. These have been treated as large concrete rooms.

The current design includes indicative mitigation proposed consists of sound absorption linings (Noise Reduction Coefficient of 0.85, covering a minimum area of 150 m^2) in plenums and attenuators. This mitigation has been included in the design to ensure the predicted noise levels would achieve the EPP Noise criteria at nearby sensitive receptors.

The minimum insertion losses of attenuators are presented in Table 6.2. Insertion loss of these indicative propriety attenuators have been based off extrapolation of the octave band insertion loss from typical attenuators at different lengths, to a relative-length applicable to the spatial allowance for attenuators in the design of the ventilation stations.

Table 6.2 Minimum insertion loss of attenuators for the Project

Fan	Location in reference to fans	Ventilation station	Octave band centre frequency, Hz Insertion Loss, dB(Lin)							
			63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Maintenance	Ambient side	East	5	12	19	26	24	16	14	12
LEP			2	5	8	13	13	10	9	8
Maintenance		West	20	31	59	68	75	43	25	23
LEP			2	5	8	13	13	10	9	8
Maintenance	Tunnel side	East/West	18	30	44	55	58	41	33	28
LEP			10	17	32	41	44	26	17	15

Table notes:

1 Silencers are to be sized so that regenerated noise is negligible compared to the actual noise level
2 Ambient side refers to attenuators located between the fan and the ventilation station emission point
3 Tunnel side refers to attenuators located between the fan and the tunnel. This is to control noise within the tunnel and thus noise emission from the portal
4 In the absence of custom-built attenuator data, attenuator octave band insertion loss is based on extrapolation of readily-available attenuator data.

Noise levels predicted with the proposed mitigation measures are presented in Table 6.3.

Table 6.3 Predicted noise level at the closest noise sensitive receptor

Scenario	Maintenance fan operation location	Internal noise criteria $L_{Aeq,1hr}$, dB	Predicted noise level $L_{Aeq,1hr}$, dB
Maintenance	East	30	27
	West		17
Degraded	East		30
	West		23
Emergency	East		30
	West		23

With the mitigation proposed, compliance with the EPP (Noise) Acoustic Quality Objectives is predicted. It should be stated that the above mitigation is indicative, and other mitigation options can be explored, such as:

- Installation of acoustic louvres on the ventilation station façade
- Internal acoustic lining within the tunnel and/or ventilation system
- Upgrade of external receiver facades (off-reservation treatment)
- Use of quieter plant equipment, including the 'best available technology economically achievable'.

Once fans are selected, if the sound power levels differ from those in Table 6.1, then mitigation will need to be reassessed. Selected fans will need to be free of tonality, and if not, a tonality penalty should be applied, and mitigation be revised.

6.3 Operational road traffic noise

6.3.1 Operational road traffic noise assessment – proposed new roads

In assessing the potential noise impacts of the proposed construction of seven new roads, Neumann Road is owned by the State, all other roads in Table 6.4 are owned by Lockyer Valley Regional Council. A desktop assessment using the Calculation of Road Traffic Noise method has been implemented to assess the potential road traffic noise impacts from these roads.

It has been assumed each of the roads will become operational following the completion of construction for the Project. The AADT volumes are based on information gathered as part of the design. The assessment year used for these predictions is 10 years after opening.

The required setback distance in meters from the road to comply with the proposed new road criteria of 60 $L_{A10(18hr)}$ dB(A) (as per CoP Vol 1) has been calculated. The quantity of sensitive receptors that are within this setback distance and predicted to exceed the criteria are included in Table 6.4.

Table 6.4 presents a summary of the predicted noise increase due to the re-alignment of seven new roads at the closest residential receptor.

Table 6.4 Operational road traffic noise predictions for proposed new roads

Location	Type[1]	Posted speed (km/h)	Surface	AADT[2] 2035[3]	Minimum setback distance (m)[4]	Number of sensitive receptors within setback distance
Airforce Road	Rural Collector	60	Sealed	1049	39	0
Brooks Road	Rural Access	60	Unsealed	1098	53	1
Off Beavan Street	Urban Access	40	Sealed	1524	39	5
Chadwick Street	Rural Access	60	Sealed	1098	53	4
Rosewood Laidley Road	Rural Access	80	Sealed	4280	205	5
Doonans Access Rd	Rural Access	40	Unsealed	1098	42	0
Neumann Road	District Road	100	Sealed	4453	42	2

Table notes:

1 LGA Classification
2 Annual Average Daily Traffic
3 2035 Annual Average Daily Traffic estimated based on annual growth factor of 2% from 2017 traffic volumes
4 Minimum setback distance is based on distance to achieve the criteria for road traffic noise levels for proposed new roads of 60 L_{A10} (18h).

The proposed new roads, Brooks Road, Off Beavan Street, Chadwick street, Rosewood Laidley Road, Neumann Road may result in exceedance of the 60 $L_{A10(18hr)}$ dB(A) road traffic noise criteria for proposed new roads. These new roads will need to be assessed in more detail during future stages of the Project to confirm compliance, or otherwise, with adopted goals. Potential road traffic noise attenuation strategies are included in Section 8. It should also be noted that the prediction methodology used in this assessment only considers road traffic noise and influence from operational rail noise or other infrastructure is not included.

6.3.2 Operational road traffic noise assessment – upgraded roads

The upgrade of twenty-seven roads is proposed within the noise and vibration study area. The required setback distance in metres from the road to comply with the upgraded roads criteria of 68 $L_{A10(18hr)}$ dB(A) (as per CoP Vol 1) has been calculated. The quantity of sensitive receptors that are within this setback distance and predicted to exceed the criteria are included in Table 6.4.

Table 6.5 presents a summary of the predicted noise increase due to the proposed upgrade of roads at the closest residential receptor.

Table 6.5 Operational road traffic noise predictions for upgraded roads

Location	Type[1]	Posted speed (km/h)	Surface	AADT[2] 2035[3]	Minimum setback distance (m)[4]	Number of sensitive receptors within setback distance
Lockyer Valley Regional Council						
Warrigal Road	Rural Access	50	Spray seal	1098	7	0
Wrights Road	Rural Access	50	Spray seal	74	1	0
Seventeen Mile Road	Rural Collector	60	Spray seal	302	1	0
Connors Road	Rural Access	60	Spray seal	108	1	0
Johns Lane	Rural Access	50	Unsealed	1098	7	0
Philps Road	Rural Access	60	Spray seal	5491	43	0
Burgess Road	Rural Access	60	Unsealed	2122	15	0
Jamiesons Road	Rural Access	60	Spray seal	2472	17	0
Smithfield Road	Rural Access	70	Spray seal	2361	22	0
Crescent Street	Urban Collector	40	Spray seal	3418	13	0
East Street	Local Road	50	Spray seal	1098	7	0
Old College Road	Urban Collector	40	Spray seal	1098	1	0
Beavan Street	Local Road	50	Spray seal	1098	7	0
Eastern Drive	Regional Road	60	Asphalt	16855	95	79
Golf Links Drive	Urban Collector	60	Spray seal	6576	30	0
Dodt Road	Rural Access	60	Spray seal	18	1	0
Gordon Street	Residential Access	50	Spray seal	1098	7	0
Railway Street Forest Hill	Rural Access	50	Spray seal	1098	7	0
Old Laidley Forest Hill Drive	Sub-Arterial	80	Spray seal	2015	25	0
Boundary Road	Sub-Arterial	50	Spray seal	1098	7	0
Paroz Road	Rural Access	80	Spray seal	660	3	0
Luck Road	Rural Access	40	Spray seal	1098	6	0

Location	Type[1]	Posted speed (km/h)	Surface	AADT[2] 2035[3]	Minimum setback distance (m)[4]	Number of sensitive receptors within setback distance
The State of Queensland						
Glenore Grove Road	District Road	30	Spray seal	3258	14	2
Laidley-Plainlands Road	District Road	60	Spray seal	7188	46	3
Ipswich City Council						
Grandchester Mount Mort Road	Rural Collector	60	Spray seal	1052	8	0
School Road	Rural Access	60	Spray seal	1098	9	0
Calvert Station Road	Local Road	70	Spray seal	604	2	0

Table notes:

1 LGA Classification
2 Annual Average Daily Traffic
3 2035 Annual Average Daily Traffic estimated based on annual growth factor of 2% from 2017 traffic volumes
4 Minimum setback distance is based on distance to achieve the criteria for road traffic noise levels for upgrade roads of 68 L_{A10} (18h).

Three of the proposed road upgrades, Eastern Drive, Glenore Grove Road and Laidley Plainland Drive are predicted to result in exceedance of the 68 $L_{A10(18hr)}$ dB(A) road traffic noise criteria for upgraded roads. These will need to be assessed in more detail during future stages of the Project to confirm exceedances against relevant legislation. Potential road traffic noise attenuation strategies are included in Section 8. It should also be noted that the prediction methodology used in this assessment only considers road traffic noise and influence from operational rail noise or other infrastructure is not included.

7 Cumulative impacts

7.1 Construction noise cumulative impacts

Only the ARTC projects adjacent to H2C have been considered in the cumulative impact assessment (CIA) for construction noise and vibration. Other projects are considered too far from the Project alignment compared to the localised nature of construction noise and vibration impacts.

Table 7.1 details major projects which may be construction simultaneously with the Project and close enough to contribute to cumulative noise levels at sensitive receptors potentially affected by the Project.

Table 7.1 Major proposed projects nearby to the Project

Project and Proponent	Location	Description	EIS status	Relationship to H2C
Gowrie to Helidon (G2H) – Inland Rail (ARTC)	Rail alignment from Gowrie to Helidon	26 km single-track dual-gauge freight railway as part of the ARTC Inland Rail Project	Draft EIS being prepared by ARTC	Potential overlap on construction commencement for G2H and finalisation of H2C
Calvert to Kagaru (C2K) – Inland Rail (ARTC)	Rail alignment from Calvert to Kagaru	53 km single-track dual-gauge freight railway as part of the ARTC Inland Rail Project	Draft EIS being prepared by ARTC	Potential overlap of finalisation of H2C and commencement of C2K

Simultaneous noise from construction works of sections G2H or C2K sections has the potential to increase noise levels at nearby sensitive receptors affected by noise from the Project. These impacts would only occur during the commencement and finalisation of the construction phase for the adjacent packages. Due to the conservative modelling methodology used for the project, the noise impacts are assessments of worst-case construction scenarios. As a result, the noise levels due to the cumulative impacts are not expected to significantly increase the predicted levels.

The modelling extends 2 km past the tie in points for both G2H and C2K Inland Rail Sections. As such the sensitive receptors located past the end of the alignment are still included within this assessment and the predicted worst-case impacts related to this project is assessed. The impact of noise would be managed by each project to ensure that the potential for adverse impacts at sensitive receptors is minimised. In addition, any overlap of construction works between projects is unlikely.

8 Mitigation measures

Mitigation measures are provided in Section 7 of the CoP Vol 2 and specific mitigation measures for the Project are discussed in this section.

The construction noise and vibration assessment detailed a number of potential exceedances of the Project construction noise and vibration criteria. These were predicted because of various construction activities which would be confirmed during detailed design. Many exceedances of the lower and upper human comfort limits have also been predicted within the noise and vibration study area. As a result of these exceedances, the following mitigation measures have been identified.

8.1 Initial mitigation

8.1.1 Construction noise and vibration initial mitigation

The mitigation measures and controls presented in Table 8.1 have been factored into the design for the Project. They have been applied prior to the prediction of construction noise and vibration impacts detailed in Section 5.4.

Table 8.1 Initial construction noise and vibration mitigation measures

Action	Mitigation measure
Project design	The Project will be designed and constructed with the aim of achieving adopted construction noise and vibration criteria.
Construction noise and vibration assessment	Where it is found that standard mitigation measures are not sufficient to reduce noise and vibration impacts to acceptable levels, additional mitigation measures will be investigated and implemented.
Communication	Local residents/stakeholders will be provided with information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during construction.
	ARTC will provide a community liaison phone number and permanent site contact so that noise and/or vibration related complaints or inquiries can be received and addressed in a timely manner.

8.1.2 Operational noise initial mitigation

The mitigation measures and controls presented in Table 8.2 have been factored into the design for the Project. They have been applied prior to the prediction of operational noise and vibration impacts detailed in Section 6.

Table 8.2 Operational noise initial mitigation measures

Aspect	Mitigation measure
Project design	The project will be designed and constructed with the aim of achieving the adopted operational noise criteria (operational road traffic noise and environmental noise objectives)
Operational noise assessment	Where it is found that standard mitigation measures are not sufficient to reduce operational noise impacts to acceptable levels, additional feasible and reasonable mitigation measures will be investigated and implemented.
Communication	Local residents/stakeholders will be provided with information to enable them to understand the likely nature, extent and duration of operational noise impacts.
	ARTC will provide a community liaison phone number and site contact so that noise related complaints or inquiries can be received and addressed in a timely manner.

8.2 Detailed mitigation measures

Construction noise and vibration impacts (refer Section 5.4) are expected to exceed the construction noise limits established in Section 4.1, in accordance with the ToR. To mitigate the predicted construction noise and vibration impacts, additional mitigation measures are detailed in Table 8.3 and are included in the draft Outline EMP (refer EIS Chapter 23: Draft Outline Environmental Management Plan).

Table 8.3 Additional construction noise and vibration mitigation measures

Delivery phase	Aspect	Mitigation and management measures
Detailed design	Noise and vibration impacts on sensitive receptors	▪ Update the construction noise and vibration assessment to reflect the construction contractor location of construction sites, construction activities and construction scheduling to inform the development of the Noise and Vibration Sub-plan to achieve the performance criteria.
	Operational road traffic noise impacts on sensitive receptors	▪ Review/update the operational road traffic noise and vibration assessment to reflect/inform the detailed design, including incorporation of potential noise treatments. The following mitigation measures will be considered as part of detailed design where operational road traffic noise impacts are predicted to exceed the adopted road traffic noise limit based on the detailed design. Each measure is listed in order of preference with corresponding strategy numbers (SN). ▪ SN1 – Noise sensitive use exclusion zone (buffer) or building location envelope ▪ SN2 – Earth mound (landscaped) ▪ SN3 – Noise fence and earth mound (landscaped) ▪ SN4 – Noise fence (only) ▪ SN5 – Noise barrier and building design ▪ SN6 – Building design (only) ▪ SN7 – Pavement surface treatment A combination of mitigation measures may be appropriate.
	Operational fixed infrastructure noise impacts on sensitive receptors	Noise from fixed infrastructure is predicted to exceed the EPP (Noise) acoustic quality objectives at the closest sensitive receptors. Mitigation will therefore be required. Indicative mitigation proposed consists of sound absorption linings (Noise Reduction Coefficient of 0.85, covering a minimum area of 150 m^2) in plenums and attenuators. Mitigation has been identified to achieve compliance and this information has been included in the design. This mitigation will also need to be reviewed during future stages of the Project to confirm compliance is achieved.
Pre-construction	Noise and vibration impacts on sensitive receptors	The Noise and Vibration Sub-plan will include: ▪ Location of sensitive receptors in proximity to the disturbance footprint ▪ Requirements for pre-construction dilapidation surveys and/ or vibration monitoring at vibration sensitive receptors during construction ▪ Specific management measures for activities that could exceed the construction noise and vibration criteria at a sensitive receptor ▪ Notification process within the community engagement plan (including who to contact in the event of a complaint) to advise of significant works with potential for noise nuisance or vibration at sensitive receptors ▪ Noise management measures including controlling noise and vibration at the source, controlling noise and vibration on the source to receptor transmission path and controlling noise and vibration at the sensitive receptor ▪ Practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on sensitive receptors ▪ Any other measures necessary to comply with conditions of approval or regulatory requirements. Where it is found that existing mitigation measures are not sufficient to reduce noise and vibration impacts to acceptable levels, additional mitigation measures will be investigated and implemented.

Delivery phase	Aspect	Mitigation and management measures
Construction and commissioning	Noise and vibration impacts on sensitive receptors	▪ Sensitive receptors identified in the Noise and Vibration Sub plan, as well as residents within at least 2 km of the disturbance footprint and other relevant stakeholders are to be provided with sufficient information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during construction. ▪ Sensitive receptors with the potential to be affected by exceedances of noise goals will be notified prior to the commencement of relevant works. ▪ Construction progress and upcoming activities will be regularly communicated to local residents/stakeholders, particularly when noisy or vibration generating activities are planned, such as vibratory compaction and piling. ▪ Implementation of the Social Impact Management Plan.
	Damage to buildings and structures	▪ Building condition/dilapidation surveys will be undertaken for buildings/structure in close proximity to the activities and at vibration sensitive receptors, including buildings of heritage value identified as potentially impacted by the Project during the detailed design phase modelling and assessment. Building condition surveys will also be undertaken at vibration sensitive receptors which are expected to exceed the adopted structural damage vibration limits. Surveys are to take place prior to commencement and on completion of vibration generating works (such as pile-driving). Following such surveys, more accurate data may be used to assess the impacts to vibration sensitive receptors. ▪ If, during detailed design and construction methodology assessments, vibration impacts are predicted to exceed the criteria at a heritage sensitive receptor, the following mitigation must be undertaken: – Consultation with the owner of the structure to determine the sensitivity of the structure to construction vibration. A more appropriate criteria to be applied at the location may be agreed upon as a result – Baseline vibration monitoring is to be undertaken prior to the activity commencing and monitored throughout the activity to assess compliance with vibration limits set as part of the sub-plan for the relevant receptor. Vibration monitoring results are to be assessed and used to refine vibration predictions and management measures as applicable such as developing and enforcing exclusion zones around the sensitive structure. ▪ Where feasible, modify the construction methodology to reduce the predicted vibration impacts. This could include: – Using smaller equipment, such as a handheld jackhammer instead of a rockbreaker – Changing the construction methodology.
	Damage to buildings and structures	Vibration monitoring will be undertaken at locations where the potential for building/structural damage risk has been identified during detailed design and is deemed warranted. This includes vibration sensitive receptors at which vibration impacts are expected to exceed the adopted structural damage criteria. Vibration monitoring will be undertaken by a suitably qualified professional.
	Noise impacts on sensitive receptors	▪ Where practicable and feasible, noise monitoring will be undertaken at noise sensitive receptors where the potential for noise impacts to exceed relevant criteria has been identified so that suitable mitigation measures can be implemented. ▪ Noise and/or vibration monitoring will be also undertaken in response to noise or vibration complaints.
	Noise impacts on sensitive receptors – hours of work	▪ Construction works will be undertaken in accordance with the nominated hours of work within the noise and vibration management plans and as per advice to stakeholders regarding permitted out of hours activities.

Delivery phase	Aspect	Mitigation and management measures
	Noise impacts on sensitive receptors – staff	■ Staff training will be undertaken so that unnecessary sources of noise are avoided. Training will enforce that: – Unnecessary shouting or loud stereos/radios on site are not tolerated – Materials are not to be dropped from height – Metal items are not thrown – Doors/gates are not slammed – Vehicle radios and engines are to be turned off or volume lowered wherever possible.
	Noise and vibration impacts on sensitive receptors – selection of construction equipment near sensitive receptors	■ Quieter and non-vibratory construction equipment will be selected for use near sensitive receptors, where feasible and reasonable. This is particularly important for any non-standard/out of hours construction activities where sensitive receptors are nearby. This is also particularly important for loud and/or vibration-intensive plant such as mulchers and piling rigs. ■ Appropriately sized equipment is to be selected for the task, such as vibratory compactors and rock excavation equipment. For example, a 22-tonne excavator is expected to operate 8 dB(A) quieter than a 40-tonne excavator, based on equipment noise emissions given by BS5228.1.
	Noise and vibration impacts on sensitive receptors – selection of construction methods near sensitive receptors	Where practicable, alternative construction methods will be adopted to reduce the noise and vibration impacts in the vicinity of sensitive receptors, such as: ■ Using damped tips on rock-breakers where appropriate ■ Using rock saws instead of blasting ■ During clearing, using excavators with grabs and rake attachments instead of chainsaws; and mulching cleared material at locations away from sensitive receptors ■ Avoiding onsite fabrication work where possible ■ Using alternatives to impact pile driving where possible, such as continuous flight auger injected piles, pressed-in preformed piles, auger bored piles, impact bored piles or vibratory piles ■ When piling, avoiding dynamic compaction using large tamping weights near sensitive and critical receptors where possible ■ Reducing energy per blow when piling (consider first whether this may result in prolonged exposure with no realised reduction in community disturbance).
	Noise and vibration impacts on sensitive receptors – blasting	Where blasting impacts are expected to exceed the adopted vibration limits, the following measures are to be implemented where feasible and reasonable: ■ Reducing the charge size by use of delays and reduced charge masses ■ Ensuring adequate blast confinement to minimise the amount of overpressure ■ Avoiding secondary blasting where possible; the use of rock breakers or drop hammers may be an acceptable alternative ■ Avoiding blasting during heavy cloud cover or during strong winds blowing towards sensitive receptors ■ Establishing a blasting timetable through community consultation for example, blasts times negotiated with surrounding sensitive receptors.

Delivery phase	Aspect	Mitigation and management measures
	Noise and vibration impacts on sensitive receptors – during hours of construction	■ Where feasible and reasonable, the duration of simultaneous operation of noise or vibration-intensive plant will be minimised. Plant and equipment used intermittently or no longer in use will be throttled or shut down ■ Vibration-intensive stationary plant located near sensitive receptors will be isolated with resilient mounts ■ Noise-emitting plant and equipment, construction compounds laydown areas will be orientated away from sensitive receptors where feasible and reasonable ■ Equipment will be operated in the correct manner and correctly maintained including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines ■ Construction plant, vehicles and machinery will be maintained and operated in accordance with manufacturer's instructions to minimise noise and vibration emissions ■ When piling, the pile and rig are to be carefully aligned, and cable slap and chain clink minimised.
	Noise and vibration impacts on sensitive receptors – mechanical plant management	■ All mechanical plant near sensitive receptors will be modified to reduce noise by practical means, such as: – Internal combustion engines will be fitted with a suitable muffler in good repair, operating as per the manufacturer's specifications, as a minimum – Pneumatic tools will be fitted with an effective silencer on their air exhaust port, where feasible and practicable – Aggregate bins and chutes will be lined with a rubber material, to dampen the vibration of the structure – When piling, acoustic damping will be provided to sheet steel piles to reduce vibration and resonance – When piling, resilient pads will be used between pile and hammerhead. Care will be taken when selecting a resilient pad as energy is transferred to the pad in the form of heat. Based on manufacturer data, between 4 and 11 dB(A) of attenuation can be achieved by engine mufflers. Various other equipment treatments such as dozer track plate dampers can provide between 6 and 10 dB(A) of attenuation, based on manufacturer data.
	Noise impacts on sensitive receptors – stationary noise sources	■ Stationary noise sources near noise sensitive receptors will be shielded or enclosed where feasible and reasonable. Acoustic shielding will also be considered where works are expected to occur close to sensitive receptors for lengthy periods. Temporary noise barriers or enclosures can provide between 5 and 10 dB(A) of attenuation, based on preliminary calculations.
	Noise and vibration impacts on sensitive receptors – shielding of noise emitting plant	■ Where feasible, structures and noise-emitting plant will be located such that the structures provide some shielding to any nearby receptors. Structures include: – Temporary site buildings such as sheds – Materials stockpiles – Fencing – Storage/shipping containers. ■ Where vibration impacts at sensitive receptors are expected to exceed the adopted structural damage goals, and where reasonable and safe to do so, cut-off trenches to interrupt the direct transmission path of vibrations between source and receptors will be provided.
	Noise impacts on sensitive receptors – annoying characteristics	■ Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.

Delivery phase	Aspect	Mitigation and management measures
	Noise impacts on sensitive receptors – delivery of materials	▪ Site access points and roads will be sited as far as is practicable from sensitive receptors ▪ Acoustic shielding will be considered if loading/unloading areas are close to sensitive receptors ▪ Delivery vehicles will be fitted with straps rather than chains where feasible ▪ Off-site truck parking areas, if required, will be located away from residences and will be nominated where practicable ▪ The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas ▪ Reversing movements of vehicles will be minimised to reduce the use of reversing alarms. Where practicable, sites will be designed such that delivery vehicles are able to drive through the site and not be required to reverse.
	Noise impacts on sensitive receptors – construction traffic	▪ Where reasonable and feasible, unsealed areas will be regularly graded and potholes filled in sealed access roads and hardstand areas to reduce noise from construction vehicles. ▪ Where reasonable and feasible, construction traffic will be kept to a minimum. For example, trucks will be fully loaded so that the volume of each delivery is maximised. Where practicable, night time construction traffic will be redirected away from noise sensitive receptors, in accordance with the construction traffic management plan ▪ Appropriate construction traffic speed limits will be established and managed near noise sensitive receptors.

8.3 Residual impacts and mitigation

Across all construction activities, approximately 60 per cent of potential exceedances of the upper standard hours noise limit under the CoP Vol 2 are within 10 dB(A) of the limit, as are half of predicted exceedances of the evening non-standard hours noise limit.

Of the construction noise mitigation measures proposed in Section 8.1.1, those which can be quantified can be expected to provide between 4 and 11 dB(A) attenuation to the predicted noise levels. The remaining approximate 40 per cent of exceedances are not expected to be reasonably or practically mitigated to below the appropriate limit by physical attenuation alone. Where further mitigation is also similarly infeasible or unreasonable, residual exceedances will need to be managed. Management of residual impacts will be undertaken in consultation with the community and affected sensitive receptors.

Residual exceedances can be expected where noise and vibration impacts are unavoidable and significant after all reasonable and practicable mitigation measures are implemented. Currently these residual impacts will be addressed through respite, temporary relocation and/or the provision of architectural treatments.

Respite involves scheduling work periods when people are least affected, such as by:

- Scheduling work for when premises are not in operation
- Restricting the works to occur within standard hours as defined by CoP Vol 2
- Restricting the number of nights per week that works are undertaken near sensitive receptors.

Temporary relocation involves the voluntary relocation of impacted occupants for short periods of time where all reasonable and practicable measures and respite periods are implemented, and further mitigation is impractical. Examples of temporary relocation may involve the offer of an alternative activity or accommodation.

Architectural treatment will only be considered for residential dwellings where noise impacts and the duration of the impact is such that it cannot be addressed by mitigation or management measures, or temporary relocation. In addition, the condition of the dwelling will influence options for at property architectural solutions.

Residual impacts are reduced for construction activities as these are not permanent sources and will cease once nearby construction is complete.

No residual impacts of operational fixed infrastructure noise have been predicted. Reasonable and feasible mitigation will be applied to operational road traffic noise impacts where necessary in accordance with CoP Vol 1 and relevant local council guidelines, to the extent that residual operational road traffic noise impacts are deemed acceptable.

9 Conclusions

9.1 Construction noise

A construction noise impact assessment has been carried out in accordance with the ToR. Reasonable worst-case construction scenarios have been assessed for each of the main construction activities. The noise and vibration study area has been divided into six NCAs following the completion of baseline monitoring at 15 representative locations.

The assessment of noise associated with construction works indicates potential exceedances against both the lower and upper external noise limits. The NCA that has the highest population density is NCA_03 located around Gatton with a total of 2,497 sensitive receptors. The assessment predicted an exceedance for the upper construction noise limit for standard hours of 787 sensitive receptors within NCA_03. The remaining NCAs had a number of sensitive receptors predicted to exceed the construction noise limits. NCA_01 located around Helidon had 48 exceedances, NCA_02 surrounding Placid Hills had 22 predicted exceedances, NCA_04 surrounding Forest Hill had 201 predicted exceedances, NCA_05 surrounding Laidley have 179 predicted exceedances and NCA_06 for the remaining areas of the noise and vibration study area have 308 predicted exceedances.

The magnitude and number of potential exceedances for the loudest construction activity has 5,090 sensitive receptors exceeding the lower limit and 1,545 exceeding the upper limit during Standard Hours within all NCAs. It is also worth highlighting that approximately 60 percent of these exceedances are lower than 10 dB(A) above the construction noise upper limit for standard hours of works. These impacts can be sufficiently mitigated through the use of physical or management mitigation measures to reduce impacts discussed in this report. Where further mitigation is also similarly infeasible or unreasonable, residual exceedances may need to be managed. As with mitigation, management of residual impacts will be undertaken in consultation with the community and affected sensitive receptors.

The ‘Earthworks’ and ‘Rail Civil Works’ construction stages are predicted to have the greatest impact from construction noise; however, other construction stages may have greater overall impact depending on actual timing and duration of each construction stage. The urban centres that have the highest predicted noise impacts are in Gatton and Forrest Hill due to the proximity of sensitive receptors to the existing West Moreton System rail corridor.

The final number, degree and nature of these measures would be selected by the contractor and be largely dependent on the construction strategy and work carried out. Specific noise management and mitigation measures would be detailed as a sub-plan within the Construction Environmental Management Plan as set out in the draft Outline EMP. The management and mitigation measures which would be included in the plan are:

- Effective community consultation – focussing on proposed works and key areas
- Training of construction site workers – in noise friendly work practices
- Use of temporary noise barriers – for fixed activities
- Monitoring – verification, compliance and noise management
- Appropriate selection and maintenance of equipment – including consideration of equipment source control options (suitable muffler and silencers for example)
- Scheduling of work for less sensitive time periods – where possible
- Situating plant in less noise sensitive locations – this includes orientation of plant and equipment
- Construction traffic management – minimising stacking at work site entrances and extended periods of idling
- Respite periods – focusing on intensive construction works.

Simultaneous noise from construction works in the sections Gowrie to Helidon or Calvert to Kagaru has the potential to increase noise levels at nearby sensitive receptors. These impacts would only occur during the commencement and finalisation of the construction phase for the adjacent packages. Due to the conservative modelling methodology adopted, the noise levels due to the cumulative impacts are predicted as worst case.

9.1.1 Construction road traffic noise

For sixteen road sections intended to be used to carry construction traffic, the maximum predicted increase in noise level is greater than the criteria. Road traffic noise management and mitigation will need to be investigated for the following roads:

- Calvert Station Road - Between Rosewood Laidley Road and Gipps Street
- Haigslea Malabar Road - Between Warrego Highway and Mount Marrow Quarry Road
- Hiddenvale Road - Between Gipps Street and Neumann Road
- Neumann Road - Full extent
- School Road - Between Rosewood Laidley Road and Rafters Road
- Thagoona Haigslea Road - Between Karrabin Rosewood Road and Schumanns Road
- Burgess Road - Between Old Toowoomba Road and Smithfield Road
- Connors Road - Between Airforce Road and Wrights Road
- Hickey Street - Between Old College Road and Buaraba Street
- Mary McKillop Street - Between Turner Street and Arthur Street
- Paroz Road - Between Summer Street and 200 East of Summer Street
- Philps Road - Between Boxmoor Street and Warrego Highway
- Railway Street - Between Summer Street and Laidley Plainland Road
- Western Drive - Between Warrego Highway and Tenthill Creek Road
- Hampton Street - Between Hursley Road and Rob Street
- Herries Street - Between Dent Street and Water Street North

Early construction activities require higher volumes of construction traffic and the number of roads potentially exceeding the criterion by the third year drops significantly. A number of these roads are in rural locations and the existing base traffic volumes have low quantities. As such the initial airborne road traffic noise levels are low before the addition of construction traffic. The impact from additional movement is typically greater than for areas where existing traffic levels are already high.

The key mitigation measure will be to ensue traffic movement is kept to a minimum (for example, ensuring trucks are fully loaded so that the volume of each delivery is maximised).

9.2 Construction vibration

Minimum working distances for vibration intensive construction work have been predicted for human comfort and structural damage limits. These setback distances have been presented in ranges to highlight the reduction in received levels for smaller plant. The required setback distance for a vibrator roller at steady state may need to be located at 10 to 90 m away to achieve the lower limit (day) criteria for human comfort of 1mm/s. When using a vibratory piling rig the setback distance to meet the 1mm/s criteria is 20 to 100 m. Equipment size would be selected by the contractor considering the minimum working distances and the distance between the area of construction and the most affected sensitive receptors.

For the proposed tunnelling works, vibration due to the operation of the roadheader was conservatively assessed for PPV (mm/s) levels. Potential amenity issues, with comparison to the adopted lower limits for dwellings during non-standard hours, indicated potential impacts at up to 10 existing sensitive receptors.

During the tunnelling works, groundborne noise due to the roadheader has been predicted to exceed the adopted ground-borne noise criteria It was found that properties within an approximate diagonal distance of 430 m from the works may exceed the standard hours criteria (at up to 29 existing sensitive receptors); and properties within an approximate distance of 615 m may exceed the non-standard hours criteria (at up to 39 sensitive receptors).

The assessment has identified that the level of impact for construction vibration can be significantly reduced through adopting of varied construction work methods. Further mitigation measures have also been included to reduce the level of impact to sensitive receptors.

If works are needed to be carried out within minimum working distances, vibration monitoring will be carried out.

Heritage, sensitive structures and critical facilities will need to be considered on a case-by-case basis, dependent on their sensitivity.

9.3 Blasting

There are five locations that have been identified as part of the design that may require blasting along the Project alignment. Two of these locations are part of the tunnel construction and have been assessed. The other three locations identified for potential blasting by the constructability team as part of the cutting for earthworks have also been assessed. The closest sensitive receptor outside of the temporary construction disturbance footprint has also been considered.

The assessment identified conservative maximum permissible charge weights and blast parameters to achieve the airblast overpressure and vibration at each blasting location adopted. Further geotechnical investigation will be required to confirm blasting locations and ground variables to calculate these values to a higher level of accuracy.

These limits have been assessed based on worst case assumptions for a confined blast and with the limited geotechnical information currently known. Once detailed geotechnical information is known these limits may be able to be increased. The closest sensitive receptor is located 31 m from the temporary construction disturbance footprint as such the permissible charge weight is under 2 kg to comply with the airblast overpressure structural damage limit. This is a low amount of charge mass and other excavation methods such as rockbreaker attached to an excavator to reduce the impacts will be considered. All locations where blasting is required will need to be confirmed by the contractor and all blasting locations will require a Blasting Management Plan including the mitigation measures included in this assessment.

9.4 Operational road traffic noise

An assessment of road traffic noise for seven proposed new roads and seventeen upgraded roads was undertaken against applicable CoP Vol 1 criteria. The assessment considered the increase in traffic volumes and relative distance to the nearest sensitive receptors for each road. Influences from other dominant noise sources have not been considered.

The road traffic noise levels from the proposed upgraded roads Eastern Drive, Glencore Grove Drive and Laidley Plainlands Road are predicted to exceed the 68 dB(A), $L_{A10(18hr)}$ criteria. Of the seven proposed new roads, five are predicted to exceed the new roads criteria of 60 dB(A), $L_{A10(18hr)}$. During detailed design if the route is not able to be altered, attenuation strategies can be used either individually or in combination to reduce the impacts and achieve compliance with the road traffic noise criteria.

9.5 Operational fixed infrastructure noise

Noise from fixed tunnel infrastructure has been assessed for the emergency and maintenance operations of the Little Liverpool Range tunnel. For predicted noise levels to meet the EPP (Noise) Acoustic Quality Objectives, mitigation has been identified to achieve compliance and this information has been included in the design.

Fixed infrastructure noise sources, such as pumps and transformers, will be located at the eastern and western tunnel portals for the Project. While noise from these sources are not yet known, nominal mitigation strategies (such as attenuators, solid barriers and enclosures) would typically be implemented, and if required, will be designed to meet appropriate noise level emissions.

10 References

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APPENDIX

O

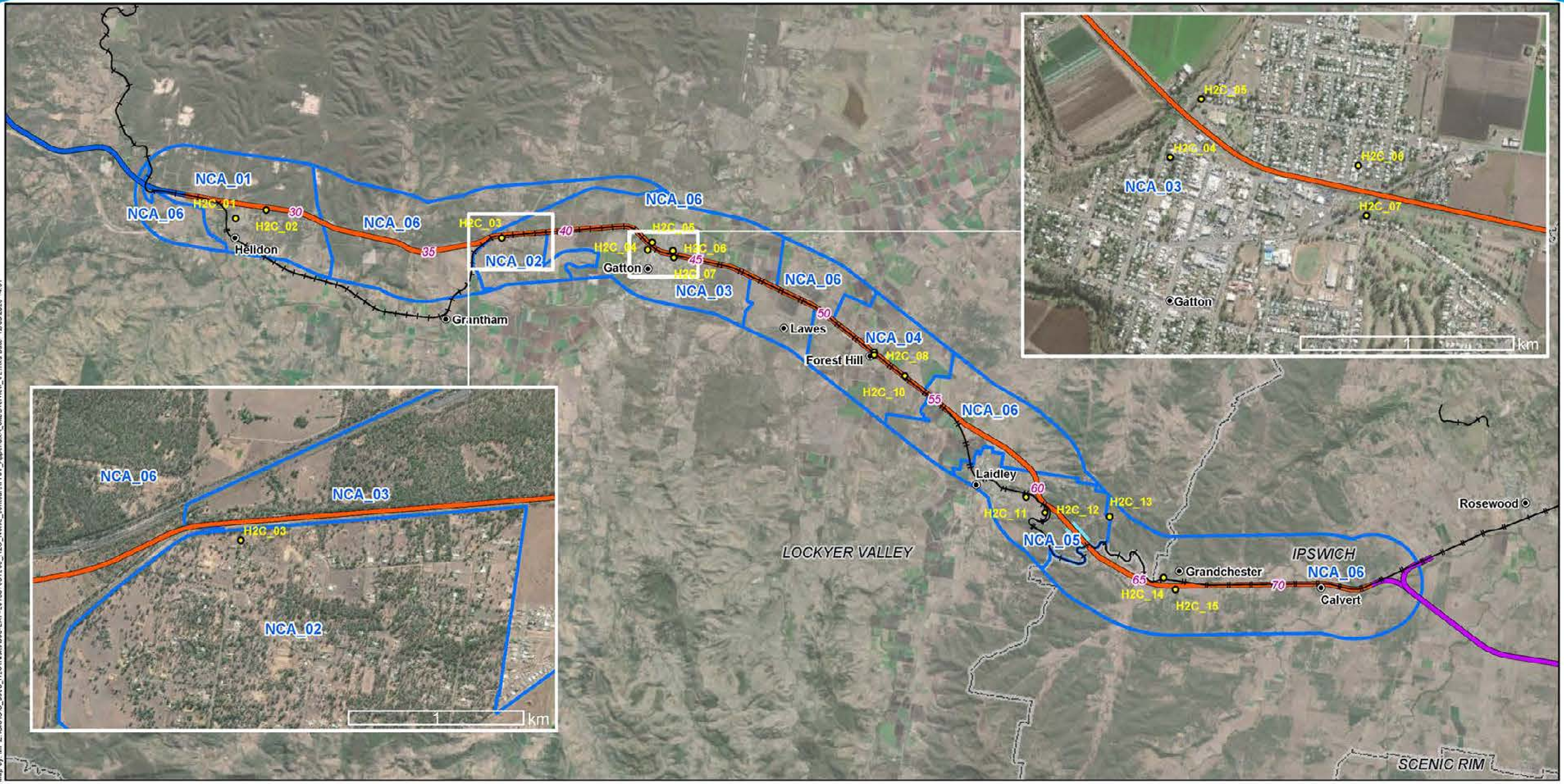
Noise and Vibration Technical Report

Appendix A Site Overview

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

IR_1381

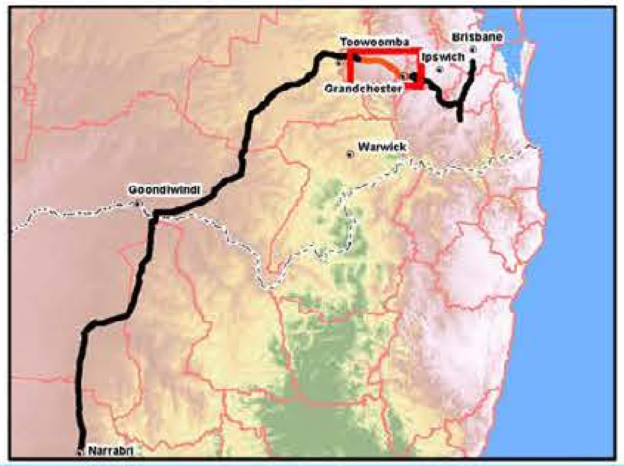
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Map by: MF Z:\GIS\GIS_330_H2C\Tasks\330-EAP-201907051253_H2C_Noise_contours\FFJV_AppendixA_SiteOverview_V2.mxd Date: 12/03/2020 14:31

Legend

- Noise Loggers
- 5 Chainage (km)
- Localities
- Existing rail
- G2H project alignment
- H2C project alignment
- C2K project alignment
- Tunnel
- NCA
- Local Government Areas



A3 scale: 1:150,000

0 1 2 3 4 5km

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Issue date: 06/03/2020 Version: 0
Coordinate System: GDA 1994 MGA Zone 56

Helidon to Calvert

Appendix A - Site overview and noise catchment areas

APPENDIX O

Noise and Vibration Technical Report

Appendix B Noise and Vibration Monitoring

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

IR_1381

Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_01

From	Thursday 29/11/2018 14:15	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 6/12/2018 11:30	Mic. Height (m)	1.8	Address	565 Connors Road
Instrument Type	01 dB Cube	Weather Station	No	Suburb	Helidon
Instrument Serial #	12602	Operator	BR	Land Use	Residential
Inst. Cal. Date	6/9/2018	Sample Int.	15 min	Latitude	27°32'39.02"S
Pre Calibration	94	RP Lot#	22/SP210417	Longitude	152° 7'35.23"E
Post Calibration	93.8				

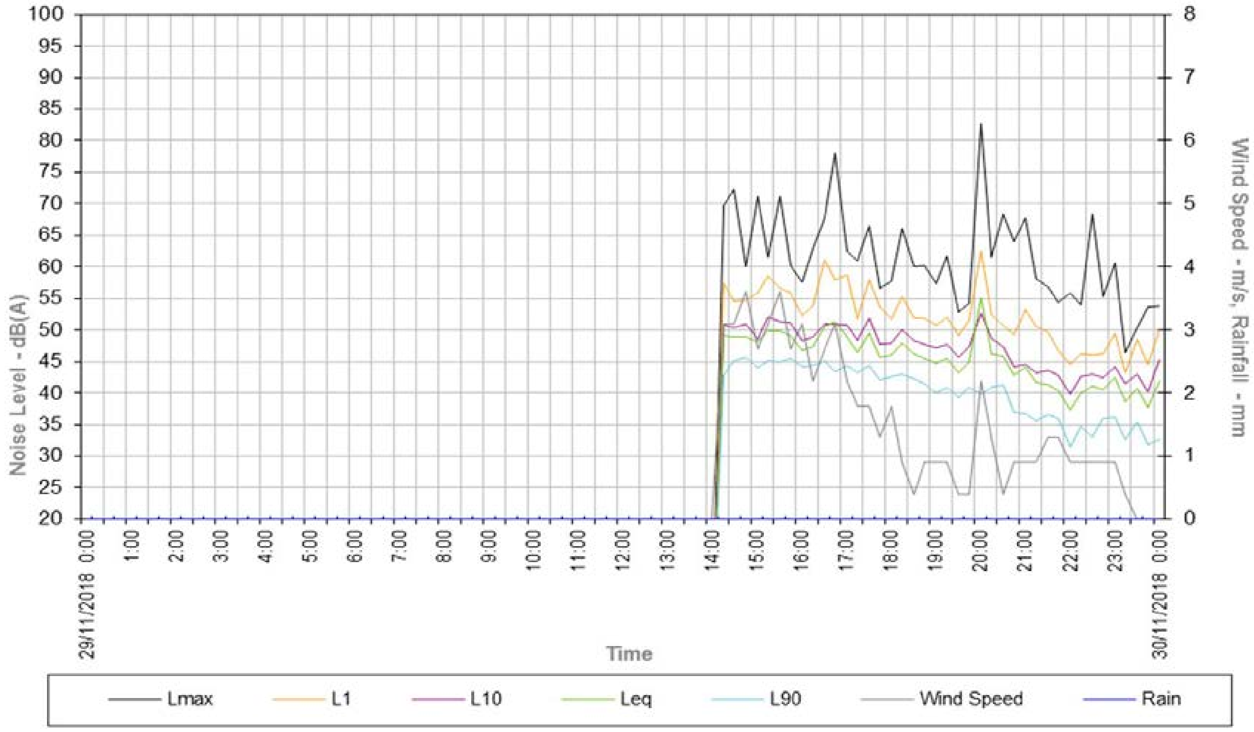
Daytime	Evening	Night
RBL **39.1 dB(A)**	RBL **34.0 dB(A)**	RBL **26.1 dB(A)**
ABLs Day (Mon-Fri 7am - 6 pm)	ABLs Evening (Mon-Fri 6 pm - 10 pm)	ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)
ABLs Day (Sat 8 am - 1 pm)	ABLs Evening (Sat 1 pm - 10 pm)	ABLs Night (Fri 6pm - 8am)
	ABLs Evening (Sun 7 am - 10 pm)	

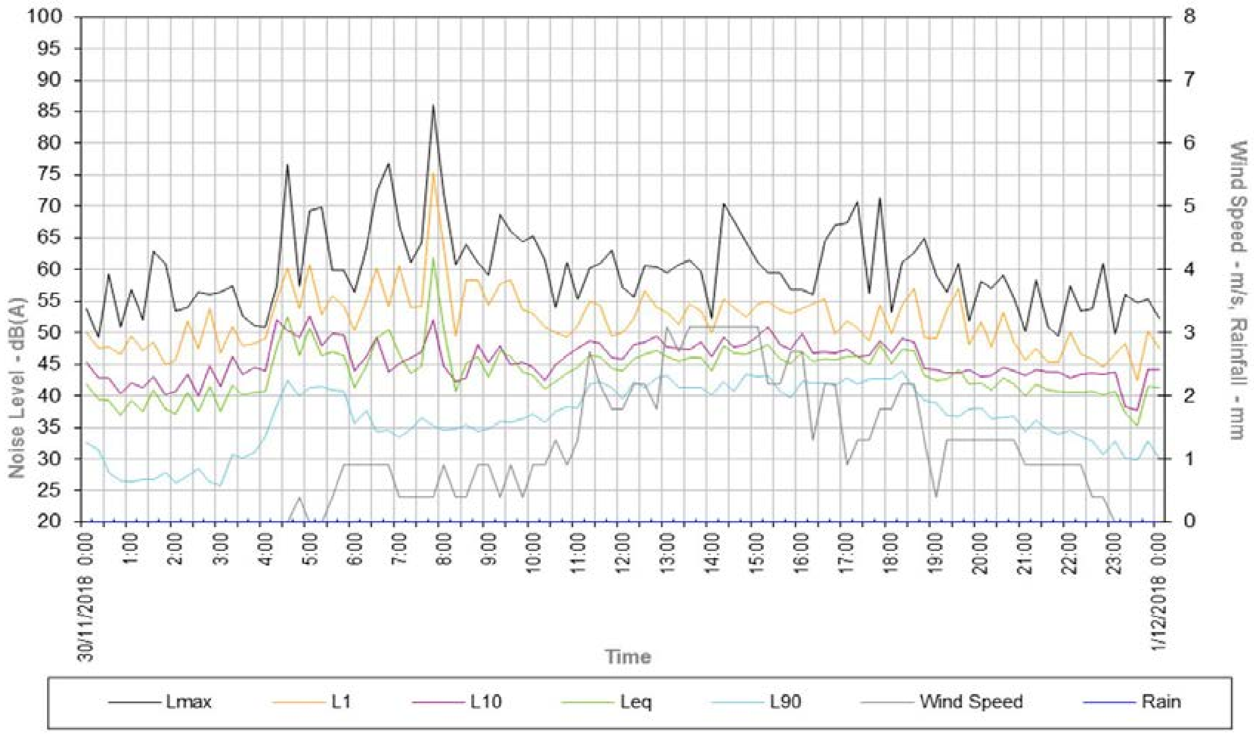
Daytime			Evening			Night		
Thursday 29/11/2018	42.9	dB(A)	Thursday 29/11/2018	36.0	dB(A)	Thursday 29/11/2018	26.1	dB(A)
Friday 30/11/2018	34.6	dB(A)	Friday 30/11/2018	34.2	dB(A)	Friday 30/11/2018	25.2	dB(A)
Saturday 1/12/2018	33.6	dB(A)	Saturday 1/12/2018	32.5	dB(A)	Saturday 1/12/2018	26.4	dB(A)
			Sunday 2/12/2018	34.0	dB(A)	Sunday 2/12/2018	32.9	dB(A)
Monday 3/12/2018	39.1	dB(A)	Monday 3/12/2018	33.6	dB(A)	Monday 3/12/2018	25.0	dB(A)
Tuesday 4/12/2018	34.8	dB(A)	Tuesday 4/12/2018	33.1	dB(A)	Tuesday 4/12/2018	23.6	dB(A)
Wednesday 5/12/2018	40.1	dB(A)	Wednesday 5/12/2018	35.8	dB(A)	Wednesday 5/12/2018	29.4	dB(A)
Thursday 6/12/2018	41.5	dB(A)						

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

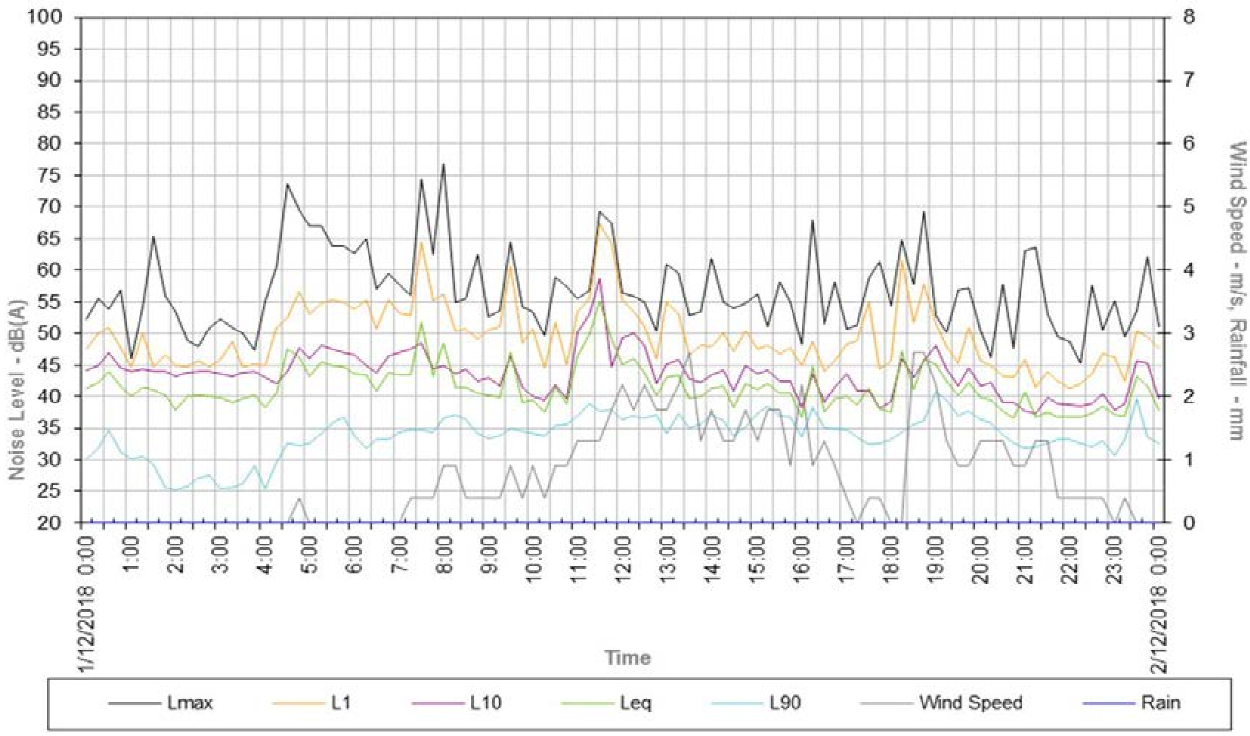
565 Connors Road

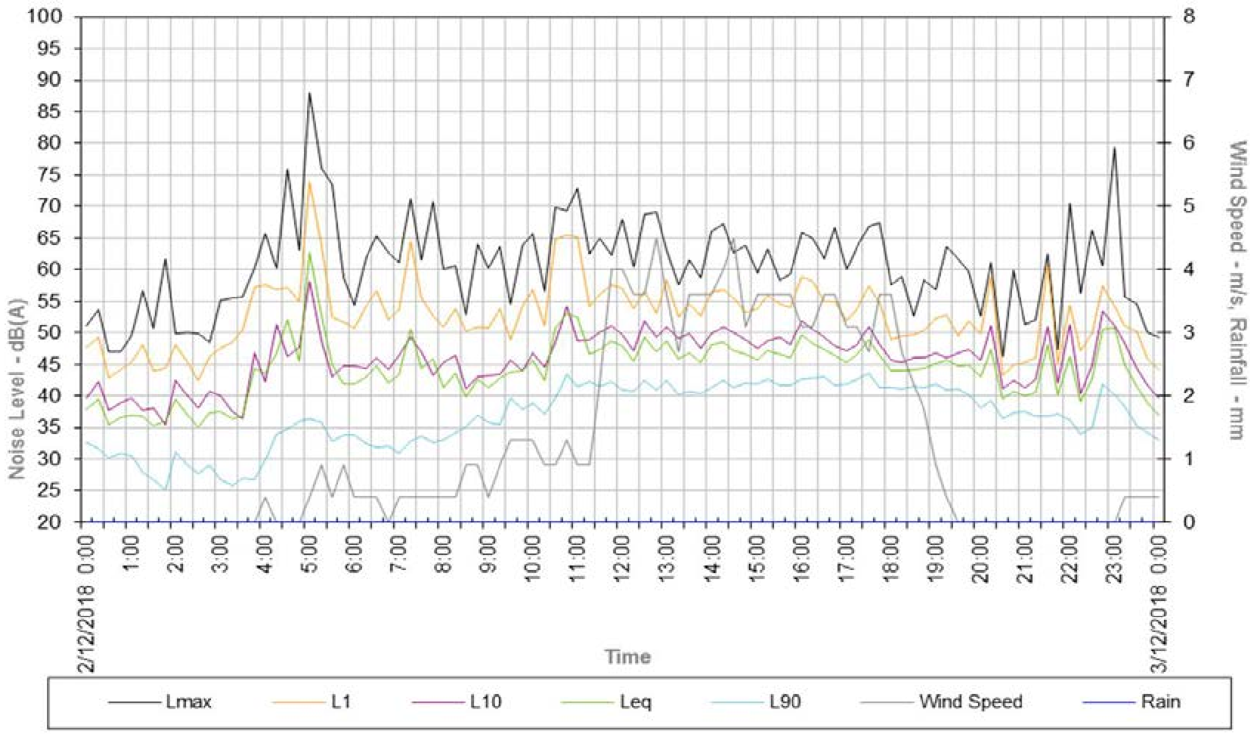




Site Noise and Weather Graphical Analysis

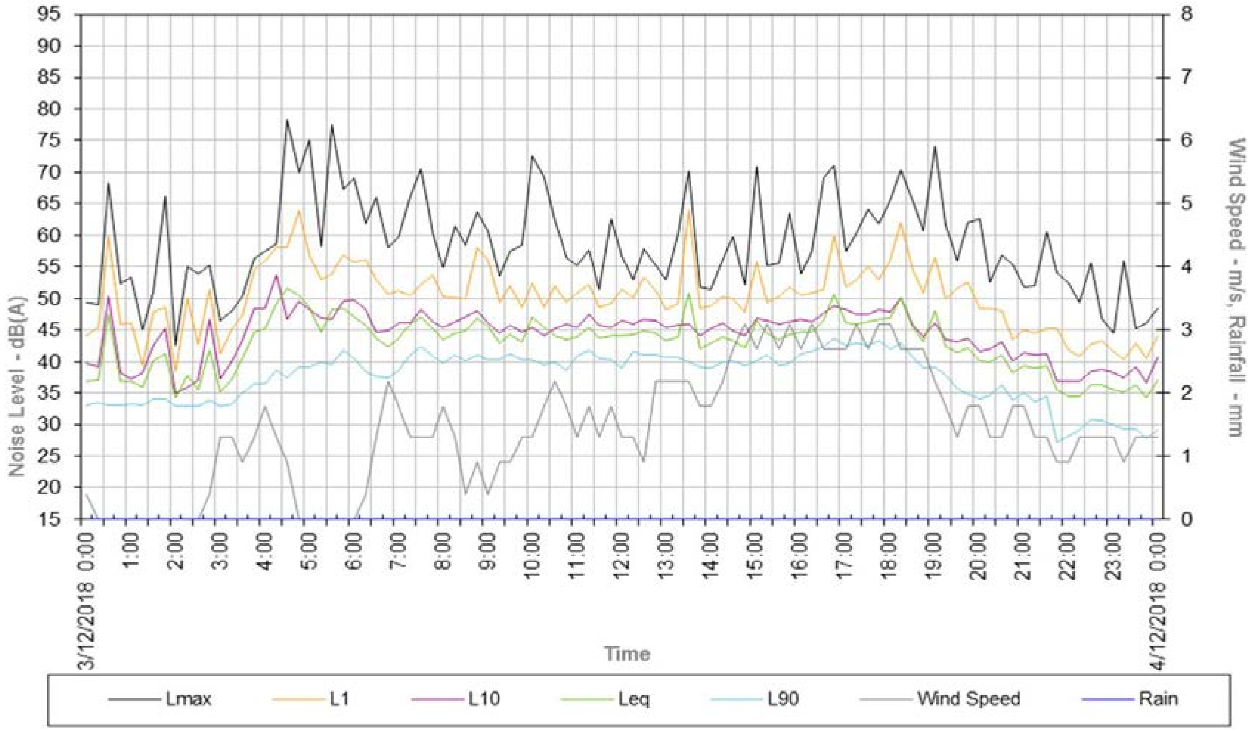
565 Connors Road

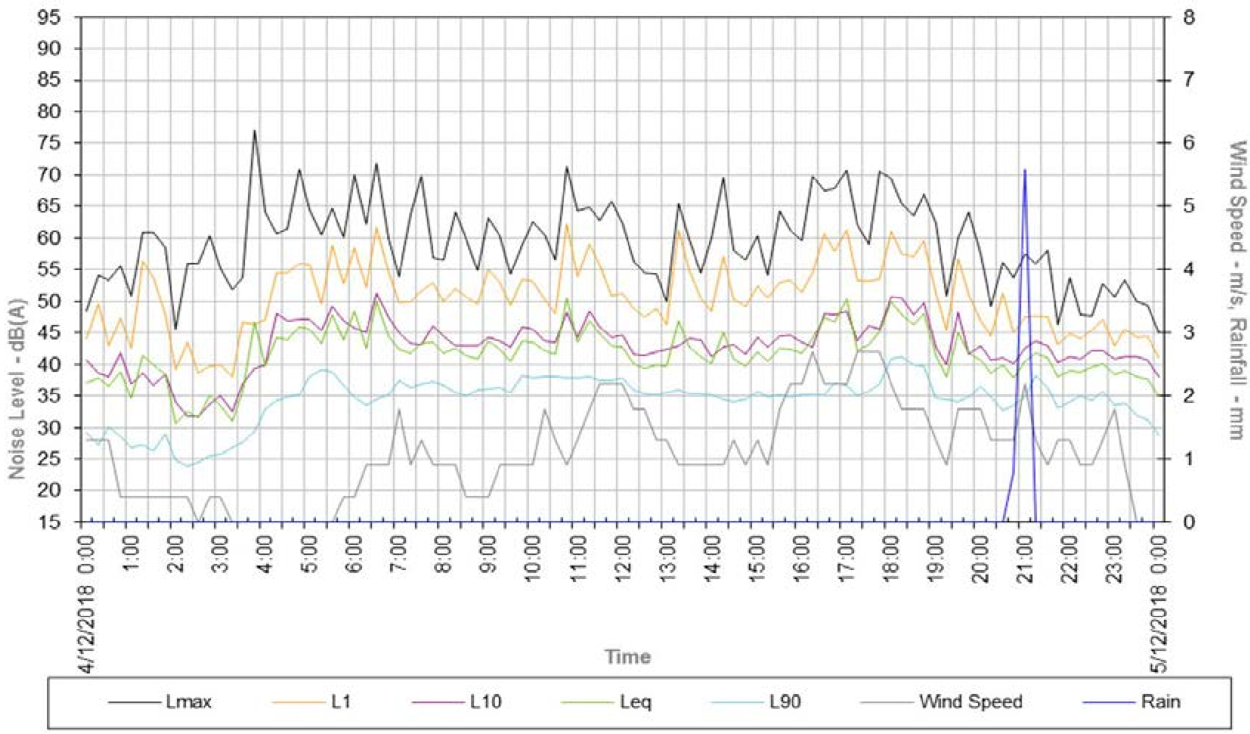




Site Noise and Weather Graphical Analysis

565 Connors Road





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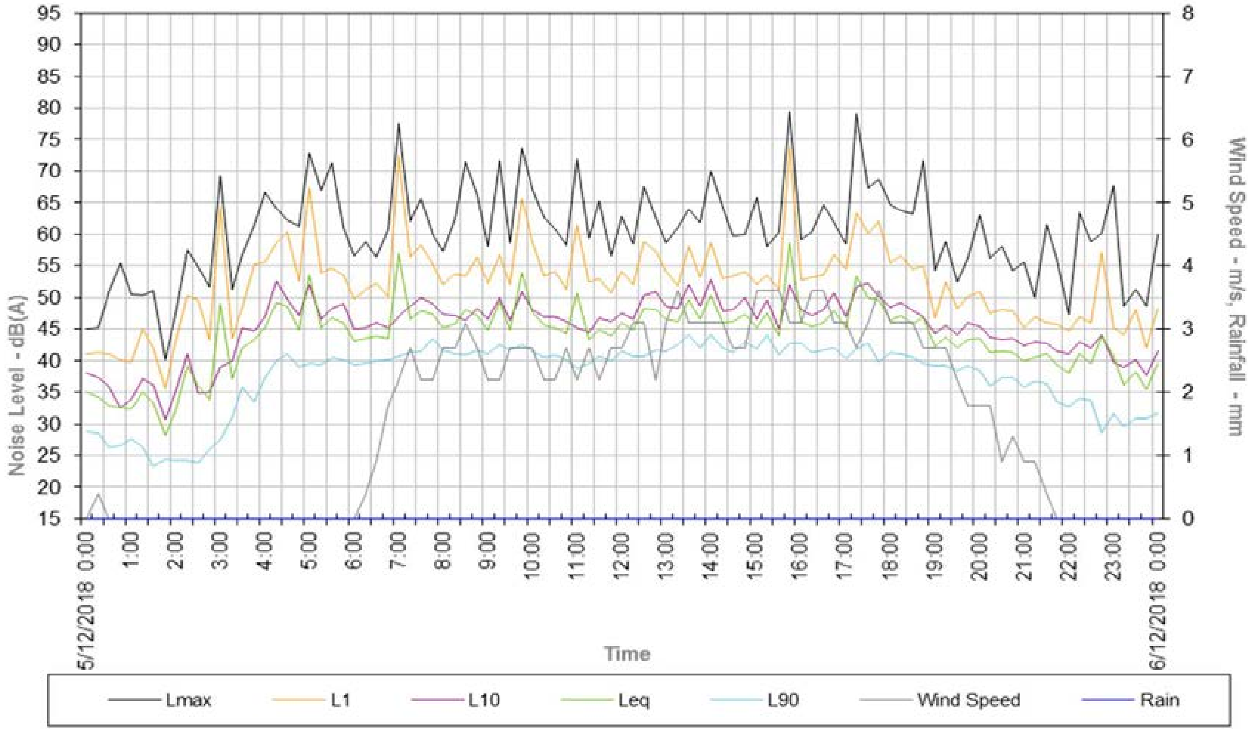
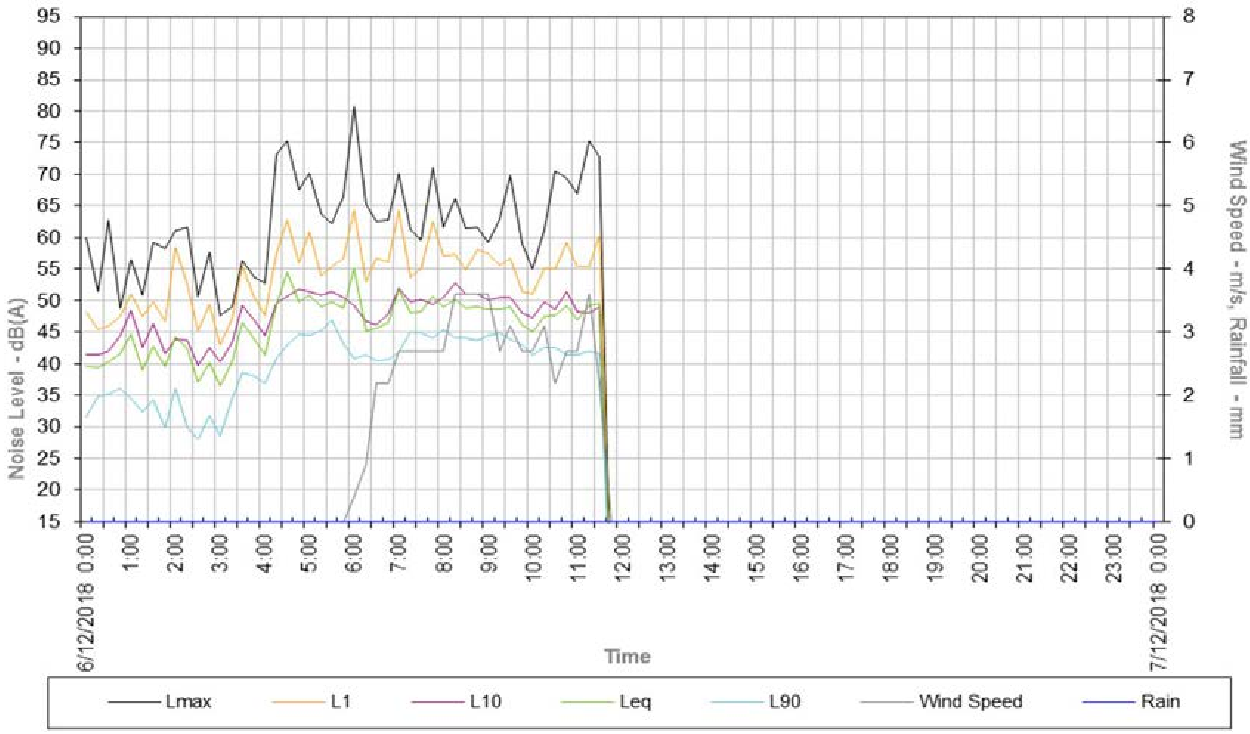
Site Noise and Weather Graphical Analysis

565 Connors Road





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Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_02

From	Thursday 29/11/2018 14:30	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 6/12/2018 13:15	Mic. Height (m)	1.8	Address	108 Seventeen Mile Road
Instrument Type	01 dB Cube	Weather Station	No	Suburb	Helidon
Instrument Serial #	10824	Operator	LAN	Land Use	Residential
Inst. Cal. Date	24/7/2018	Sample Int.	15 min	Latitude	27°32'29.38"S
Pre Calibration	93.8	RP Lot#	10/RP811728	Longitude	152° 8'15.14"E
Post Calibration	94.1				

Daytime

RBL **37.9 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Thursday 29/11/2018	40.7	dB(A)
Friday 30/11/2018	36.7	dB(A)
Saturday 1/12/2018	37.9	dB(A)
Monday 3/12/2018	34.5	dB(A)
Tuesday 4/12/2018	35.6	dB(A)
Wednesday 5/12/2018	42.4	dB(A)
Thursday 6/12/2018	43.3	dB(A)

Evening

RBL **36.9 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Thursday 29/11/2018	37.2	dB(A)
Friday 30/11/2018	36.9	dB(A)
Saturday 1/12/2018	37.0	dB(A)
Sunday 2/12/2018	36.9	dB(A)
Monday 3/12/2018	35.7	dB(A)
Tuesday 4/12/2018	35.6	dB(A)
Wednesday 5/12/2018	41.1	dB(A)

Night

RBL **34.5 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

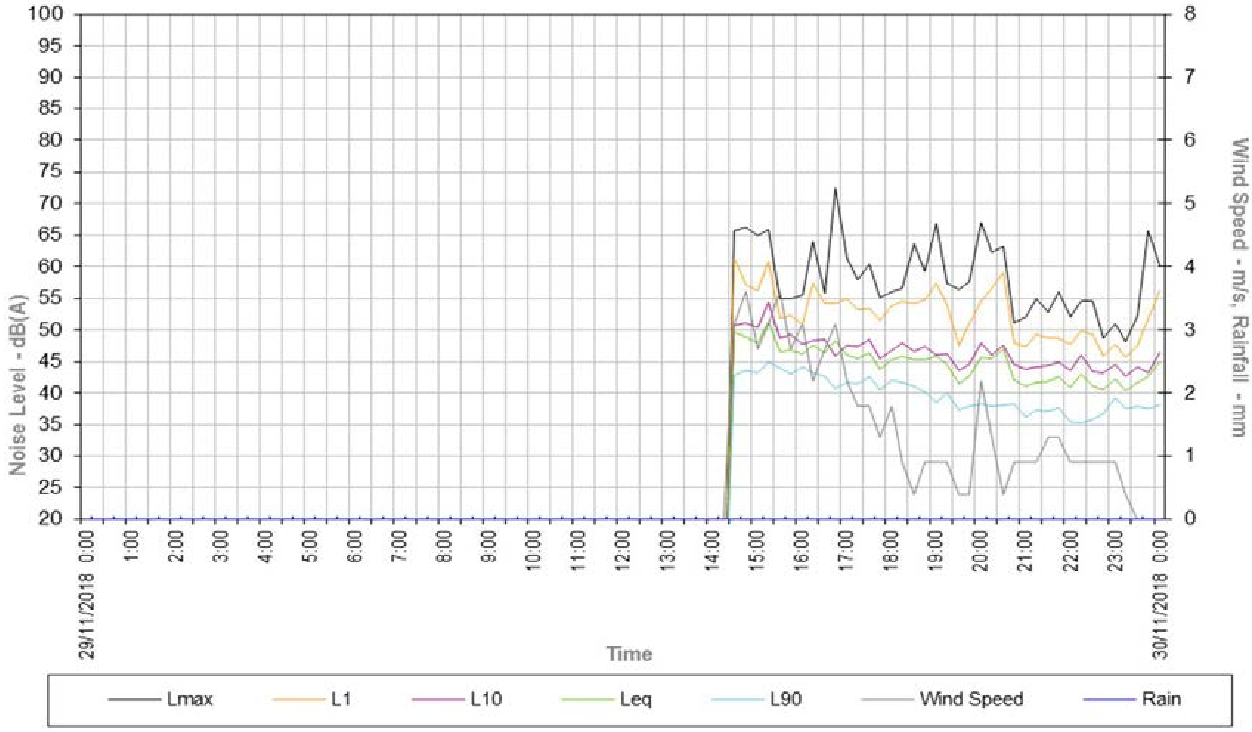
ABLs Night (Fri 6pm - 8am)

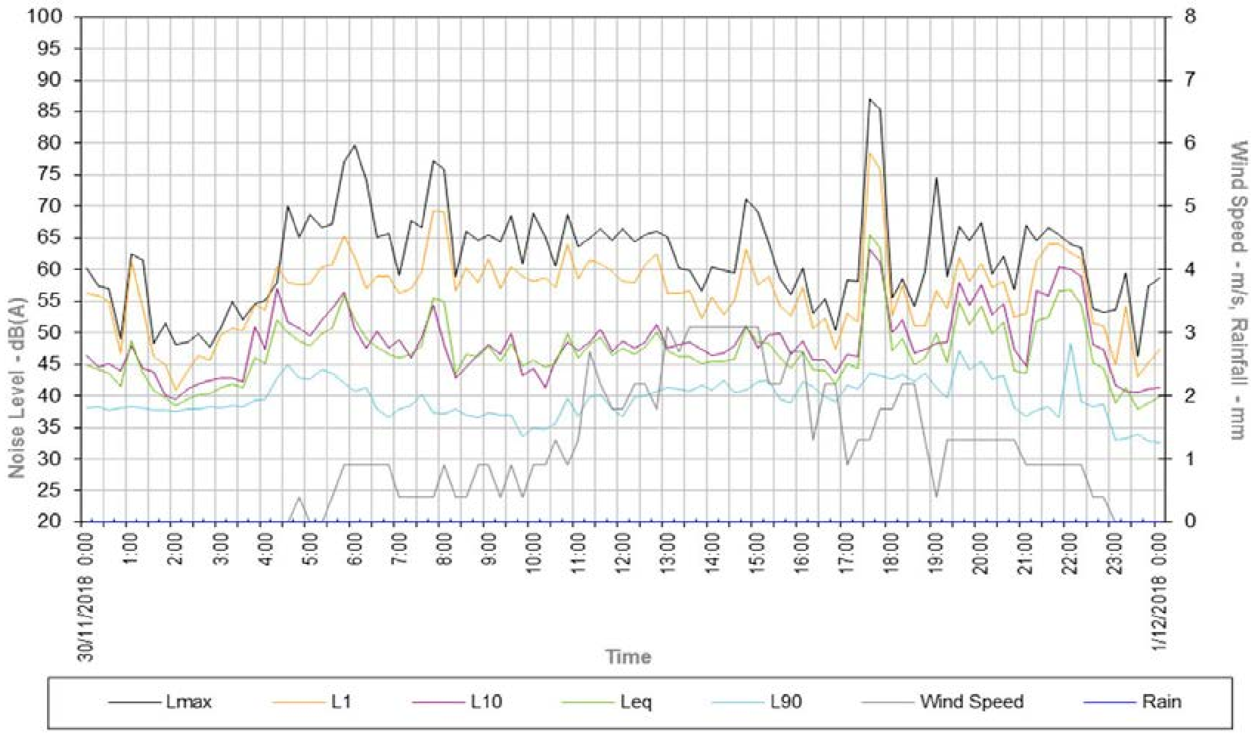
Thursday 29/11/2018	36.6	dB(A)
Friday 30/11/2018	32.7	dB(A)
Saturday 1/12/2018	34.5	dB(A)
Sunday 2/12/2018	35.8	dB(A)
Monday 3/12/2018	28.3	dB(A)
Tuesday 4/12/2018	29.4	dB(A)
Wednesday 5/12/2018	35.3	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

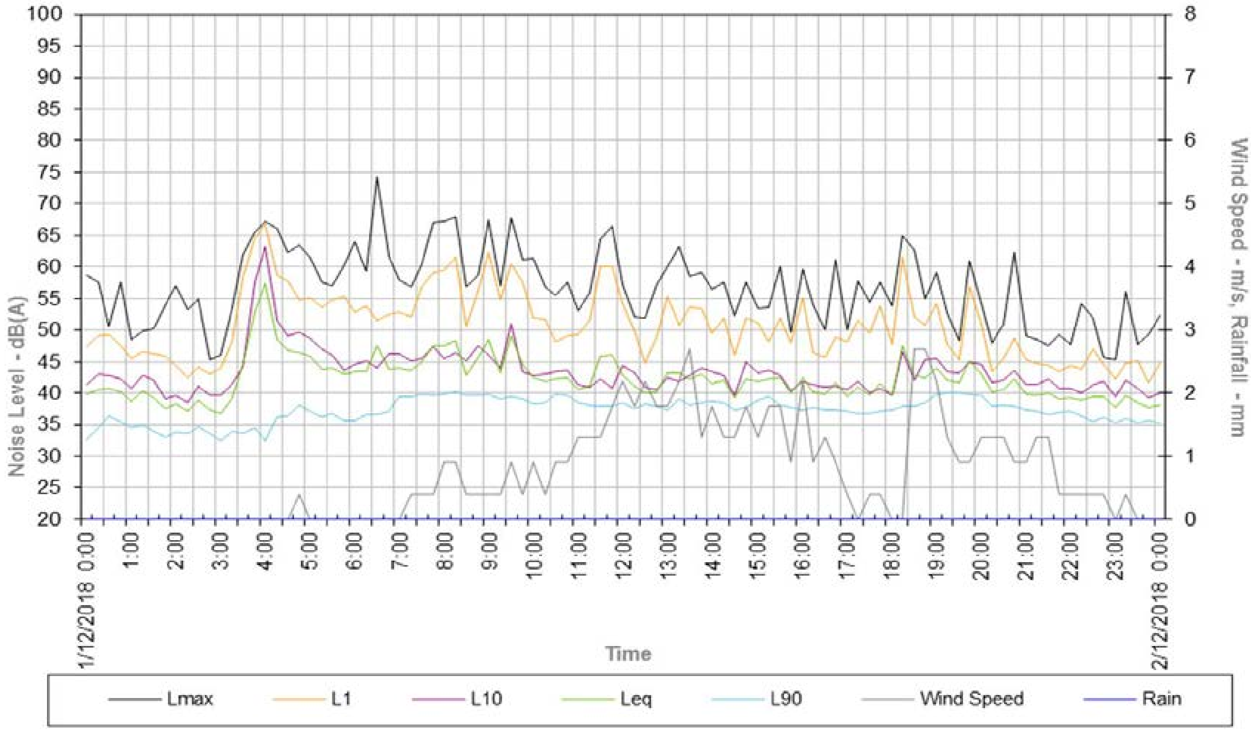
108 Seventeen Mile Road

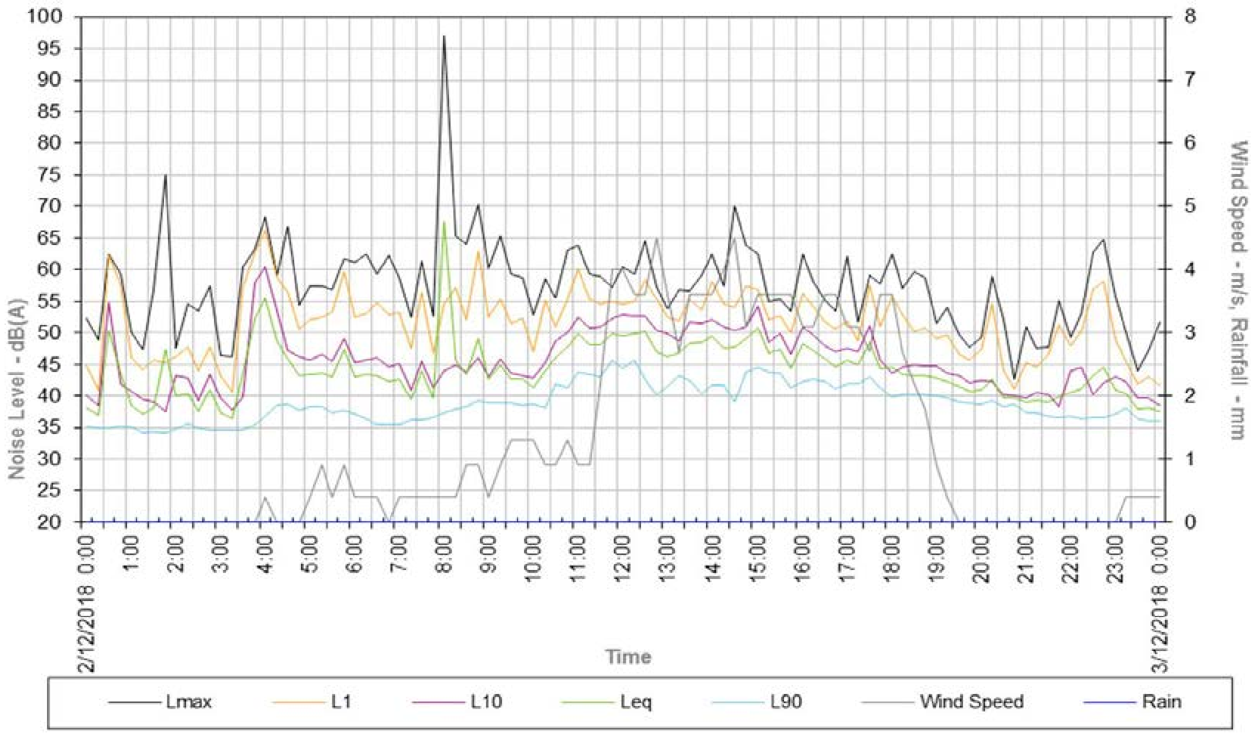




Site Noise and Weather Graphical Analysis

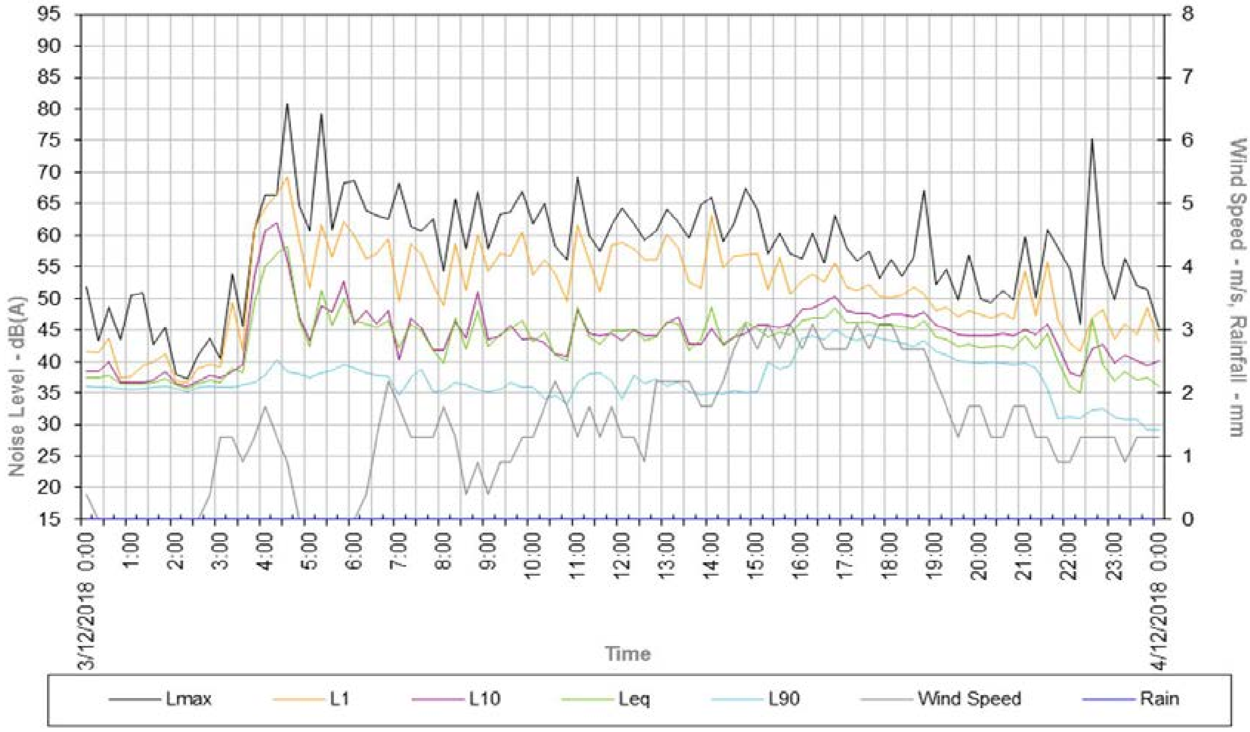
108 Seventeen Mile Road

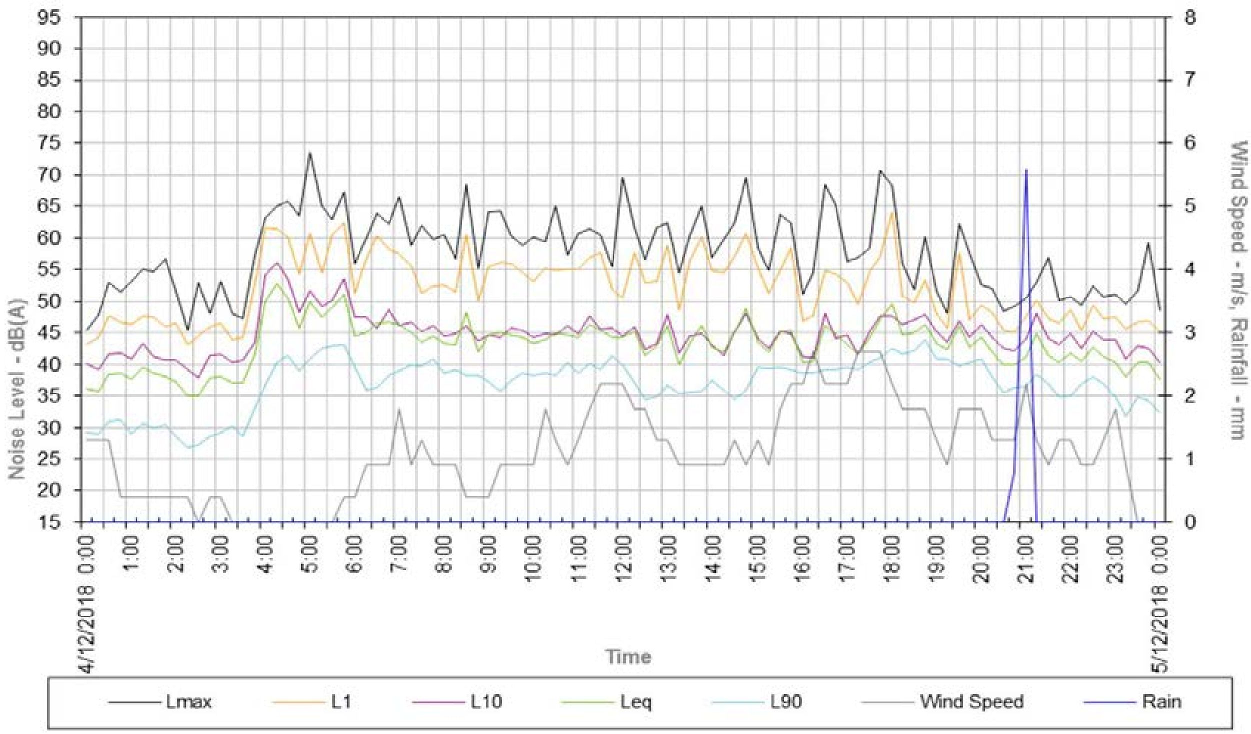




Site Noise and Weather Graphical Analysis

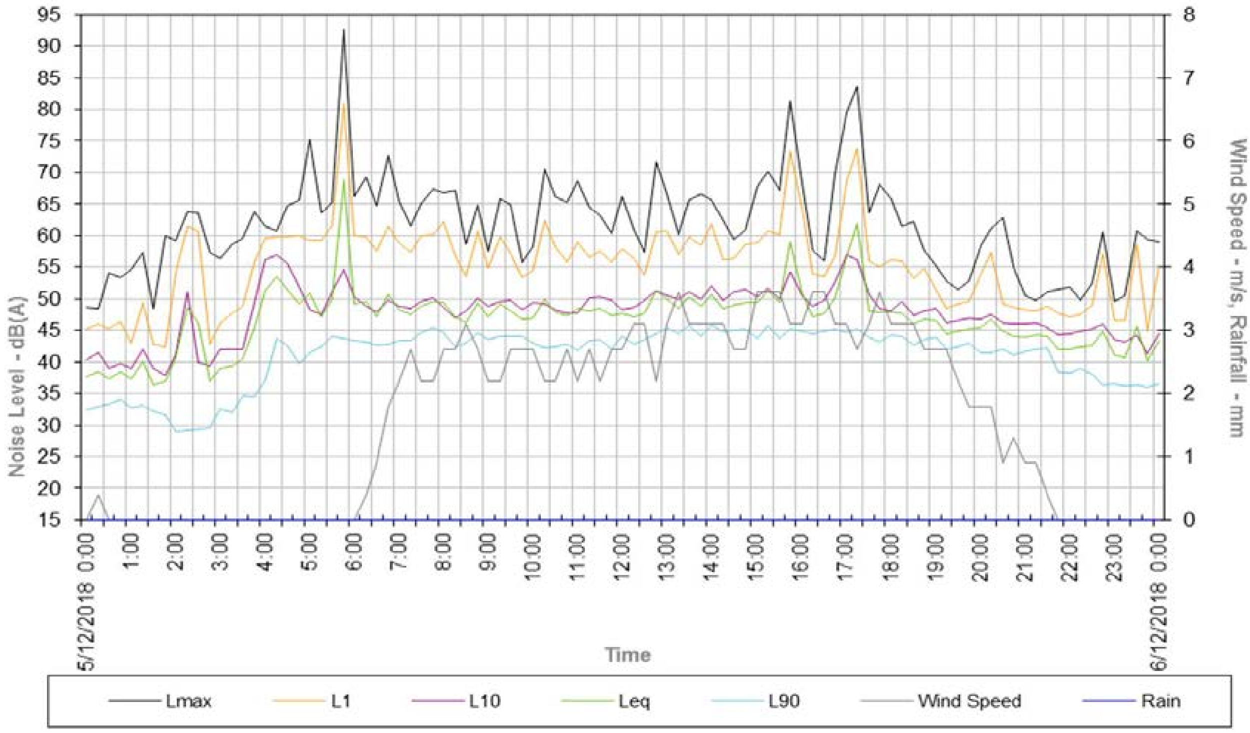
108 Seventeen Mile Road

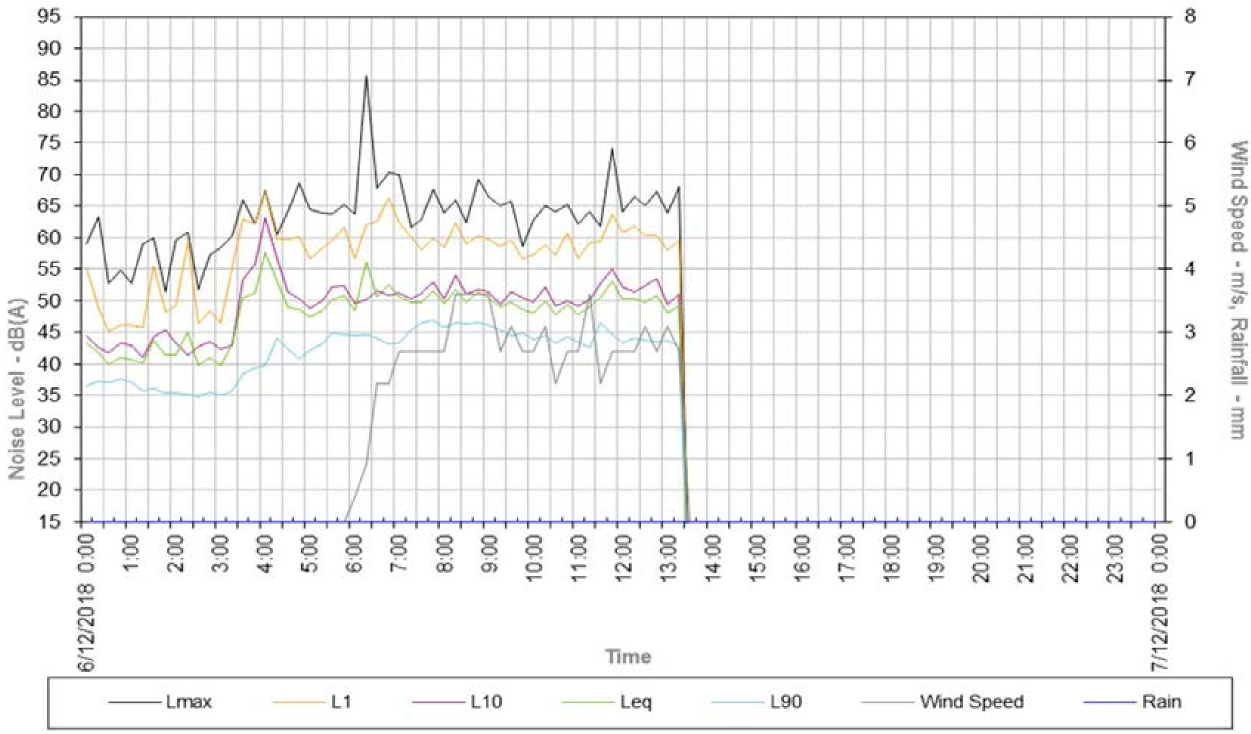




Site Noise and Weather Graphical Analysis

108 Seventeen Mile Road





Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_03

From	Thursday 29/11/2018 11:30	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 6/12/2018 10:00	Mic. Height (m)	1.8	Address	150 Brigalow Street
Instrument Type	01 dB Cube	Weather Station	No	Suburb	Placid Hills
Instrument Serial #	11100	Operator	LAN	Land Use	Residential
Inst. Cal. Date	24/7/2018	Sample Int.	15 min	Latitude	27°33'3.69"S
Pre Calibration	93.8	RP Lot#	17/RP164762	Longitude	152°13'21.75"E
Post Calibration	94.2				

Daytime

RBL **43.7 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Evening

RBL **42.4 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Night

RBL **30.8 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

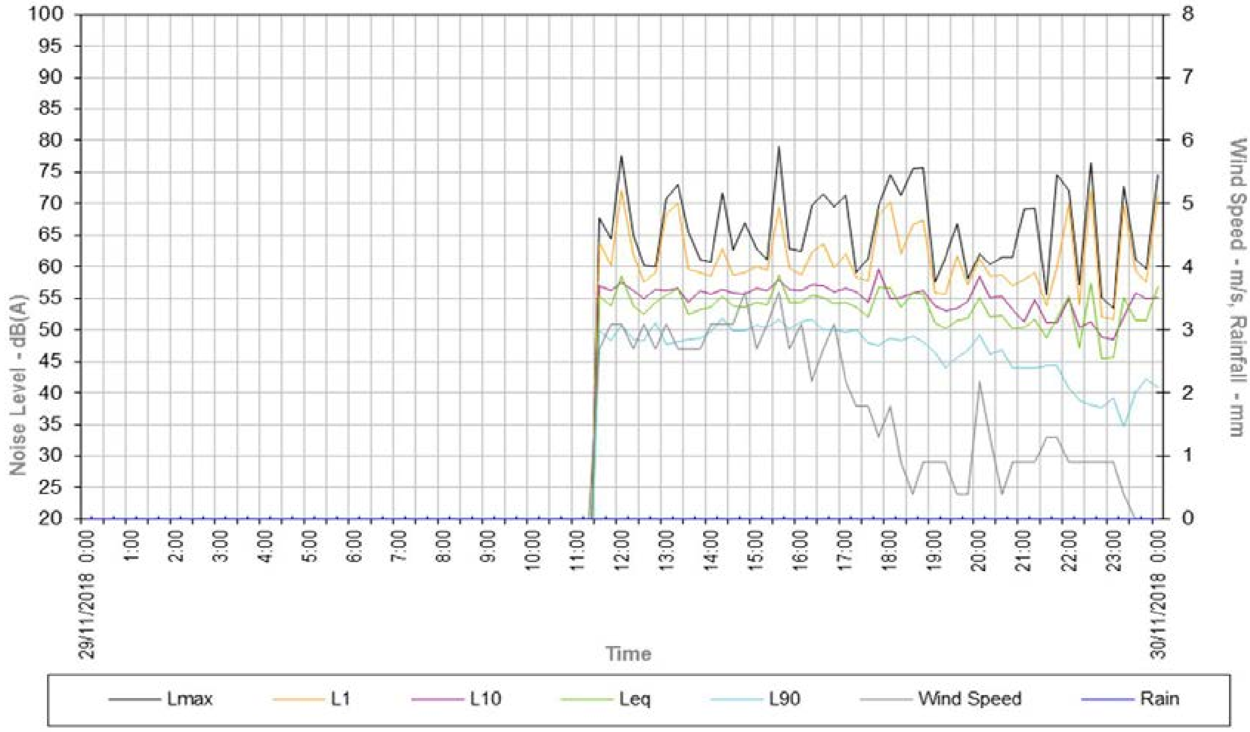
ABLs Night (Fri 6pm - 8am)

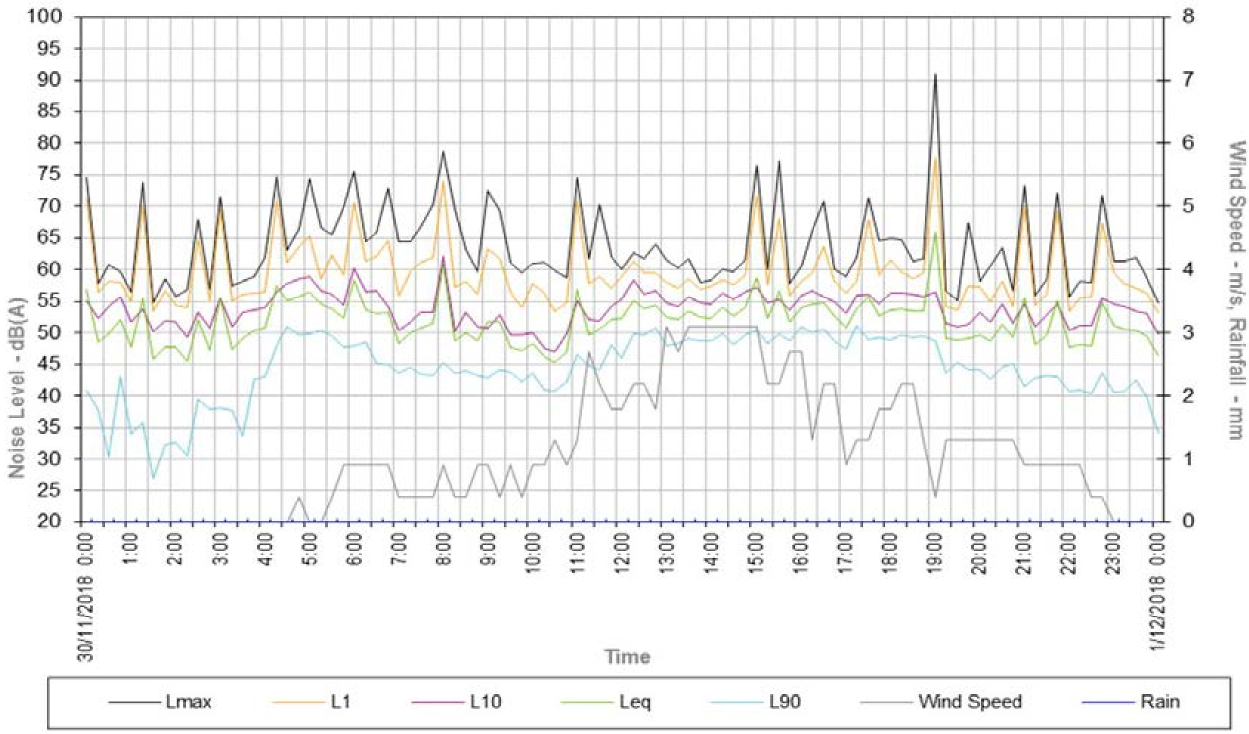
Thursday 29/11/2018	48	dB(A)	Thursday 29/11/2018	43.9	dB(A)	Thursday 29/11/2018	32.1	dB(A)
Friday 30/11/2018	42.9	dB(A)	Friday 30/11/2018	42.7	dB(A)	Friday 30/11/2018	33.5	dB(A)
Saturday 1/12/2018	40.1	dB(A)	Saturday 1/12/2018	42.4	dB(A)	Saturday 1/12/2018	25.5	dB(A)
			Sunday 2/12/2018	40.5	dB(A)	Sunday 2/12/2018	27.7	dB(A)
Monday 3/12/2018	43.4	dB(A)	Monday 3/12/2018	40.7	dB(A)	Monday 3/12/2018	27.5	dB(A)
Tuesday 4/12/2018	43.7	dB(A)	Tuesday 4/12/2018	40.7	dB(A)	Tuesday 4/12/2018	31.3	dB(A)
Wednesday 5/12/2018	46.0	dB(A)	Wednesday 5/12/2018	43.0	dB(A)	Wednesday 5/12/2018	30.8	dB(A)
Thursday 6/12/2018	48.9	dB(A)						

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

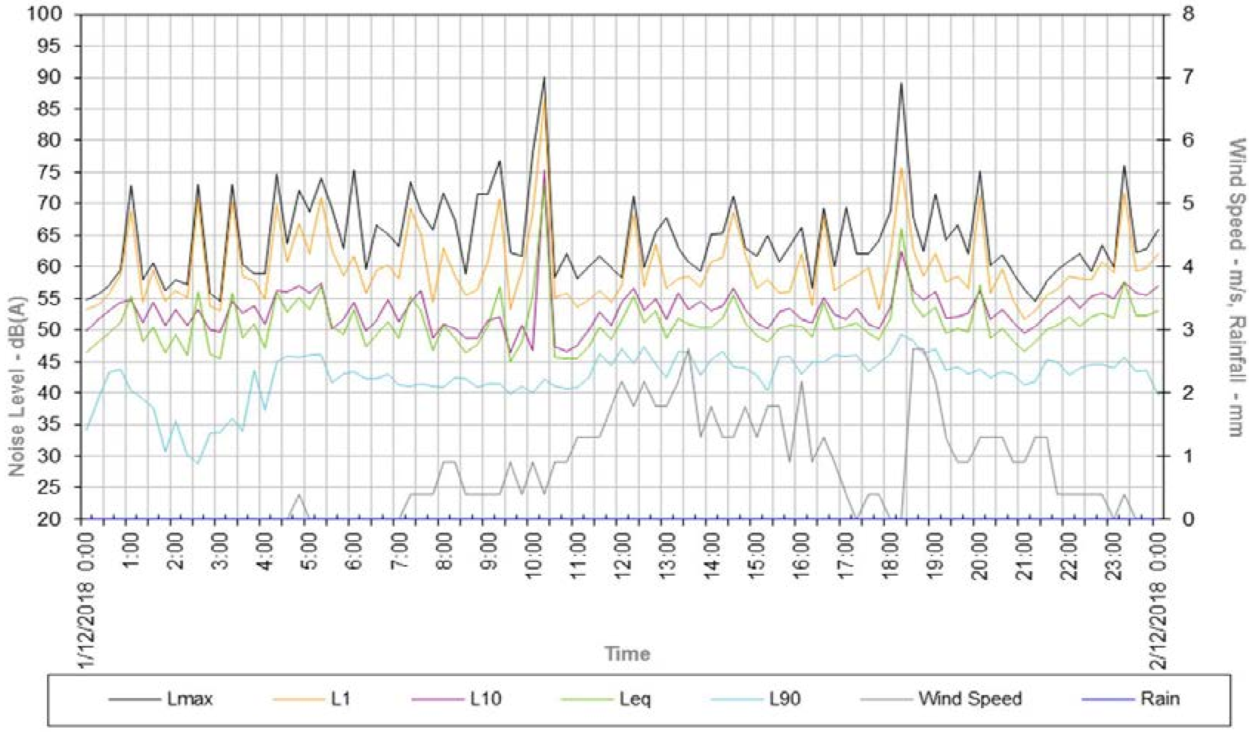
150 Brigalow Street

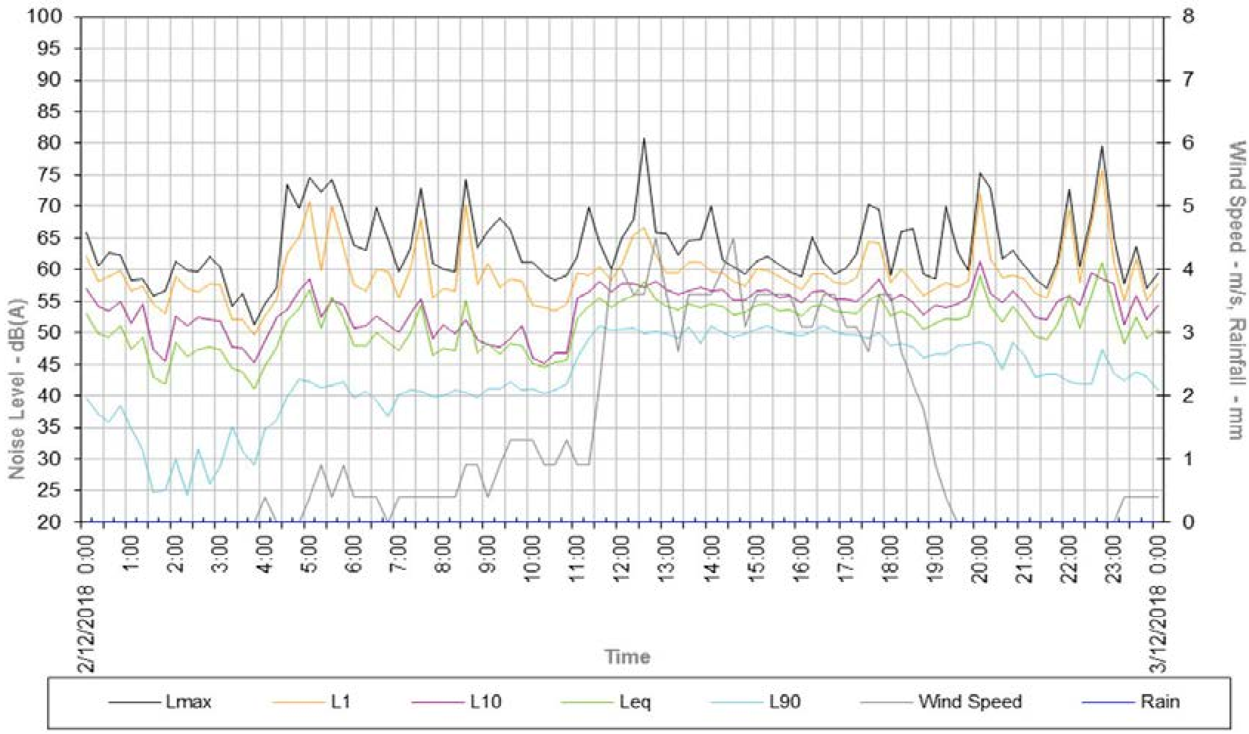




Site Noise and Weather Graphical Analysis

150 Brigalow Street





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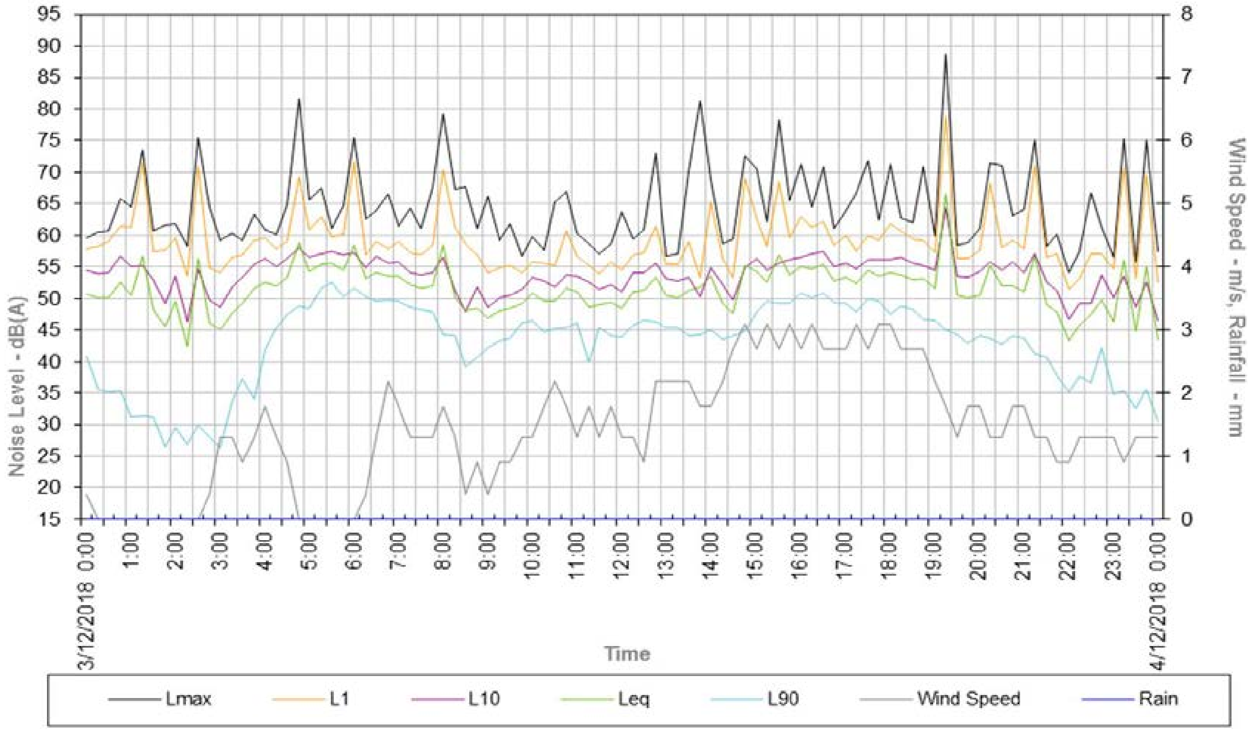
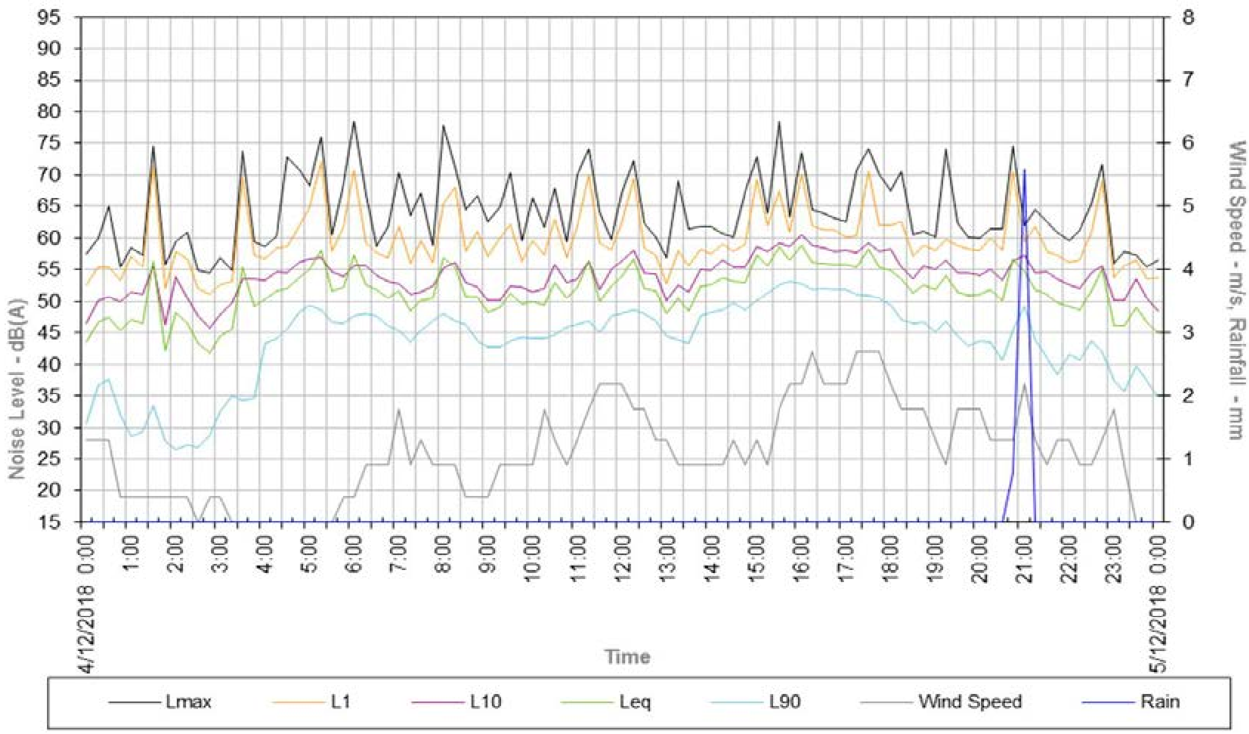
Site Noise and Weather Graphical Analysis

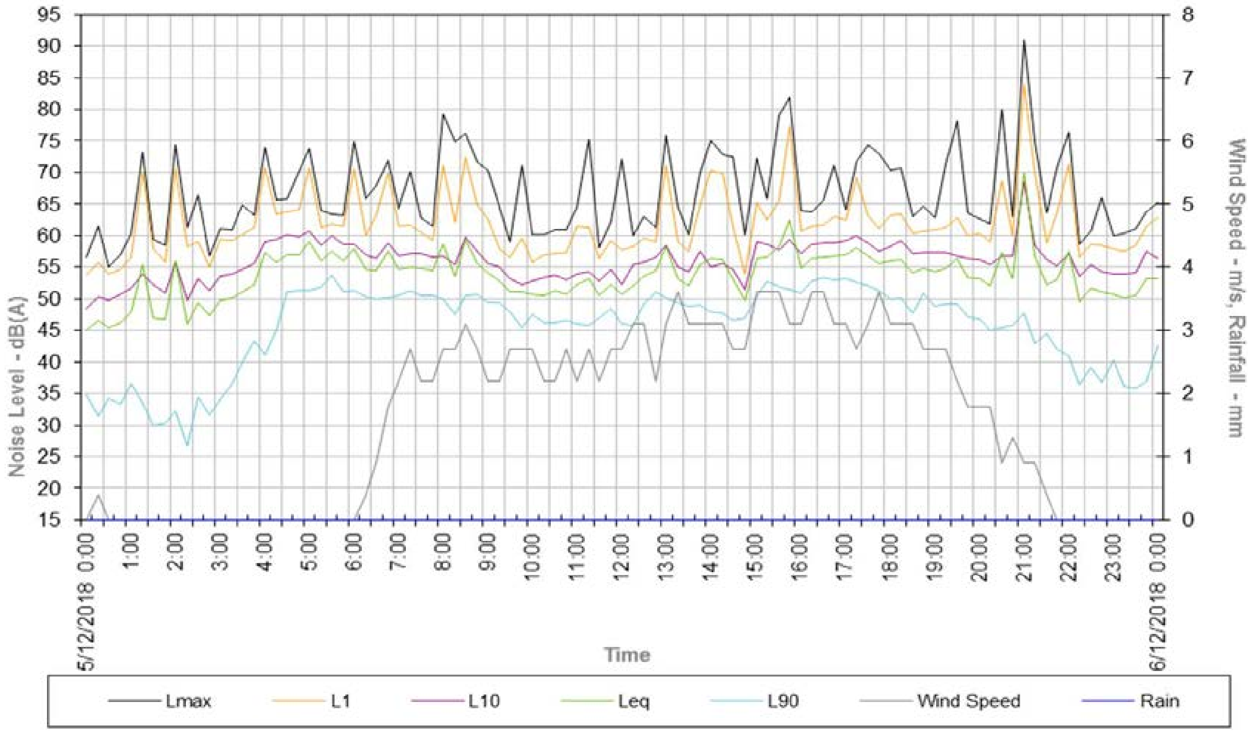
150 Brigalow Street

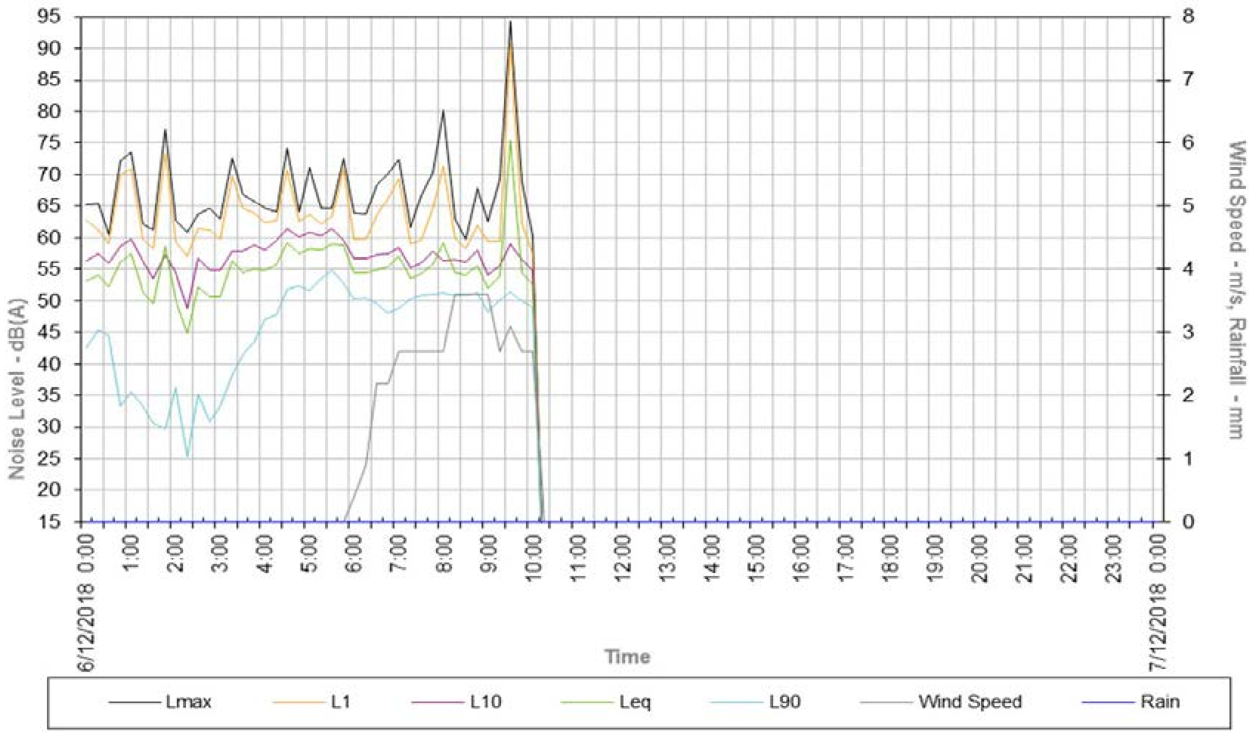




Site Noise and Weather Graphical Analysis

150 Brigalow Street





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Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_04

From	Thursday 29/11/2018 12:00	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 6/12/2018 10:45	Mic. Height (m)	1.8	Address	14 East Street
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Wandoan
Instrument Serial #	12608	Operator	BR	Land Use	Residential
Inst. Cal. Date	7/9/2018	Sample Int.	15 min	Latitude	27°33'18.43"S
Pre Calibration	94	RP Lot#	1/RP64333	Longitude	152°16'32.15"E
Post Calibration	94				

Daytime

RBL **38.1 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Thursday 29/11/2018	42.4	dB(A)
Friday 30/11/2018	38.0	dB(A)
Saturday 1/12/2018	35.1	dB(A)
Monday 3/12/2018	38.1	dB(A)
Tuesday 4/12/2018	36.4	dB(A)
Wednesday 5/12/2018	42.1	dB(A)
Thursday 6/12/2018	42.2	dB(A)

Evening

RBL **35.7 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Thursday 29/11/2018	36.8	dB(A)
Friday 30/11/2018	37.6	dB(A)
Saturday 1/12/2018	35.7	dB(A)
Sunday 2/12/2018	34.9	dB(A)
Monday 3/12/2018	35.7	dB(A)
Tuesday 4/12/2018	34.6	dB(A)
Wednesday 5/12/2018	34.9	dB(A)

Night

RBL **29.2 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

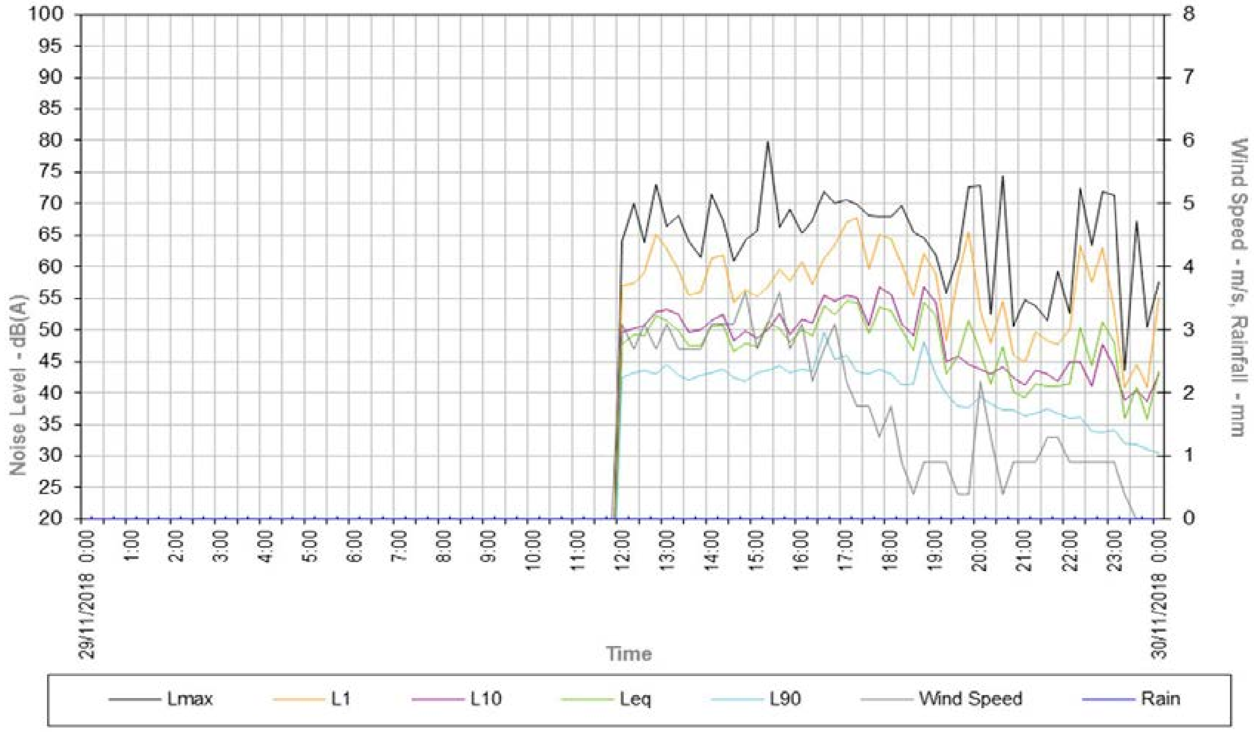
ABLs Night (Fri 6pm - 8am)

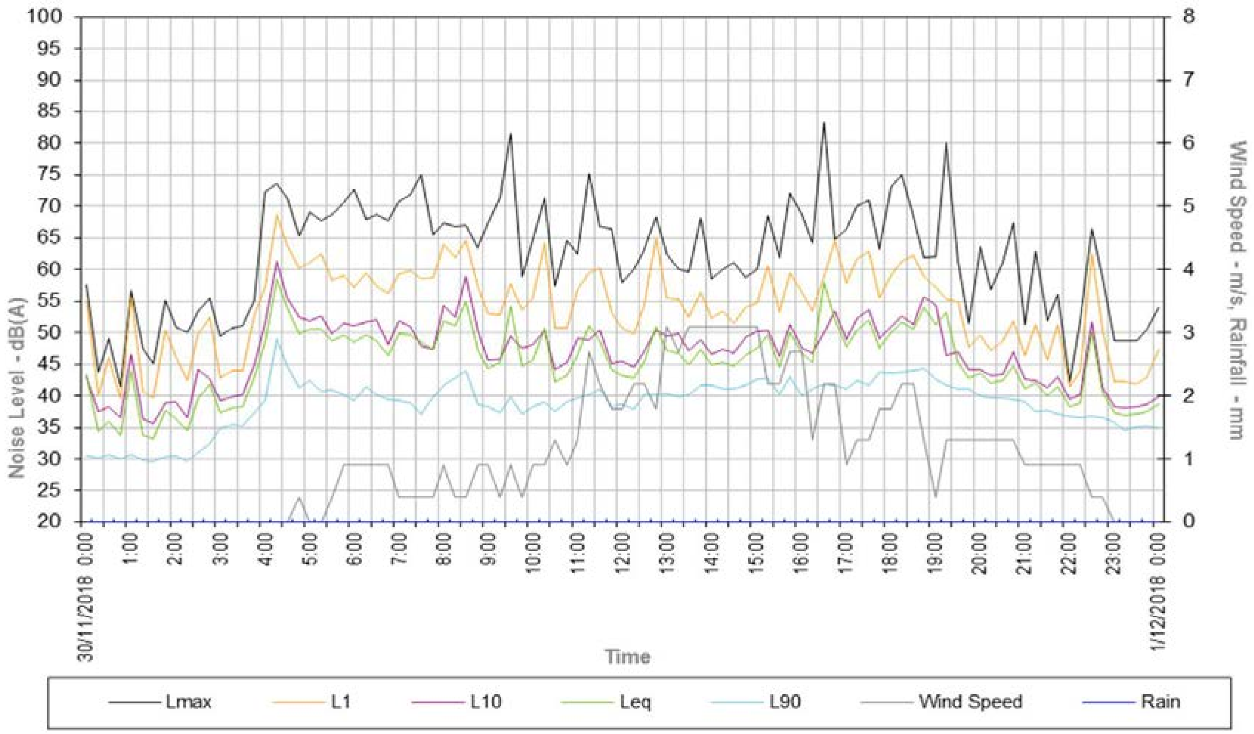
Thursday 29/11/2018	29.8	dB(A)
Friday 30/11/2018	28.7	dB(A)
Saturday 1/12/2018	29.2	dB(A)
Sunday 2/12/2018	30.9	dB(A)
Monday 3/12/2018	29.2	dB(A)
Tuesday 4/12/2018	26.8	dB(A)
Wednesday 5/12/2018	28.7	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

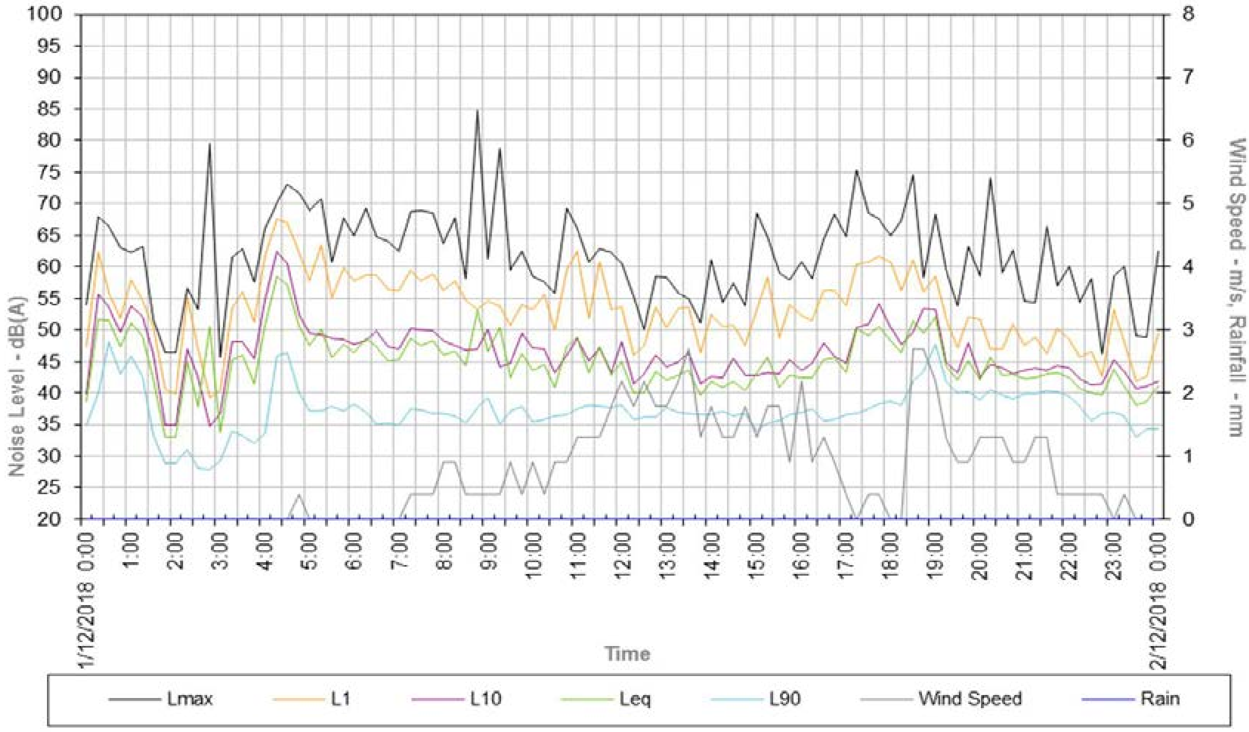
14 East Street

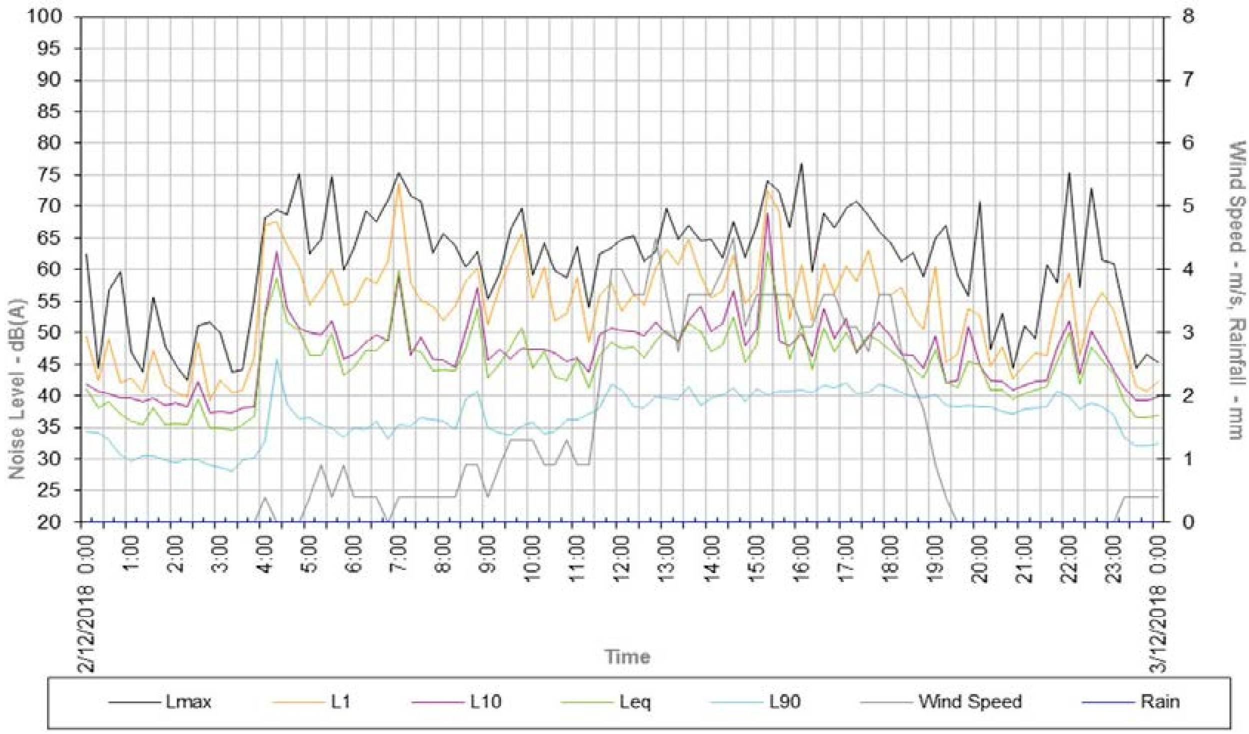




Site Noise and Weather Graphical Analysis

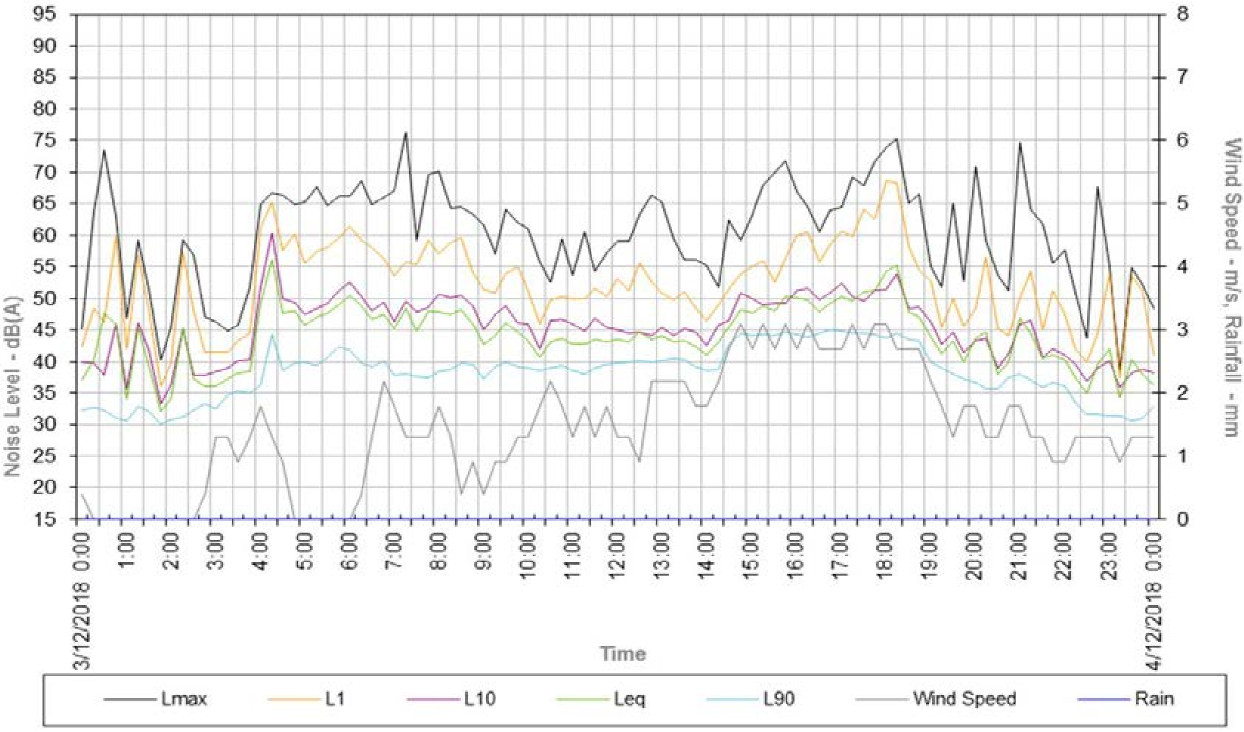
14 East Street

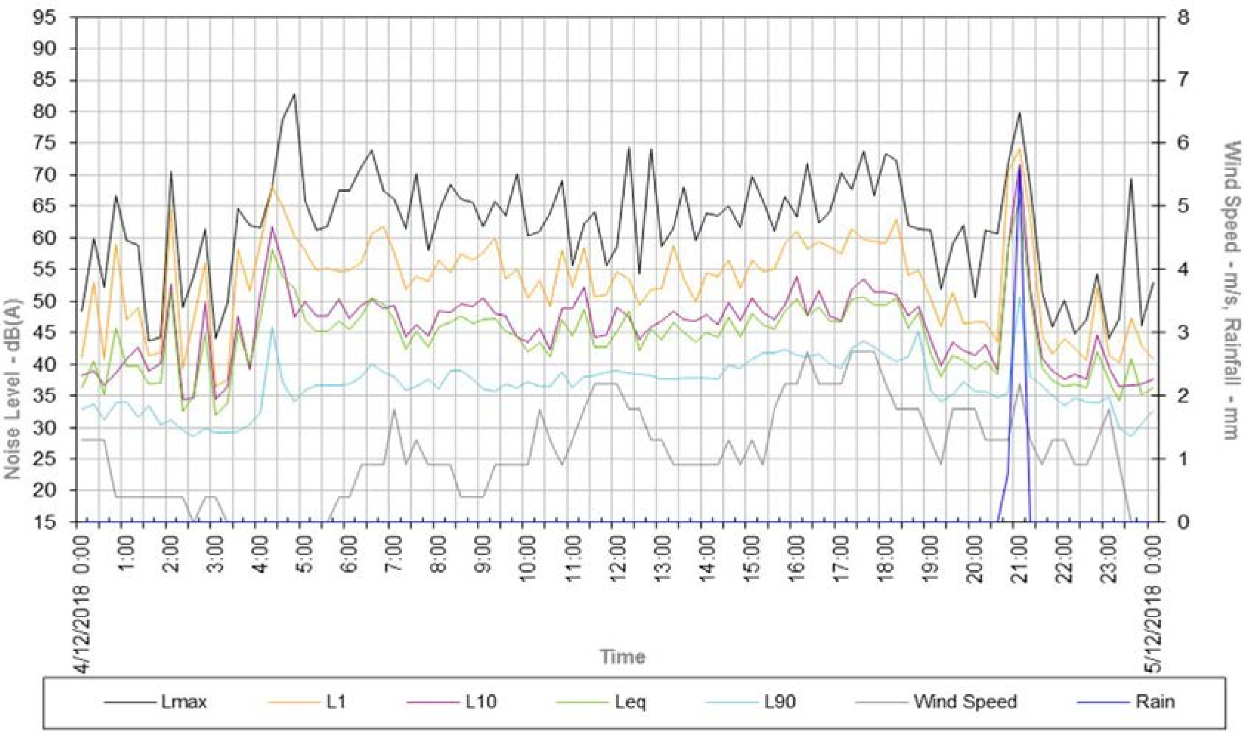




Site Noise and Weather Graphical Analysis

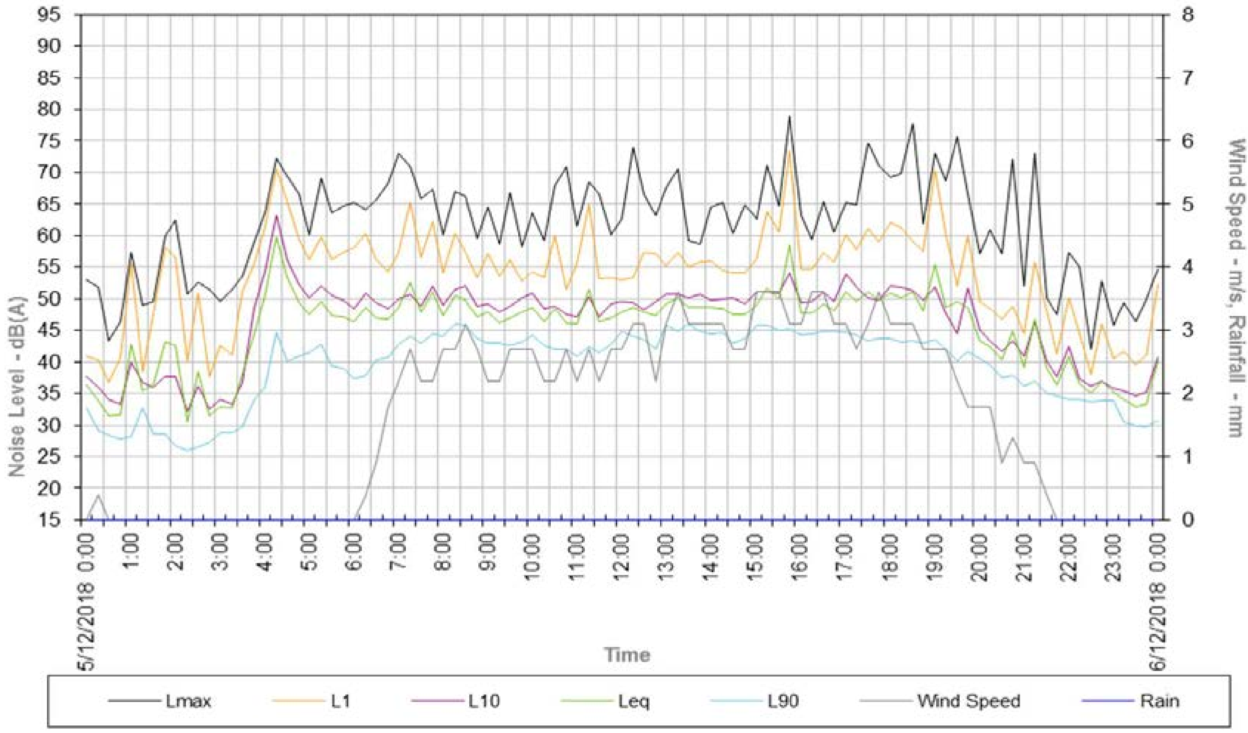
14 East Street

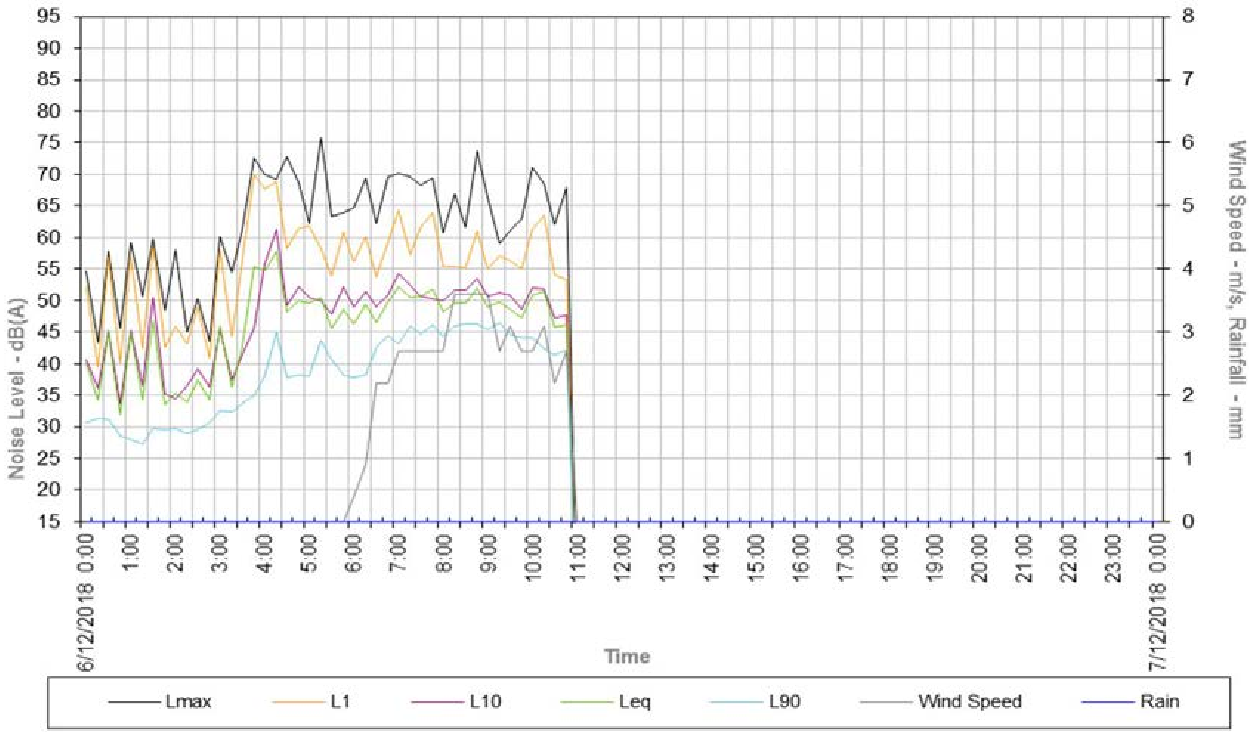




Site Noise and Weather Graphical Analysis

14 East Street





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Noise Monitoring Data Sheet

Inland Rail

SITE ID **H2C_05**

From	Thursday 6/12/2018 9:00	Meas. Type	Free Field	Package	Helidon to Calvert
To	Tuesday 18/12/2018 16:45	Mic. Height (m)	1.8	Address	1 Old College Road
Instrument Type	Rion NL-52	Weather Station	No	Suburb	Gatton
Instrument Serial #	01265386	Operator	BR	Land Use	Residential
Inst. Cal. Date	7/9/2018	Sample Int.	15 min	Latitude	27°33'9.54"S
Pre Calibration	94	RP Lot#	1/SP255664	Longitude	152°16'37.51"E
Post Calibration	94				

Daytime

RBL **37.9 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Thursday 6/12/2018	42	dB(A)
Friday 7/12/2018	43.0	dB(A)
Saturday 8/12/2018	42.8	dB(A)
Monday 10/12/2018	35.8	dB(A)
Tuesday 11/12/2018	37.2	dB(A)
Wednesday 12/12/2018	37.8	dB(A)
Thursday 13/12/2018	38.6	dB(A)
Friday 14/12/2018	37.9	dB(A)
Saturday 15/12/2018	37.6	dB(A)
Monday 17/12/2018	38.1	dB(A)

Evening

RBL **37.6 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Thursday 6/12/2018	37.6	dB(A)
Friday 7/12/2018	37.5	dB(A)
Saturday 8/12/2018	37.3	dB(A)
Sunday 9/12/2018	39.7	dB(A)
Monday 10/12/2018	38.7	dB(A)
Tuesday 11/12/2018	35.3	dB(A)
Wednesday 12/12/2018	33.7	dB(A)
Thursday 13/12/2018	33.6	dB(A)
Friday 14/12/2018	39.7	dB(A)
Saturday 15/12/2018	38.3	dB(A)
Sunday 16/12/2018	37.7	dB(A)
Monday 17/12/2018	39.2	dB(A)

Night

RBL **31.0 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

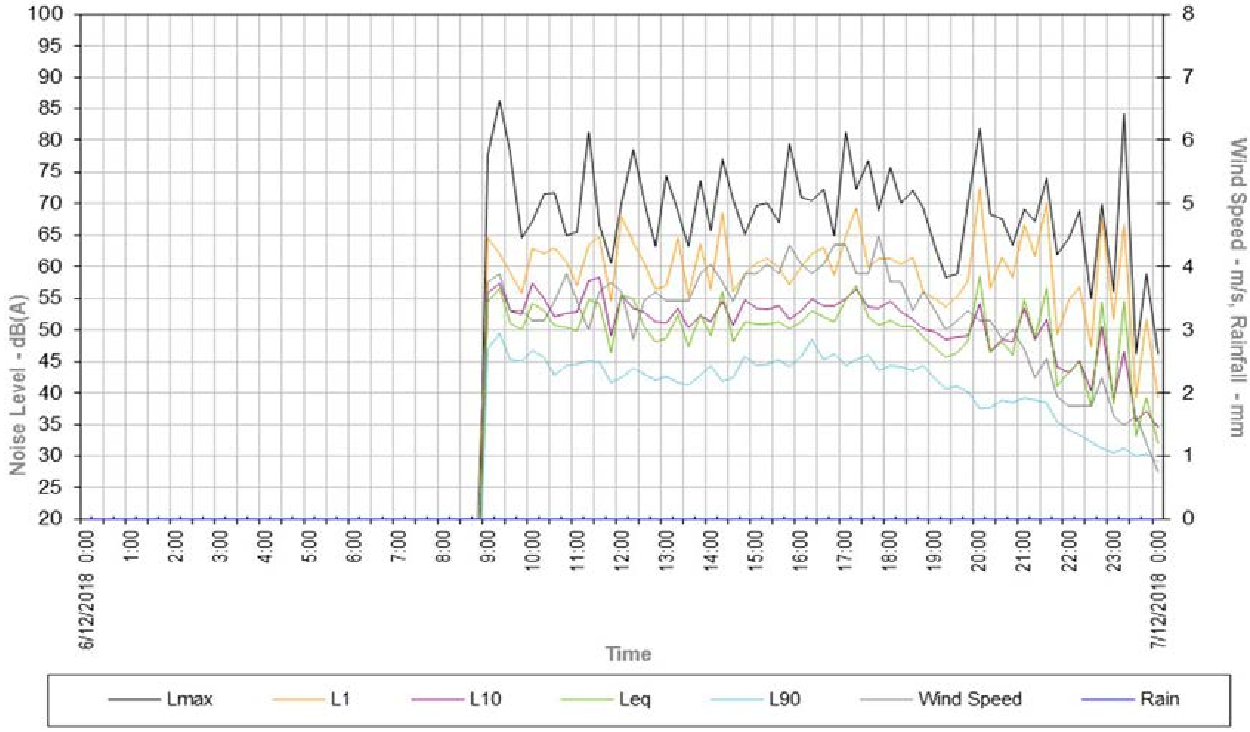
ABLs Night (Fri 6pm - 8am)

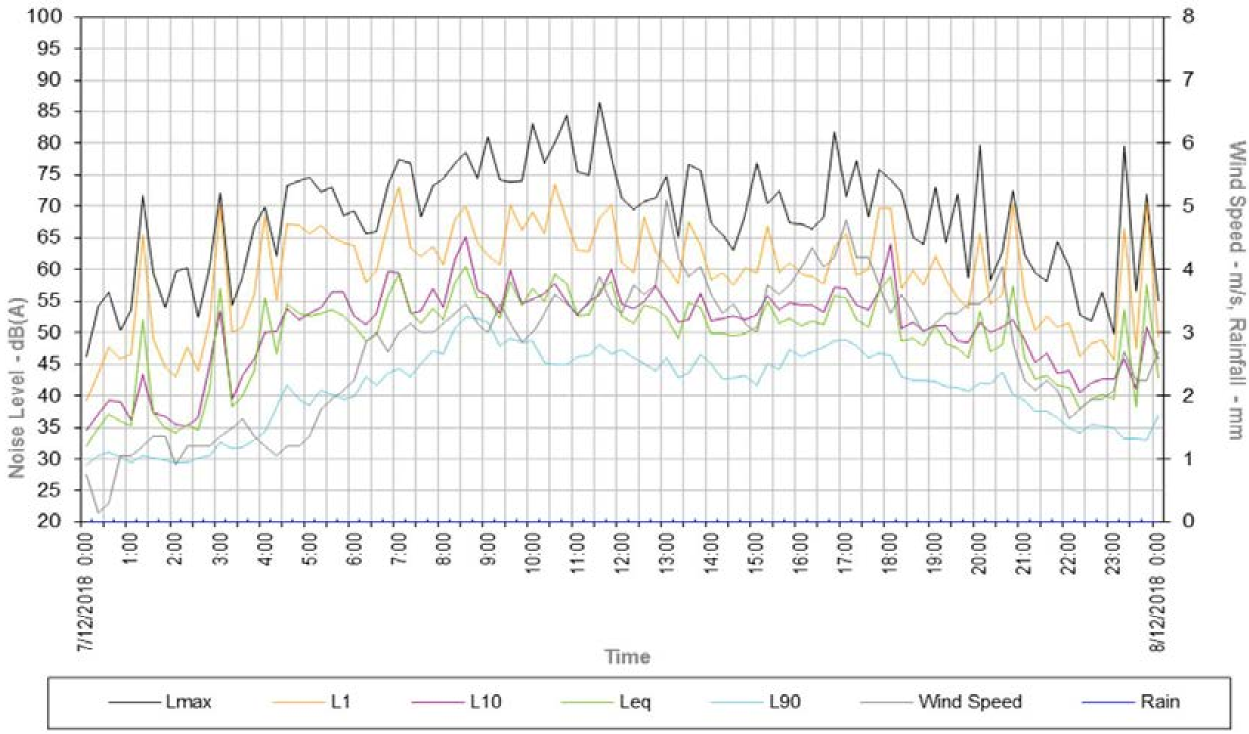
Thursday 6/12/2018	29.2	dB(A)
Friday 7/12/2018	30.3	dB(A)
Saturday 8/12/2018	28.7	dB(A)
Sunday 9/12/2018	28.5	dB(A)
Monday 10/12/2018	30.3	dB(A)
Tuesday 11/12/2018	31.0	dB(A)
Wednesday 12/12/2018	31.0	dB(A)
Thursday 13/12/2018	31.2	dB(A)
Friday 14/12/2018	36.6	dB(A)
Saturday 15/12/2018	34.9	dB(A)
Sunday 16/12/2018	39.0	dB(A)
Monday 17/12/2018	35.5	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

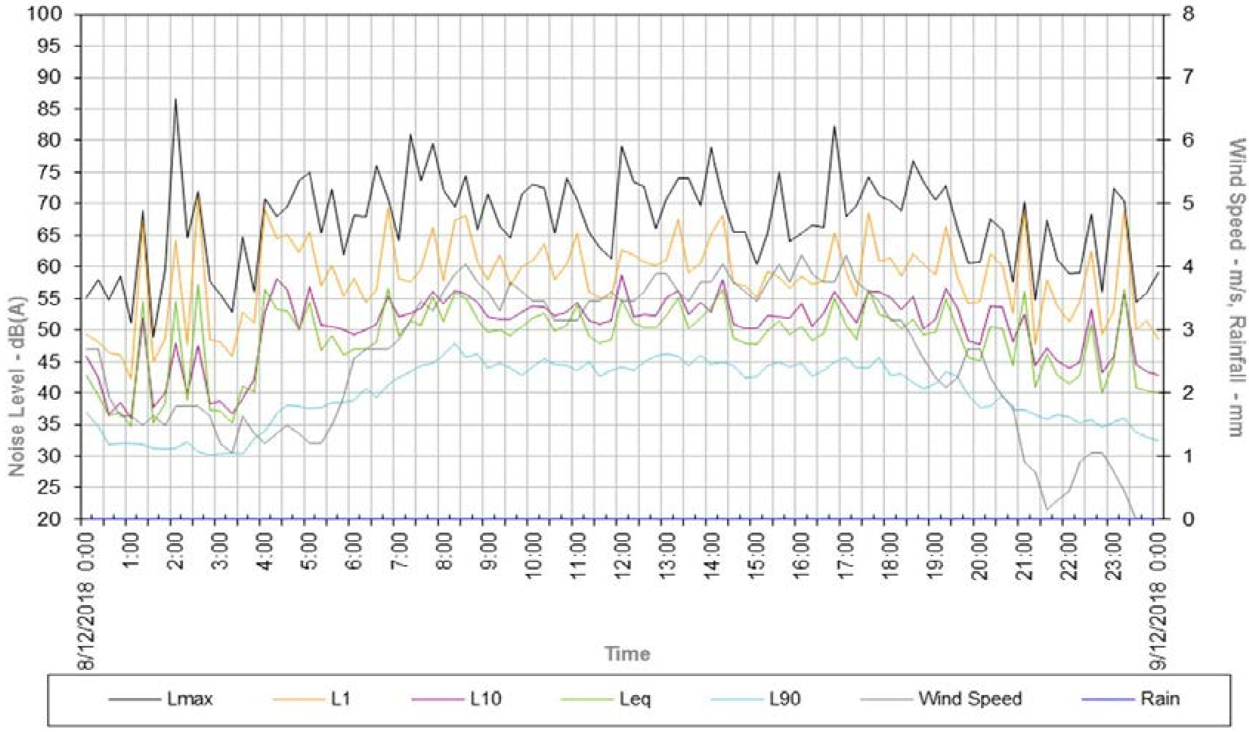
1 Old College Road

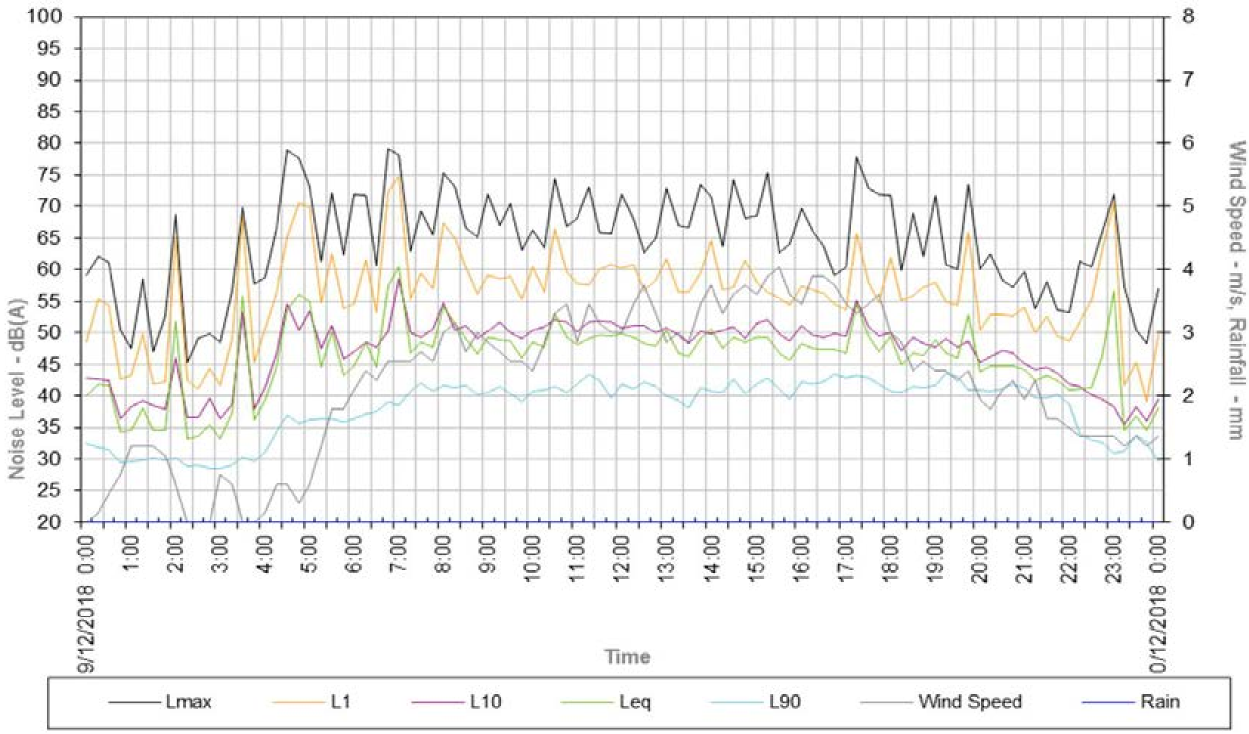




Site Noise and Weather Graphical Analysis

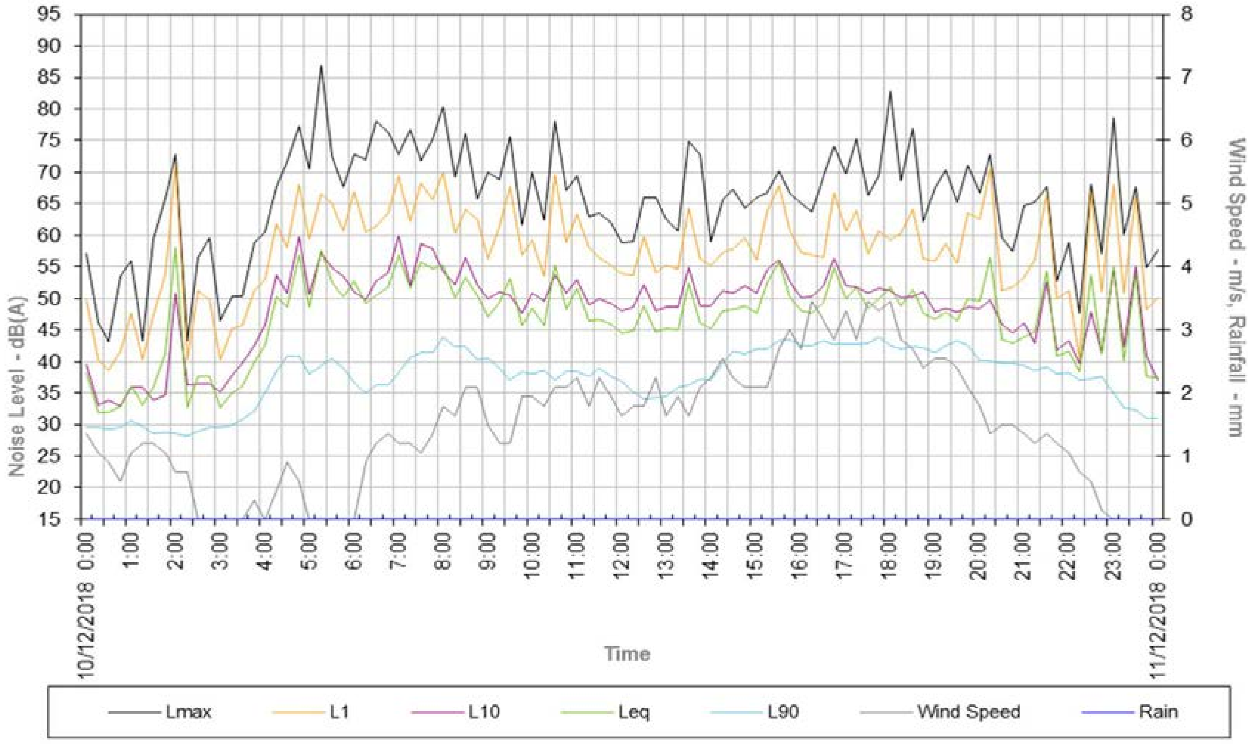
1 Old College Road

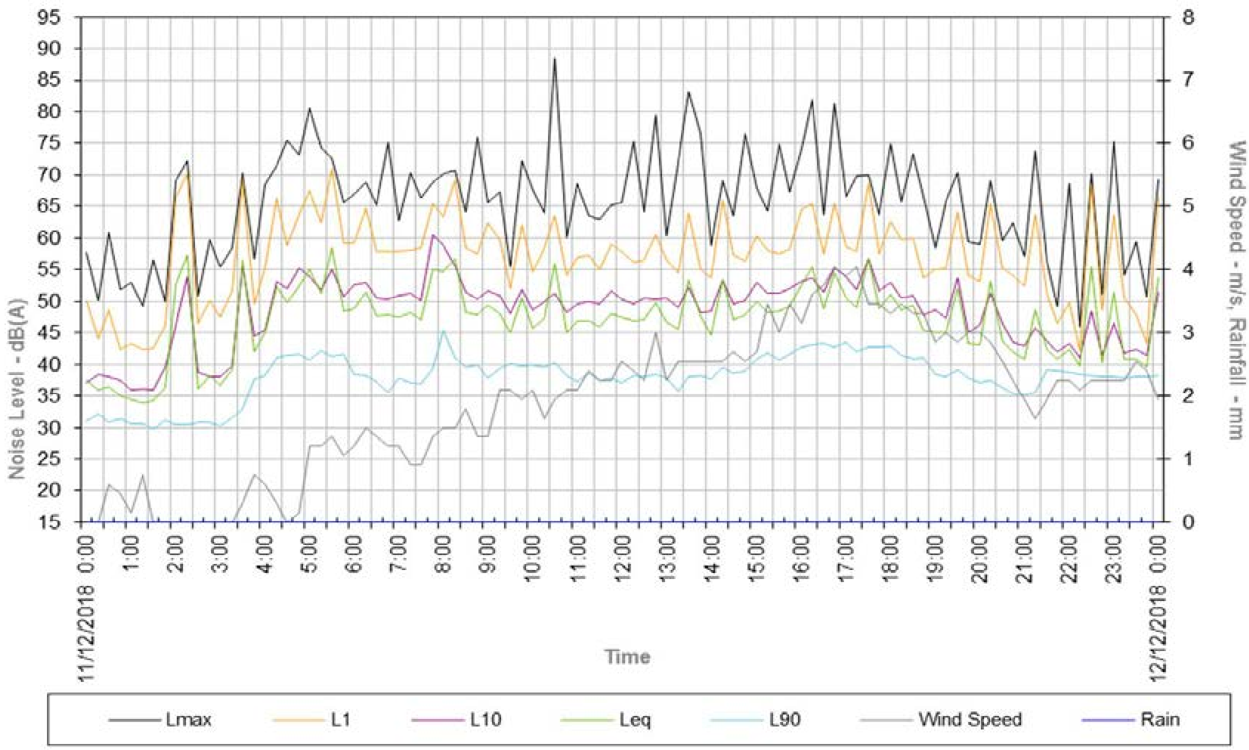




Site Noise and Weather Graphical Analysis

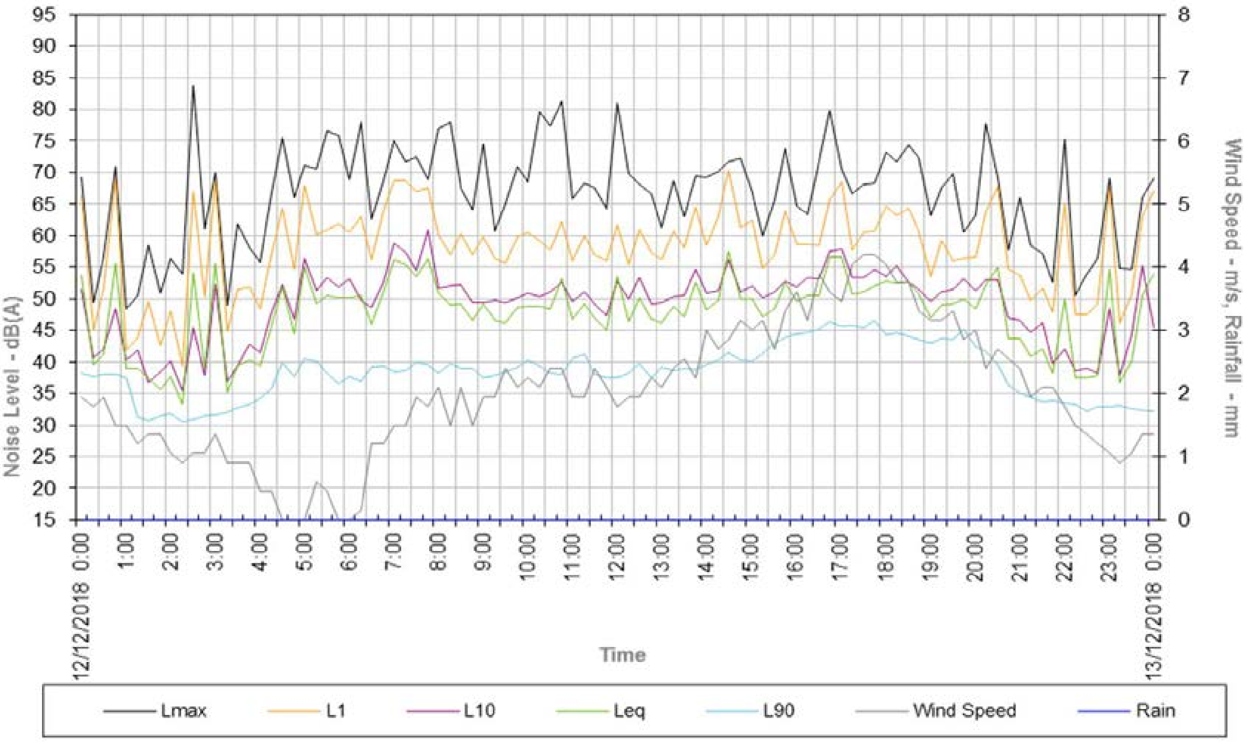
1 Old College Road

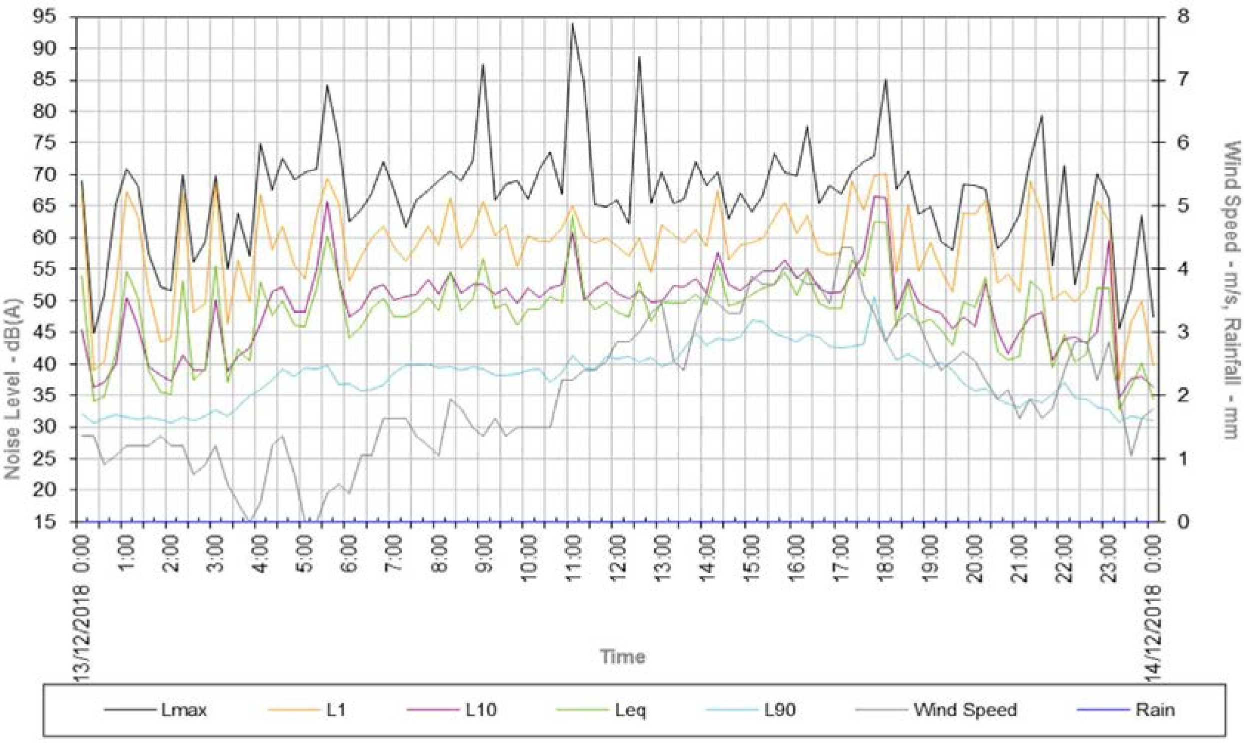




Site Noise and Weather Graphical Analysis

1 Old College Road





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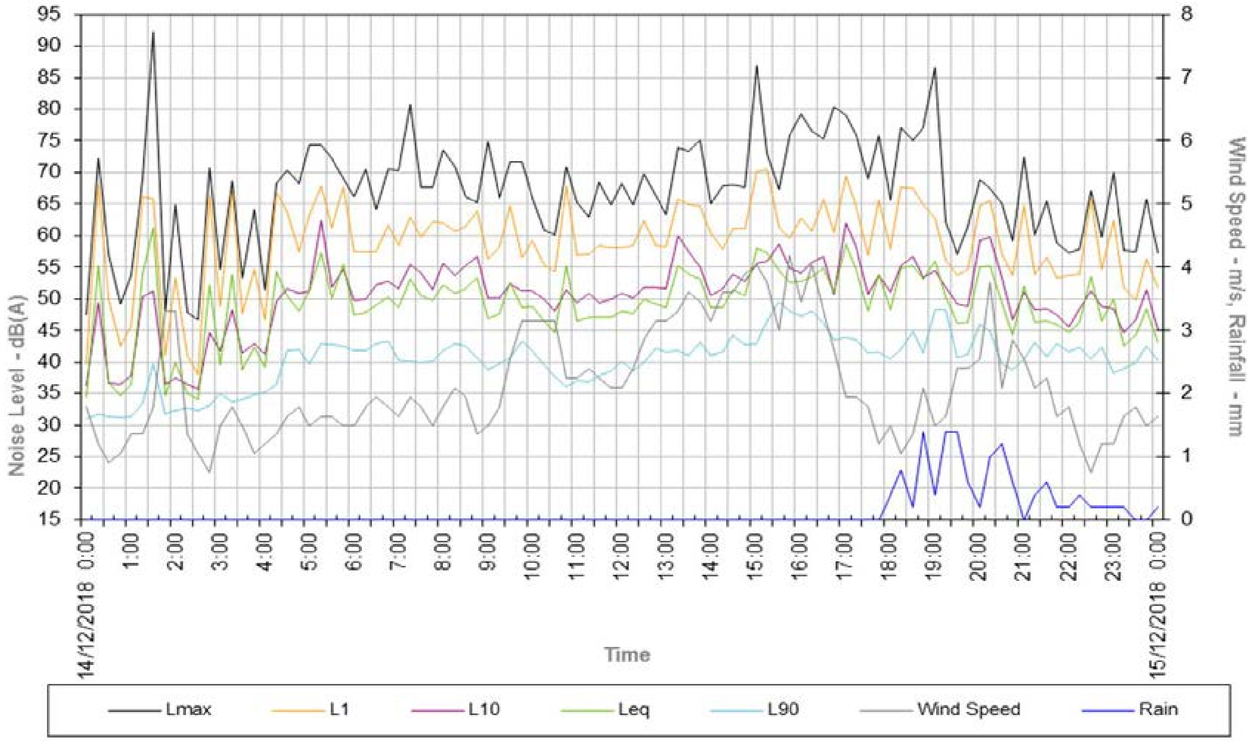
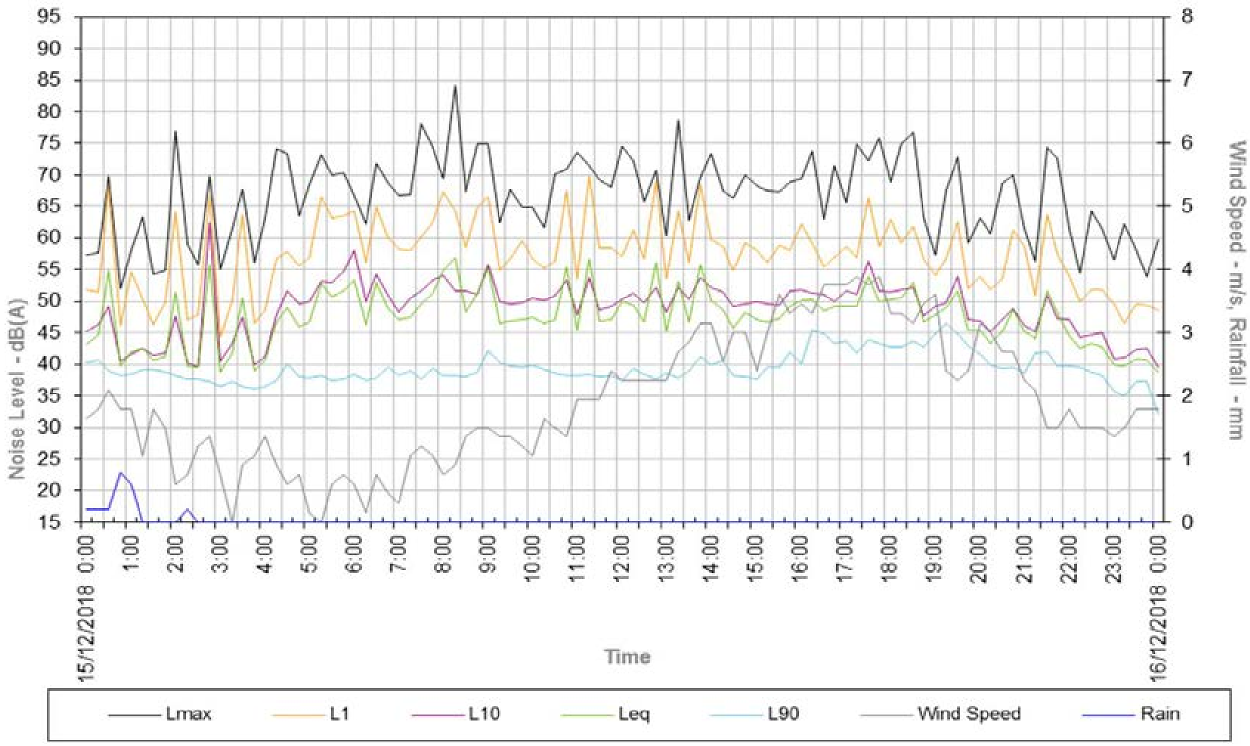
Site Noise and Weather Graphical Analysis

1 Old College Road





Future Freight
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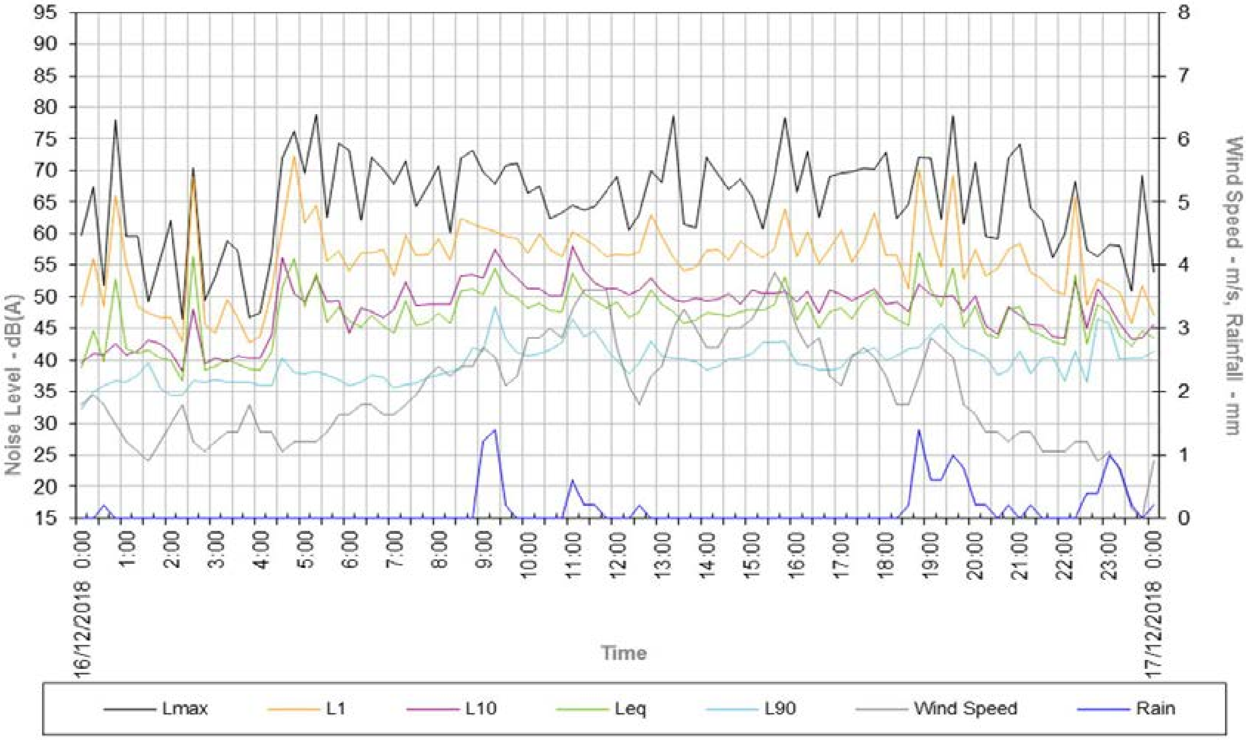
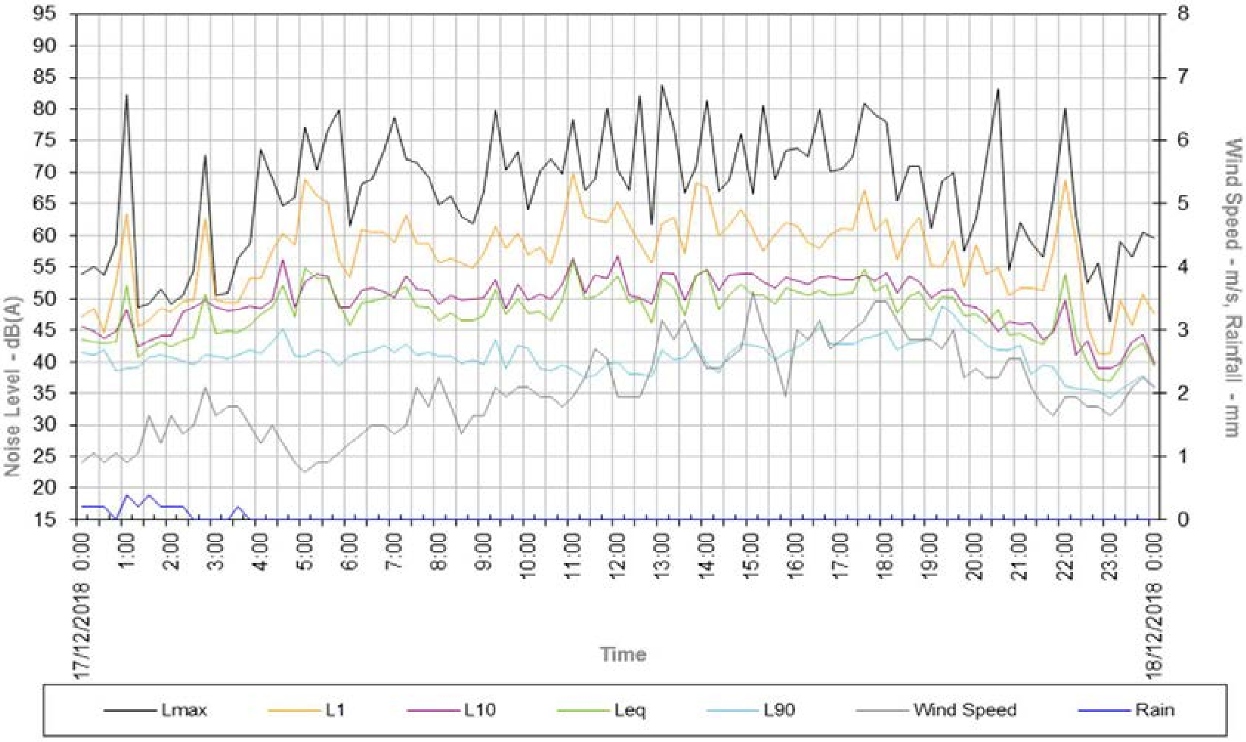
Site Noise and Weather Graphical Analysis

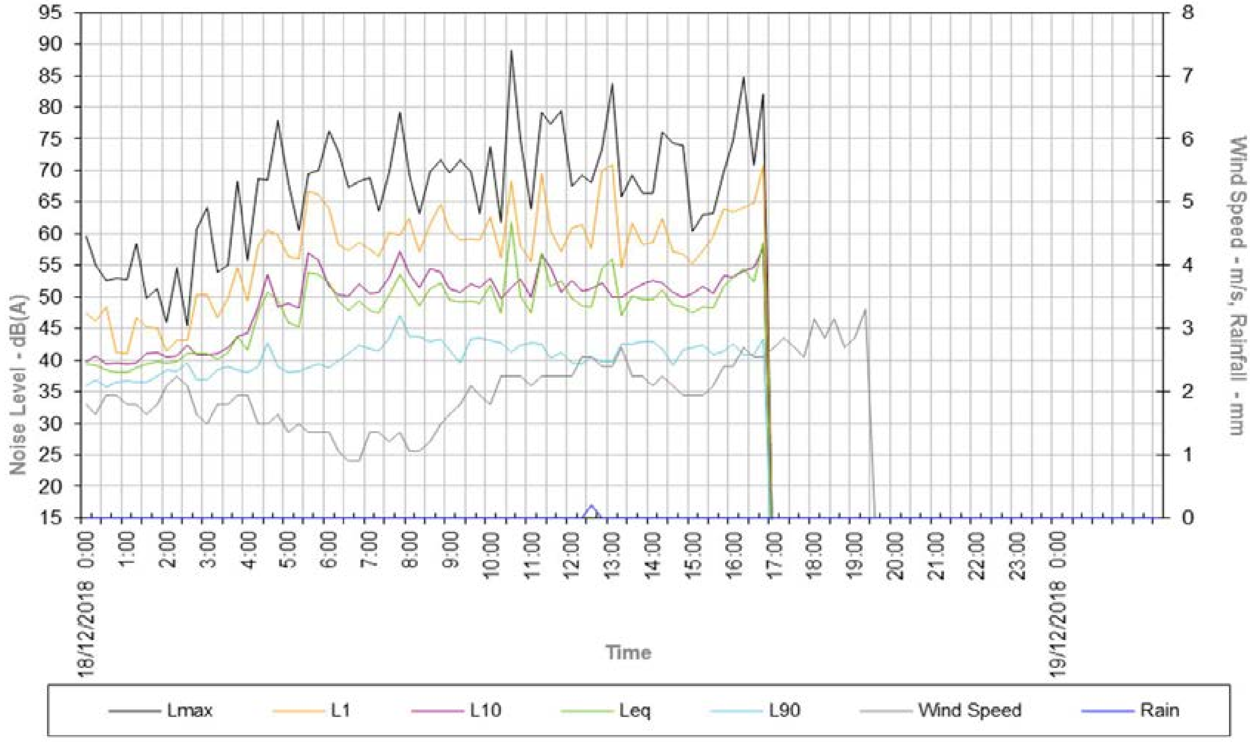
Saturday, 0 January 1900





Site Noise and Weather Graphical Analysis

1 Old College Road



Noise Monitoring Data Sheet

Inland Rail

SITE ID **H2C_06**

From	Wednesday 28/11/2018 16:30	Meas. Type	Free Field	Package	Helidon to Calvert
To	Friday 7/12/2018 8:00	Mic. Height (m)	1.8	Address	4 Ford Street
Instrument Type	Larson Davis 831	Weather Station	Yes	Suburb	Gatton
Instrument Serial #	1620	Operator	LAN	Land Use	Residential
Inst. Cal. Date	12/10/2018	Sample Int.	15 min	Latitude	27°33'19.85"S
Pre Calibration	94	RP Lot#	9/RP72317	Longitude	152°17'4.34"E
Post Calibration	94.1				

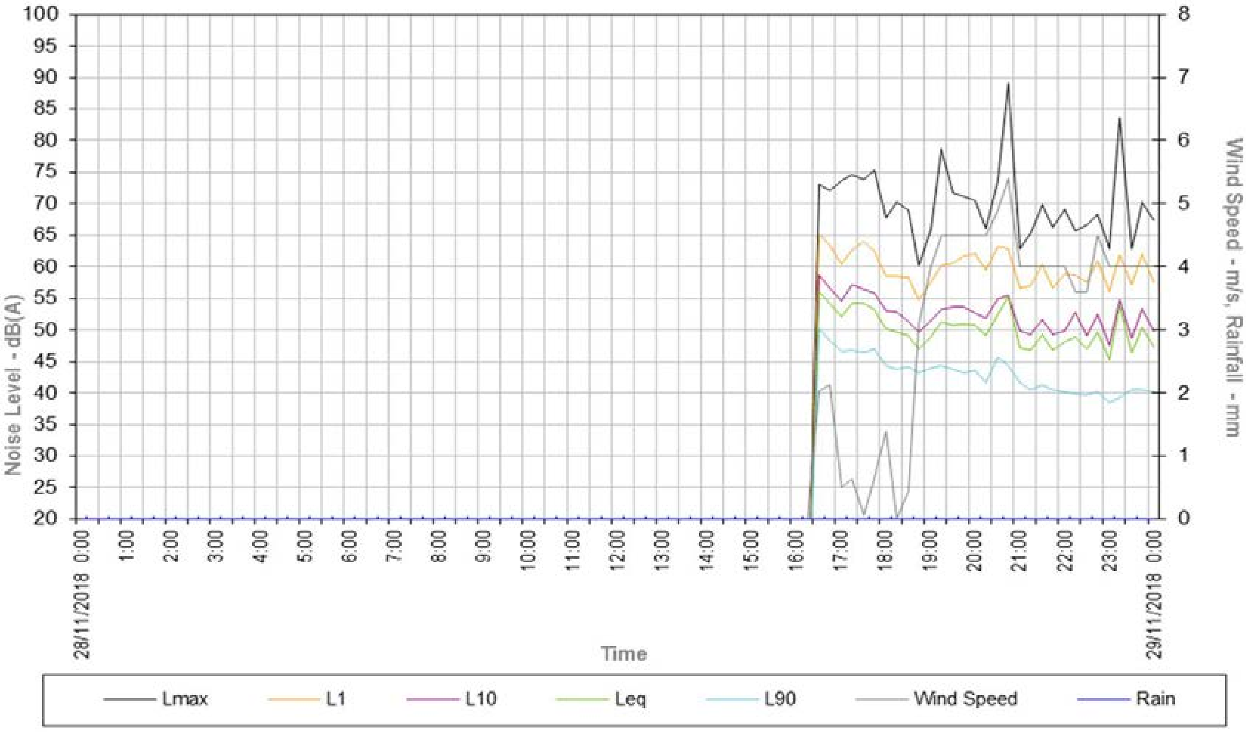
Daytime	Evening	Night
RBL **39.3 dB(A)**	RBL **36.0 dB(A)**	RBL **28.5 dB(A)**
ABLs Day (Mon-Fri 7am - 6 pm)	ABLs Evening (Mon-Fri 6 pm - 10 pm)	ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)
ABLs Day (Sat 8 am - 1 pm)	ABLs Evening (Sat 1 pm - 10 pm)	ABLs Night (Fri 6pm - 8am)
	ABLs Evening (Sun 7 am - 10 pm)	

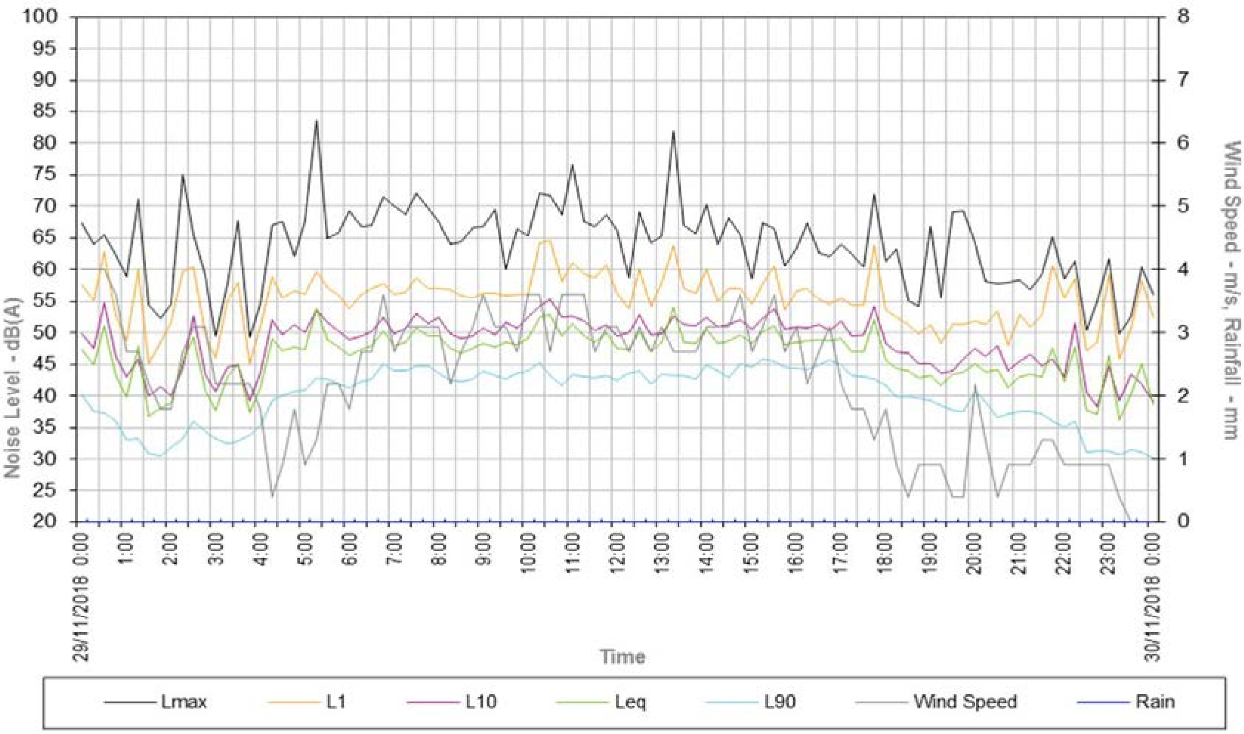
Daytime			Evening			Night		
			Wednesday 28/11/2018	40.6	dB(A)	Wednesday 28/11/2018	32.3	dB(A)
Thursday 29/11/2018	42.4	dB(A)	Thursday 29/11/2018	36.5	dB(A)	Thursday 29/11/2018	29.9	dB(A)
Friday 30/11/2018	38.9	dB(A)	Friday 30/11/2018	36.3	dB(A)	Friday 30/11/2018	28.5	dB(A)
Saturday 1/12/2018	36.4	dB(A)	Saturday 1/12/2018	34.7	dB(A)	Saturday 1/12/2018	27.8	dB(A)
			Sunday 2/12/2018	36.0	dB(A)	Sunday 2/12/2018	30.5	dB(A)
Monday 3/12/2018	37.0	dB(A)	Monday 3/12/2018	34.8	dB(A)	Monday 3/12/2018	27.0	dB(A)
Tuesday 4/12/2018	39.3	dB(A)	Tuesday 4/12/2018	34.5	dB(A)	Tuesday 4/12/2018	28.9	dB(A)
Wednesday 5/12/2018	44.8	dB(A)	Wednesday 5/12/2018	36.1	dB(A)	Wednesday 5/12/2018	28.5	dB(A)
Thursday 6/12/2018	45.3	dB(A)	Thursday 6/12/2018	36.0	dB(A)	Thursday 6/12/2018	26.2	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

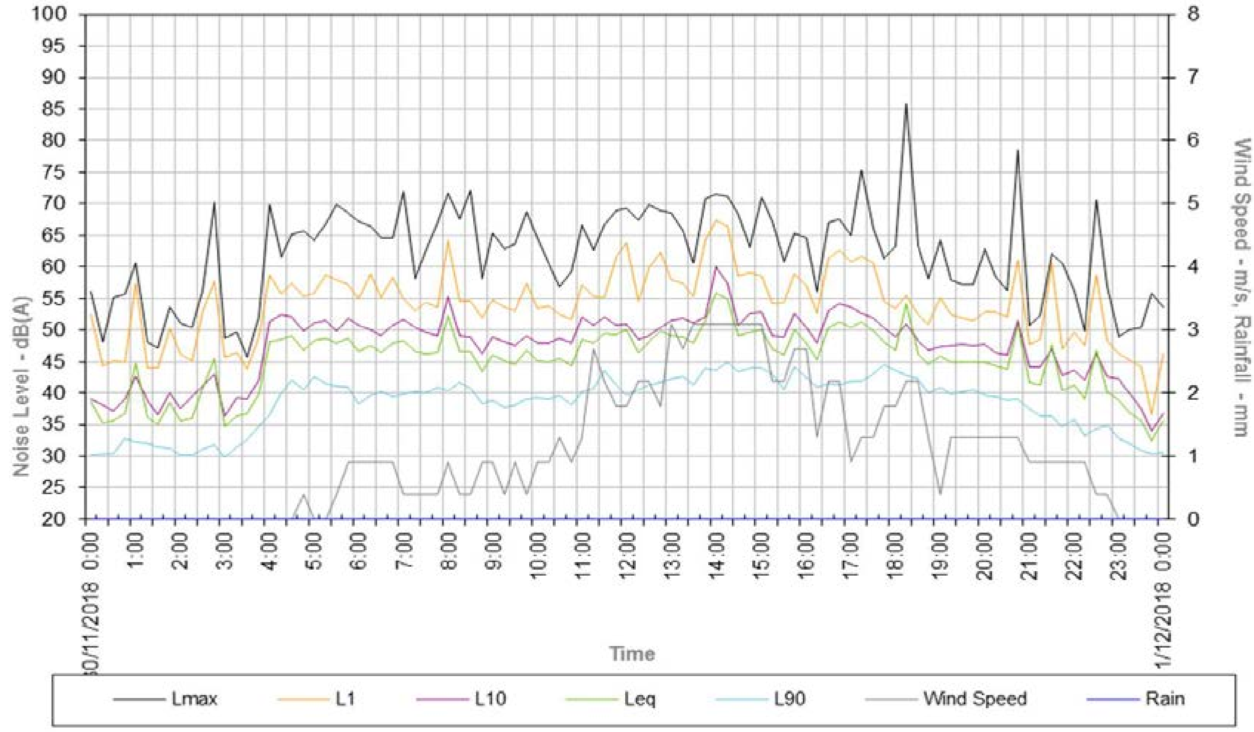
4 Ford Street

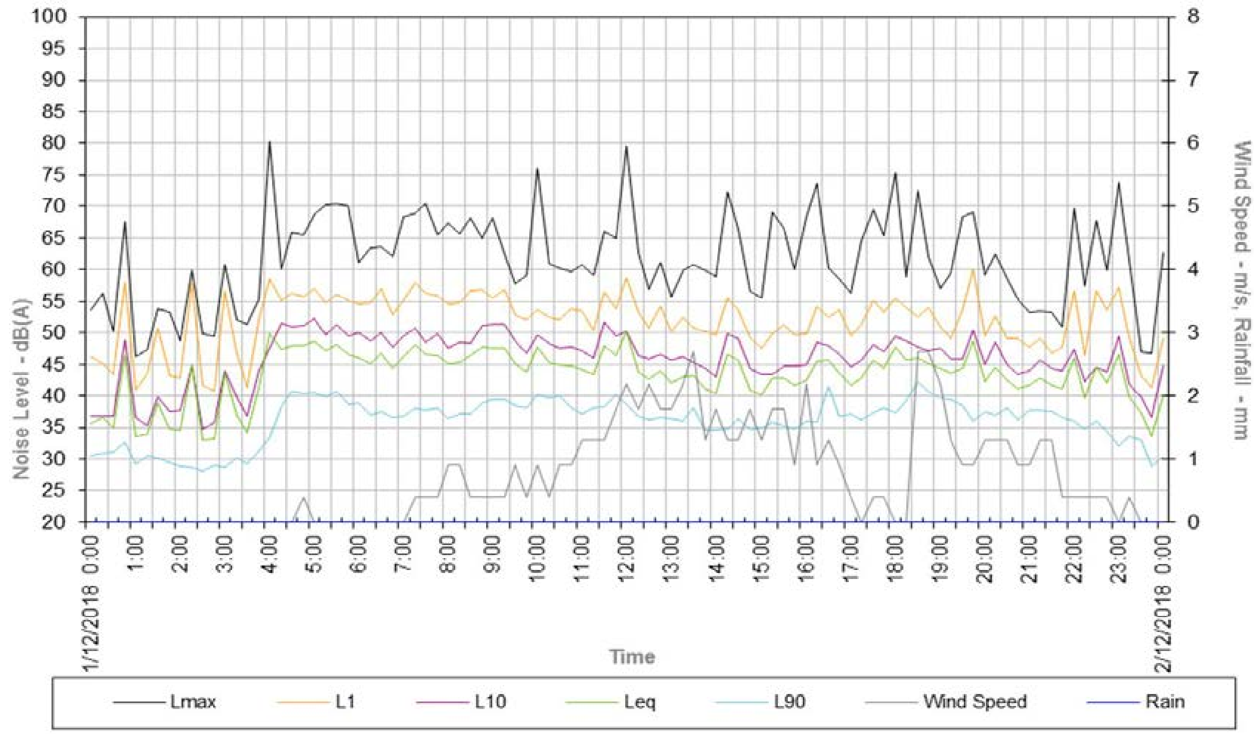




Site Noise and Weather Graphical Analysis

4 Ford Street

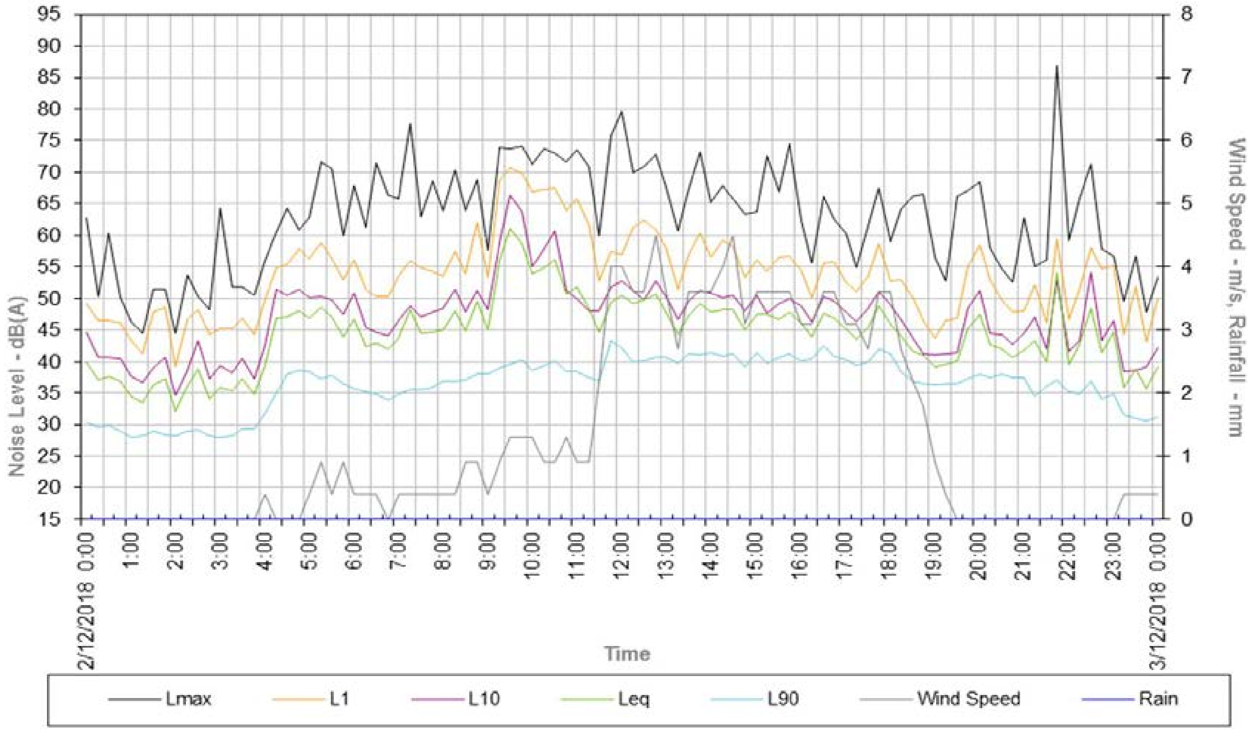


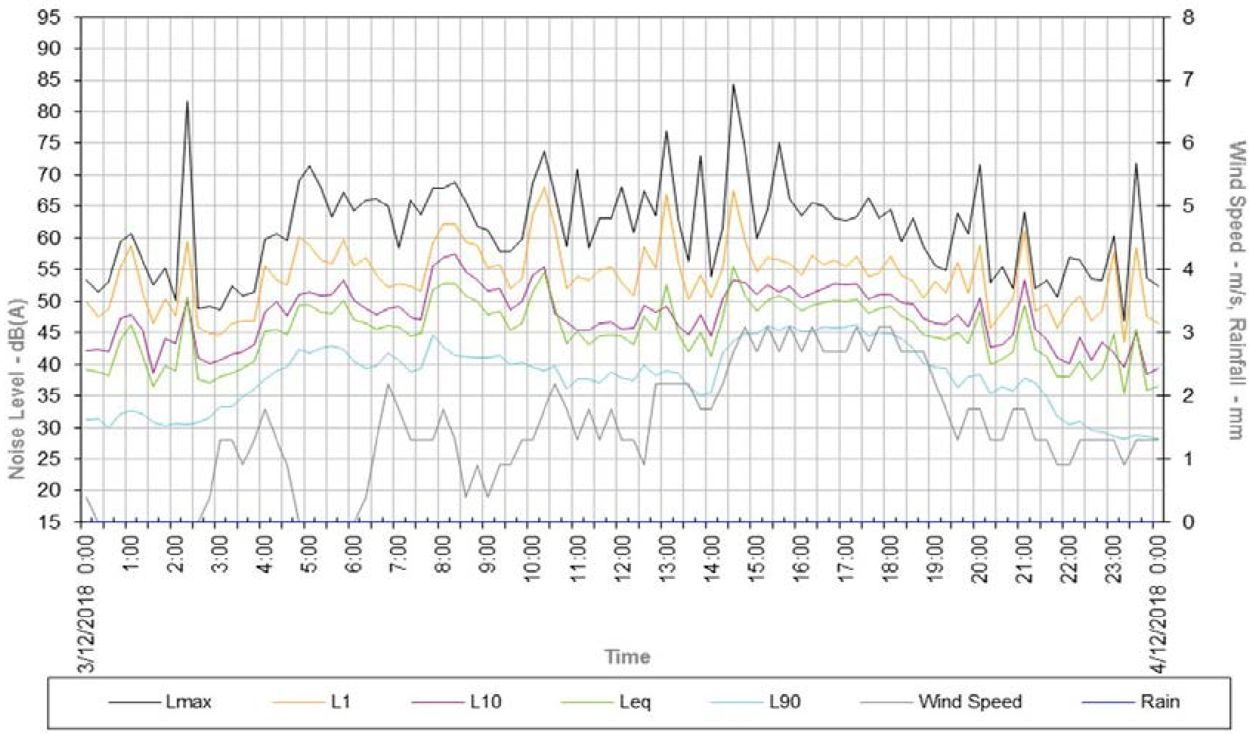


Future Freight
Integrating Community, Environment and Engineering

Site Noise and Weather Graphical Analysis

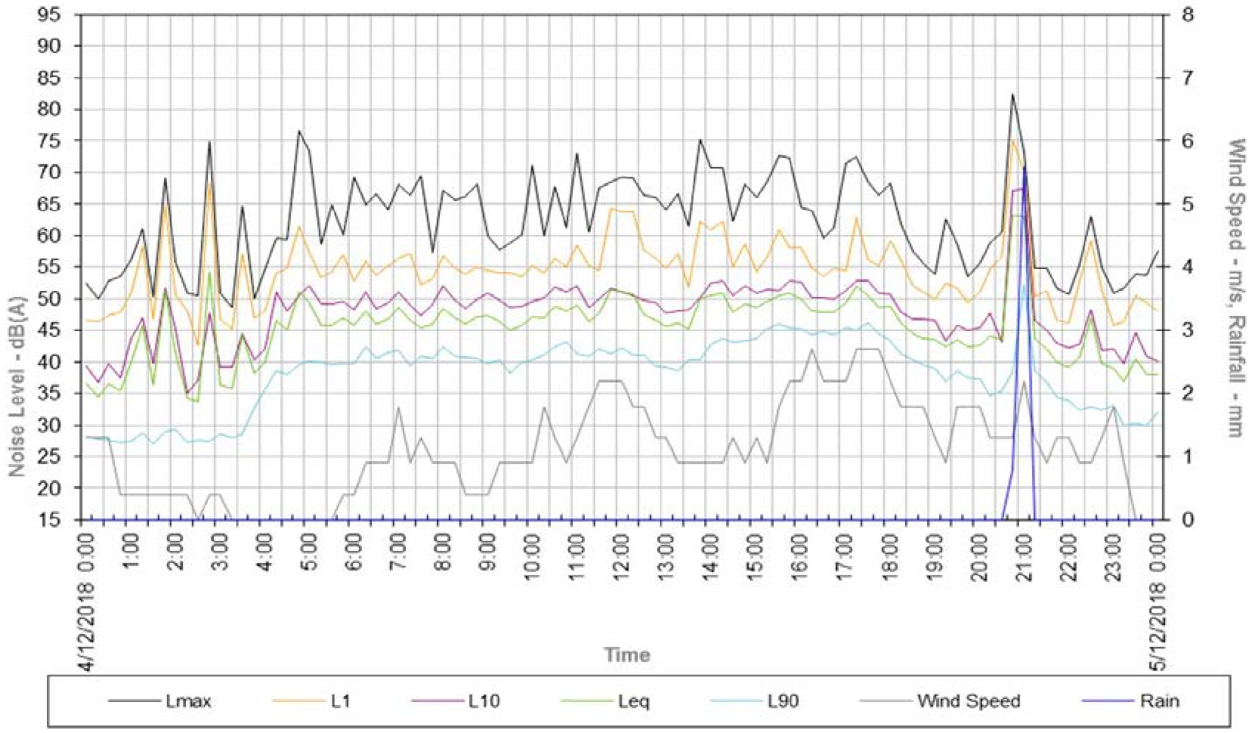
4 Ford Street

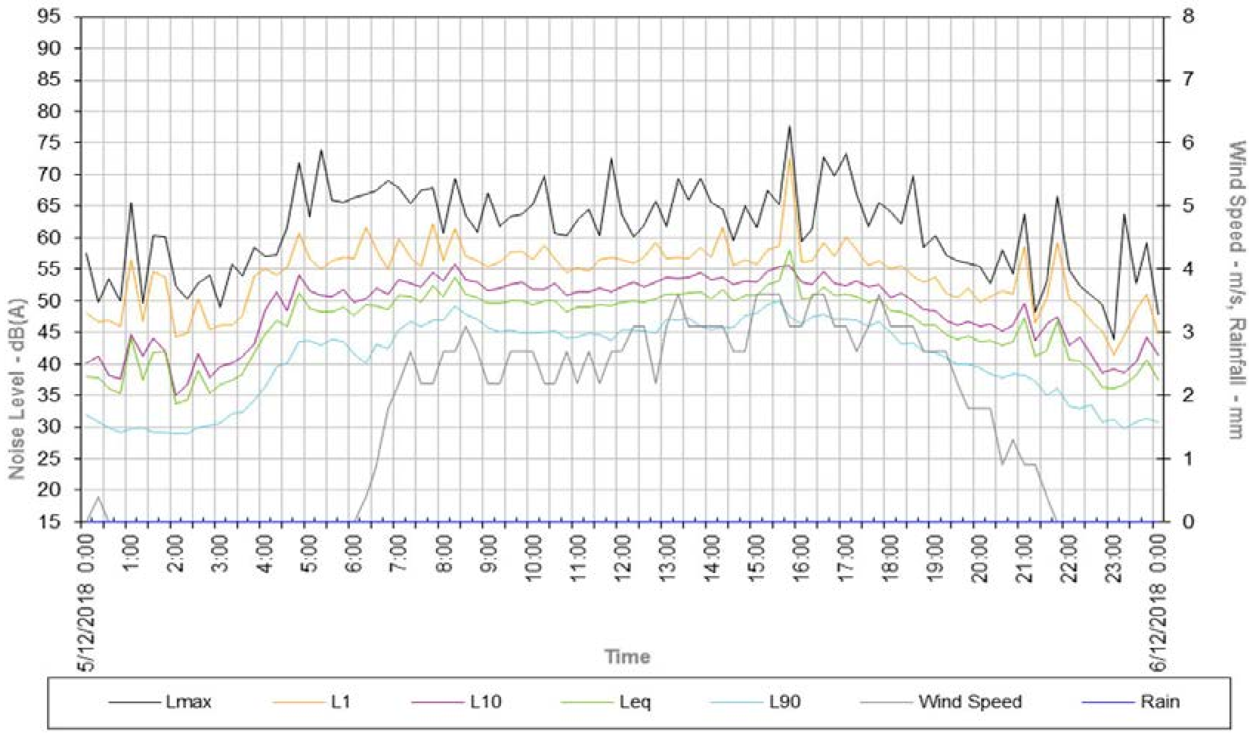




Site Noise and Weather Graphical Analysis

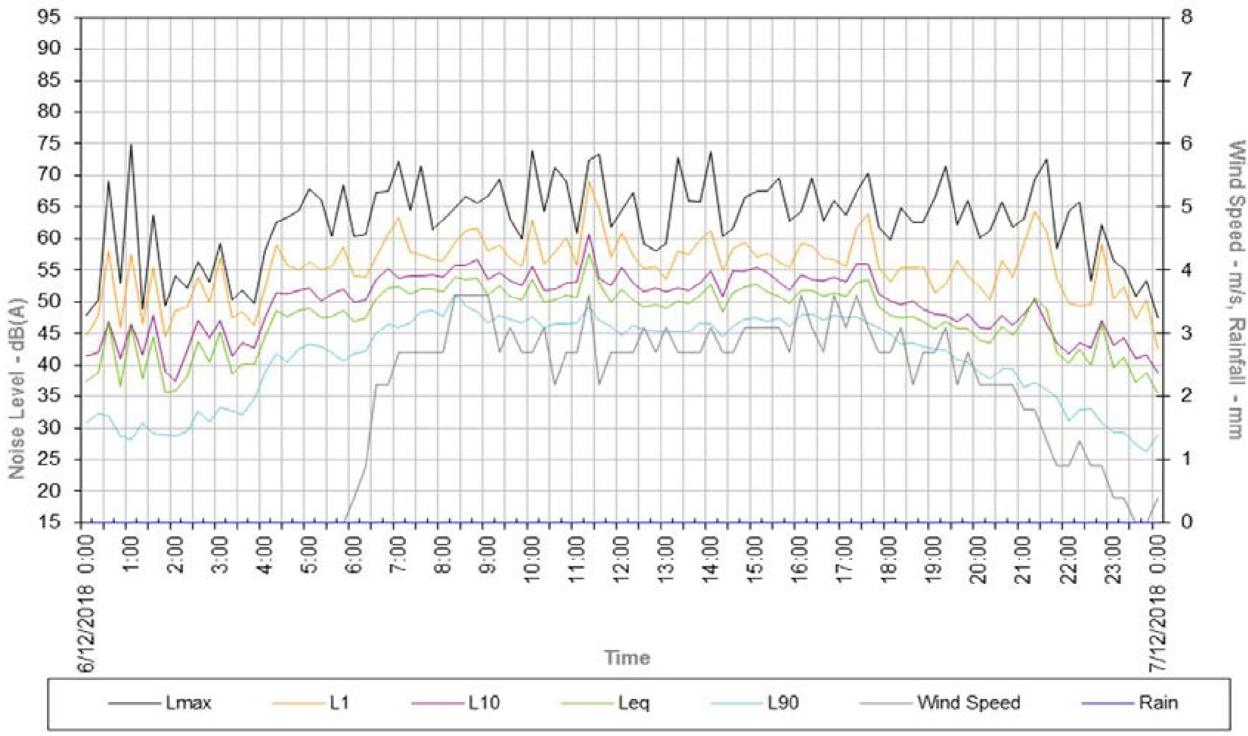
4 Ford Street

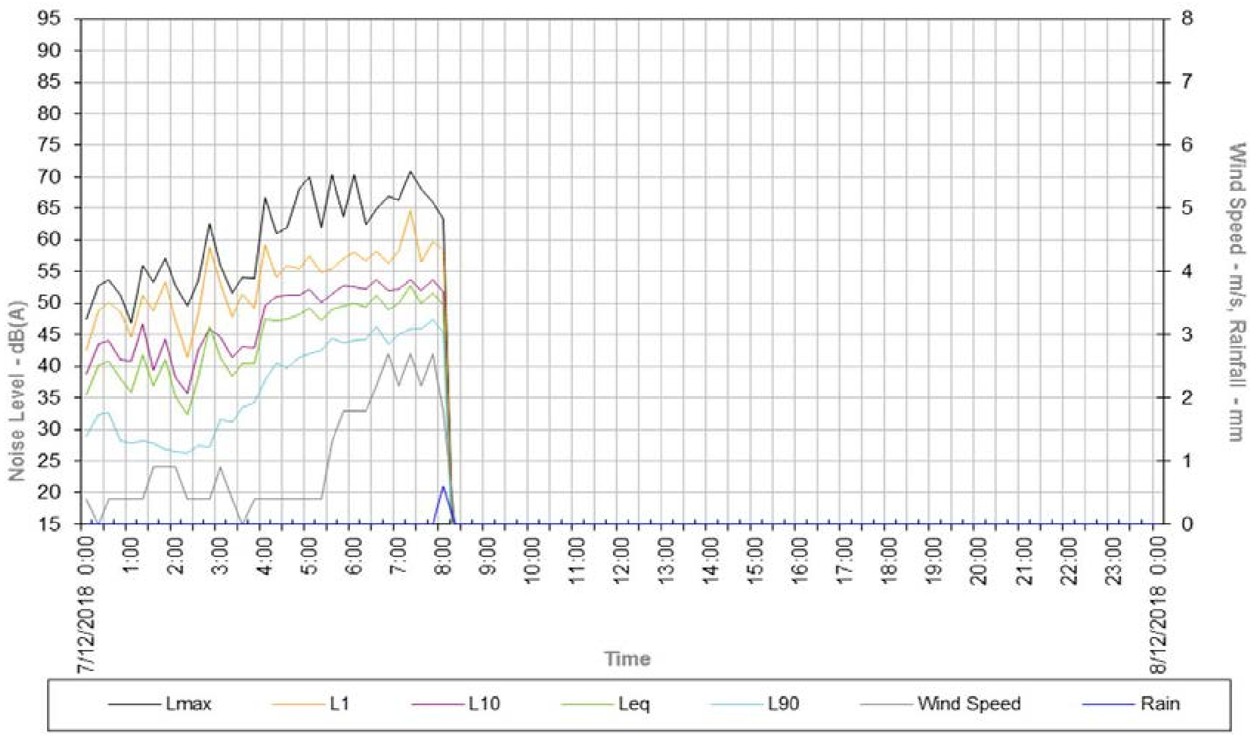




Site Noise and Weather Graphical Analysis

4 Ford Street





Noise Monitoring Data Sheet

Inland Rail

SITE ID
H2C_07

From	Thursday 29/11/2018 16:45	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 6/12/2018 15:00	Mic. Height (m)	1.8	Address	Golf Links Dr & Woodlands Rd
Instrument Type	01 dB CUBE	Weather Station	No	Suburb	Gatton
Instrument Serial #	11096	Operator	LAN	Land Use	Residential
Inst. Cal. Date	08/03/2018	Sample Int.	15 min	Latitude	27°33'27.51"S
Pre Calibration	94	RP Lot#	99/SP145215	Longitude	152°17'5.71"E
Post Calibration	94.1			Name	Christian Life Centre Gatton

Daytime

RBL **48.3 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Friday 30/11/2018	48.8	dB(A)
Saturday 1/12/2018	46.6	dB(A)
Monday 3/12/2018	46.9	dB(A)
Tuesday 4/12/2018	47.8	dB(A)
Wednesday 5/12/2018	49.6	dB(A)
Thursday 6/12/2018	50.4	dB(A)

Evening

RBL **42.7 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Thursday 29/11/2018	39.8	dB(A)
Friday 30/11/2018	43.8	dB(A)
Saturday 1/12/2018	45.1	dB(A)
Sunday 2/12/2018	42.7	dB(A)
Monday 3/12/2018	42.0	dB(A)
Tuesday 4/12/2018	40.6	dB(A)
Wednesday 5/12/2018	45.6	dB(A)

Night

RBL **32.6 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

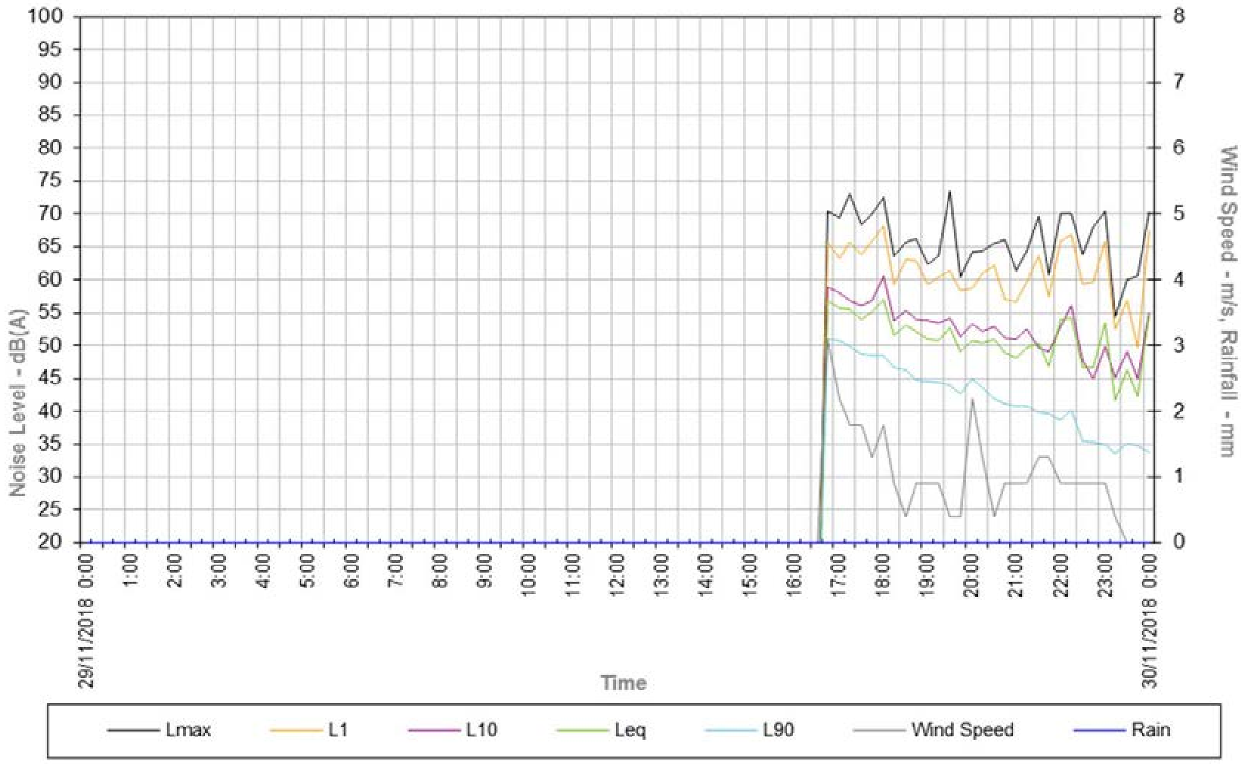
ABLs Night (Fri 6pm - 8am)

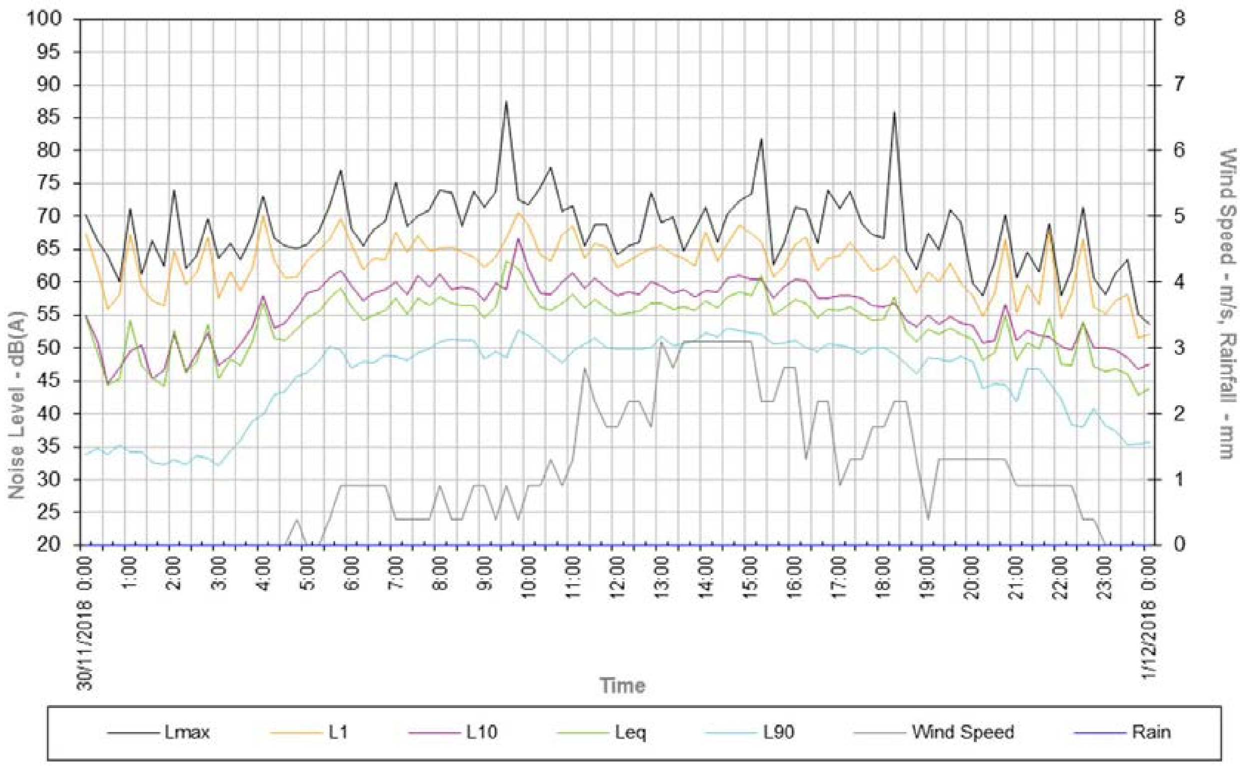
Thursday 29/11/2018	32.6	dB(A)
Friday 30/11/2018	31.7	dB(A)
Saturday 1/12/2018	30.9	dB(A)
Sunday 2/12/2018	33.6	dB(A)
Monday 3/12/2018	32.4	dB(A)
Tuesday 4/12/2018	35.8	dB(A)
Wednesday 5/12/2018	34.3	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

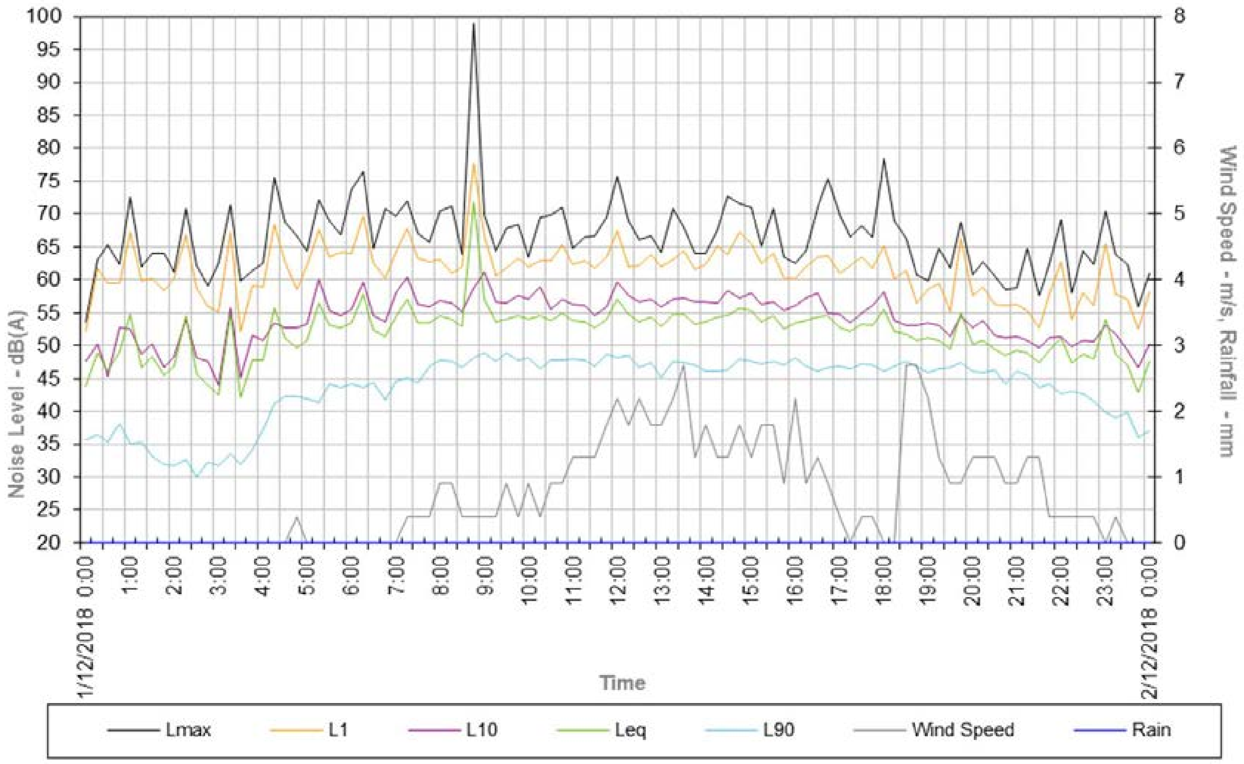
Golf Links Dr & Woodlands Rd

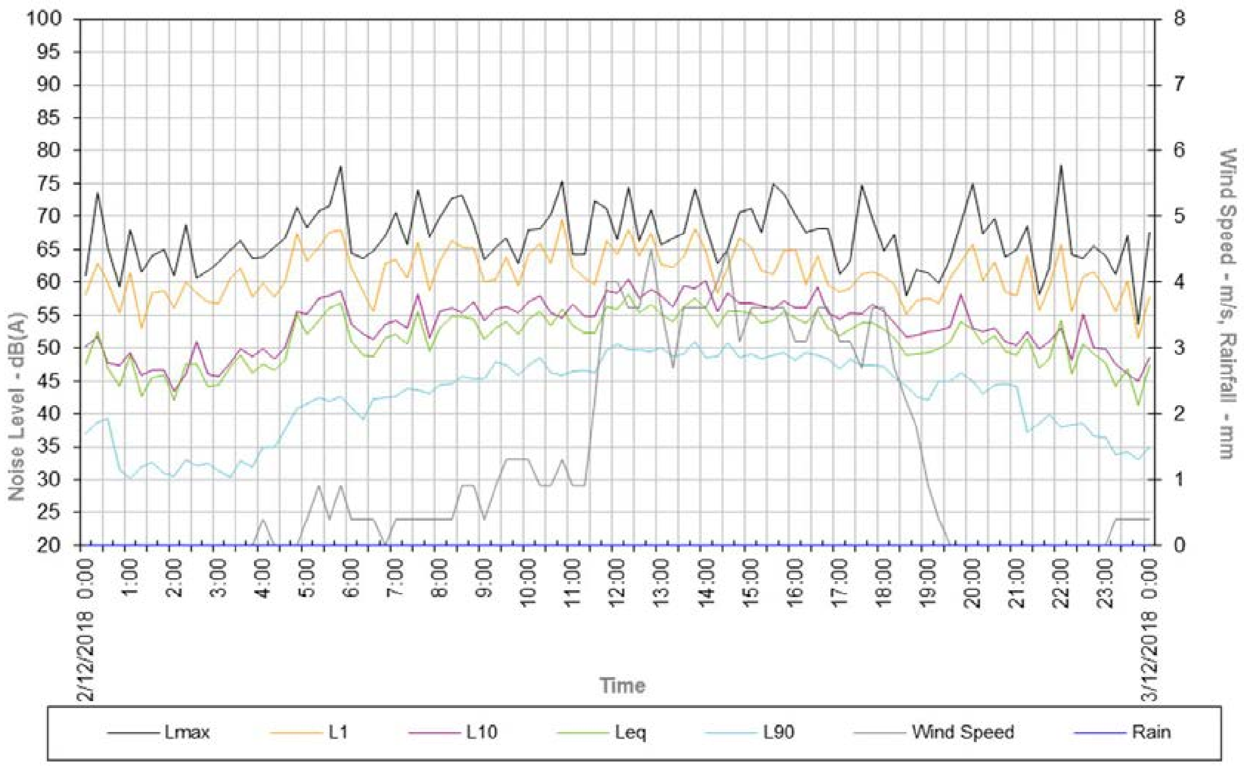




Site Noise and Weather Graphical Analysis

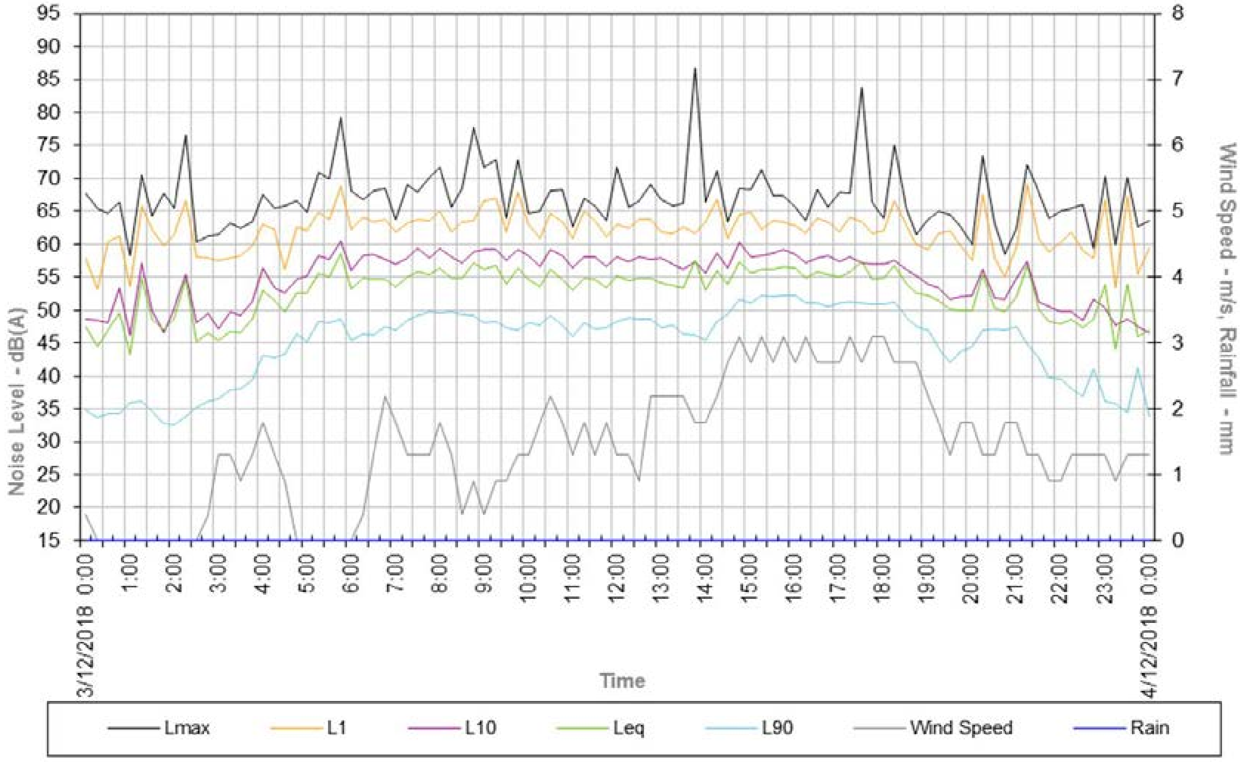
Golf Links Dr & Woodlands Rd

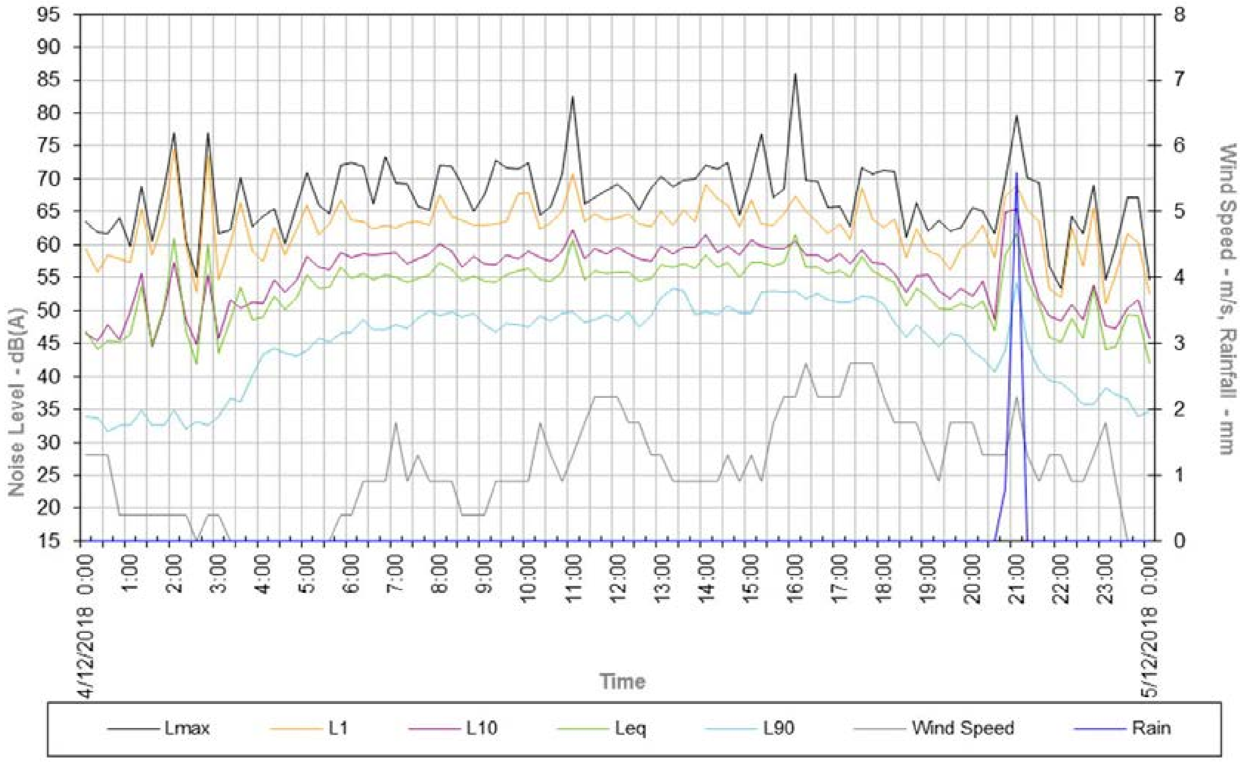




Site Noise and Weather Graphical Analysis

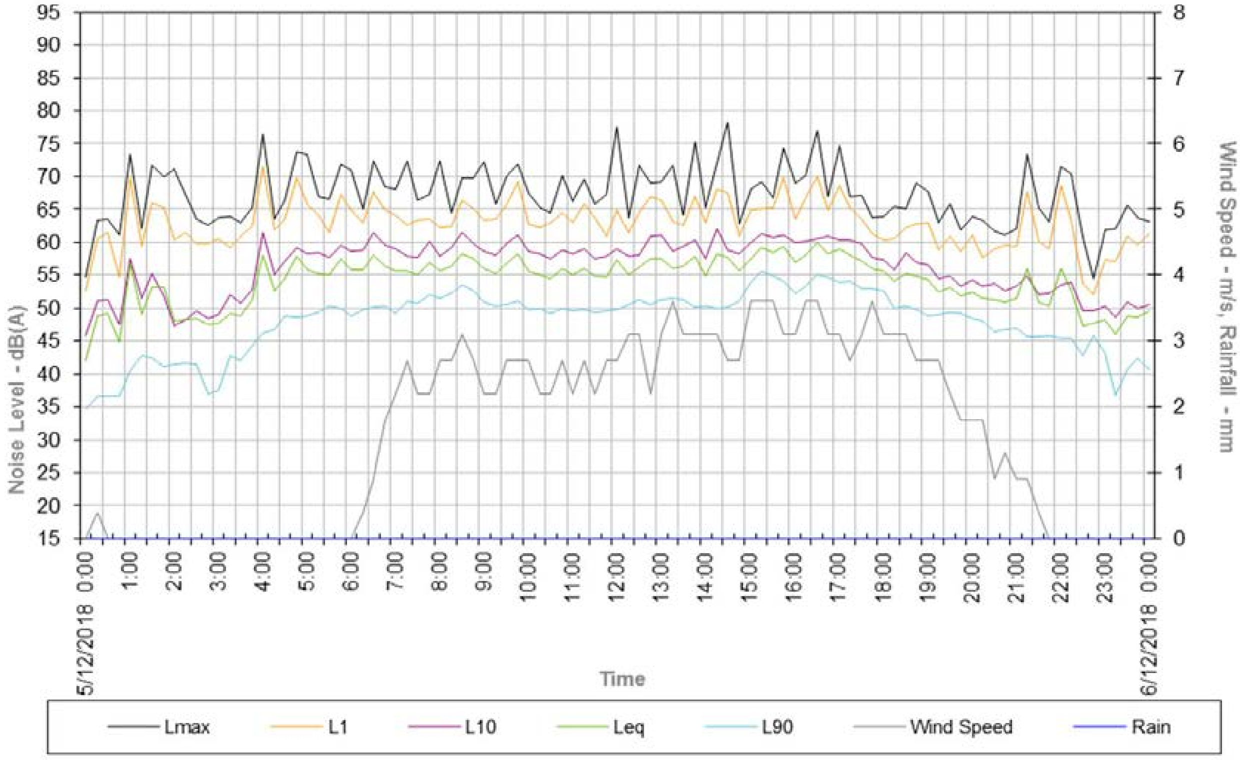
Golf Links Dr & Woodlands Rd

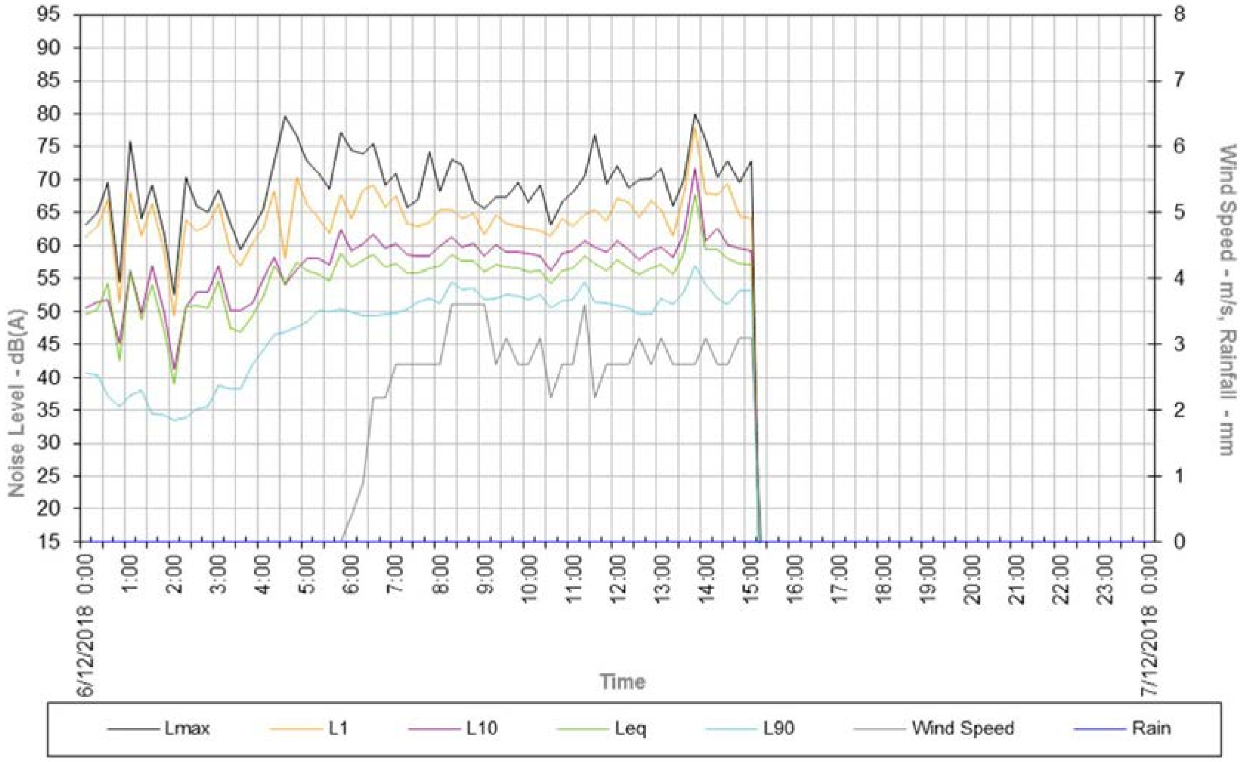




Site Noise and Weather Graphical Analysis

Golf Links Dr & Woodlands Rd





Noise Monitoring Data Sheet

Inland Rail

SITE ID
H2C_08

From	Friday 30/11/2018 10:45	Meas. Type	Façade	Package	Helidon to Calvert
To	Friday 7/12/2018 9:00	Mic. Height (m)	1.8	Address	0 Hunt Street
Instrument Type	01 dB CUBE	Weather Station	No	Suburb	Forrest Hill
Instrument Serial #	11107	Operator	LAN	Land Use	Residential
Inst. Cal. Date	08/03/2018	Sample Int.	15 min	Latitude	27°35'18.66"S
Pre Calibration	94	RP Lot#	2/RP196756	Longitude	152°21'26.64"E
Post Calibration	93.9				

Daytime
RBL **38.6 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Friday 30/11/2018	39.3	dB(A)
Saturday 1/12/2018	36.9	dB(A)
Monday 3/12/2018	38.0	dB(A)
Tuesday 4/12/2018	37.5	dB(A)
Wednesday 5/12/2018	42.4	dB(A)
Thursday 6/12/2018	42.1	dB(A)

Evening
RBL **35.1 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Friday 30/11/2018	38.0	dB(A)
Saturday 1/12/2018	35.7	dB(A)
Sunday 2/12/2018	34.0	dB(A)
Monday 3/12/2018	34.3	dB(A)
Tuesday 4/12/2018	35.1	dB(A)
Wednesday 5/12/2018	34.4	dB(A)
Thursday 6/12/2018	38.3	dB(A)

Night
RBL **31.7 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

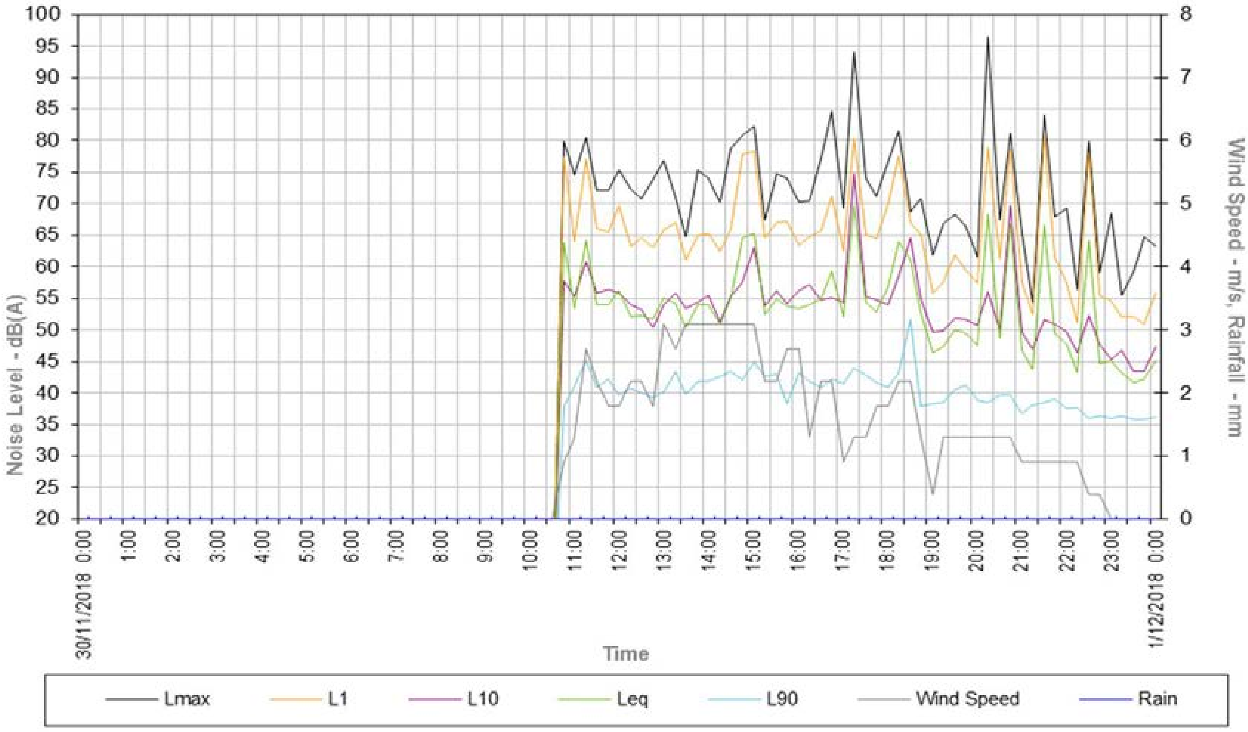
ABLs Night (Fri 6pm - 8am)

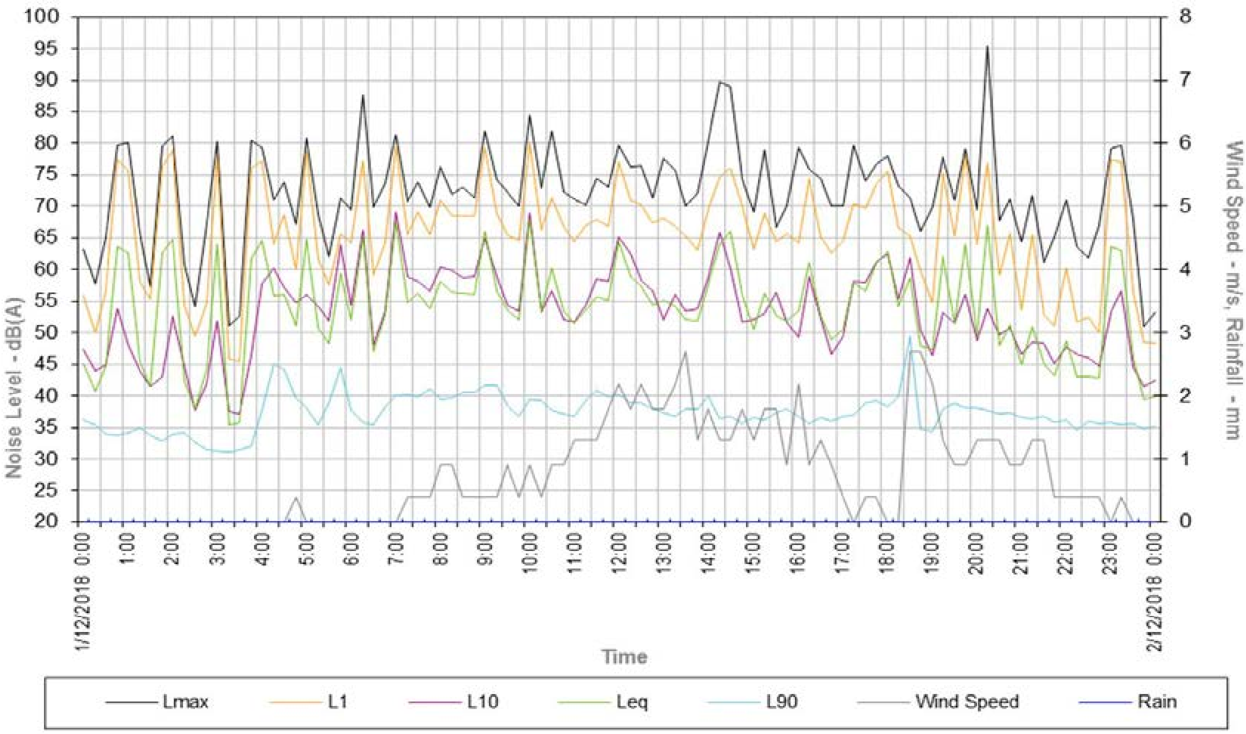
Friday 30/11/2018	31.5	dB(A)
Saturday 1/12/2018	32.2	dB(A)
Sunday 2/12/2018	29.8	dB(A)
Monday 3/12/2018	32.4	dB(A)
Tuesday 4/12/2018	32.3	dB(A)
Wednesday 5/12/2018	31.3	dB(A)
Thursday 6/12/2018	31.7	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

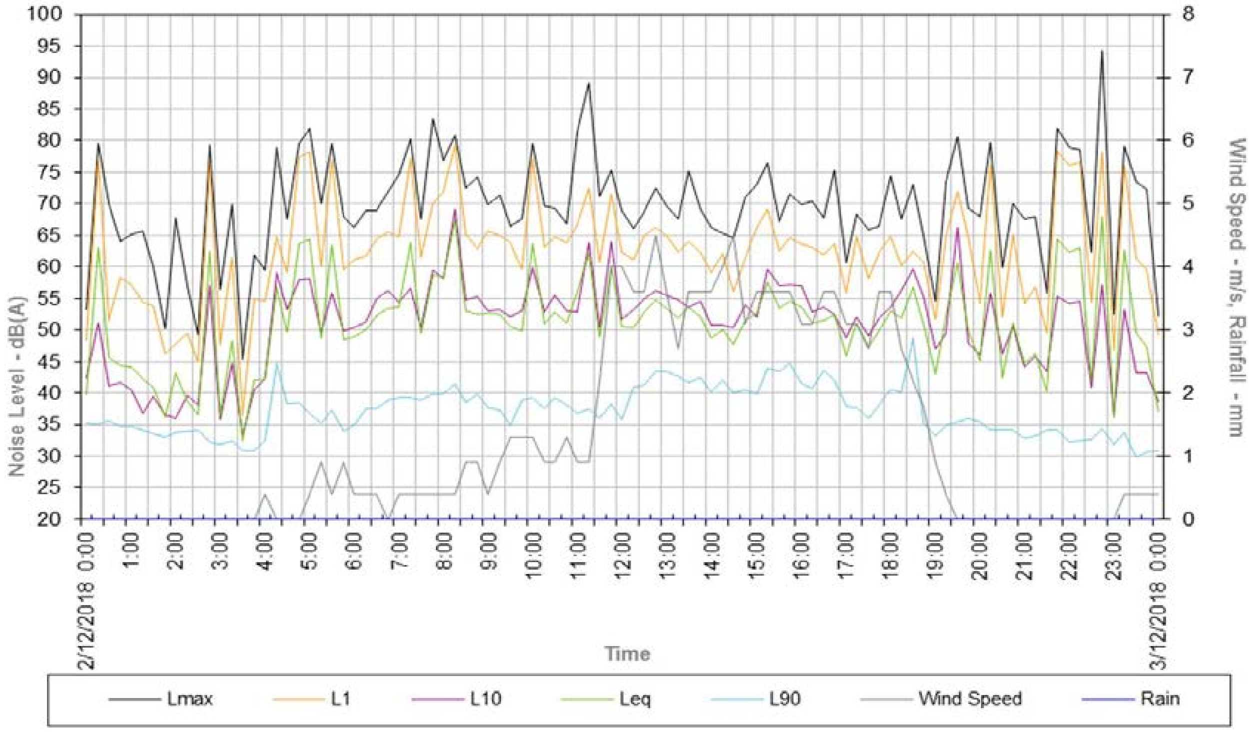
0 Hunt Street

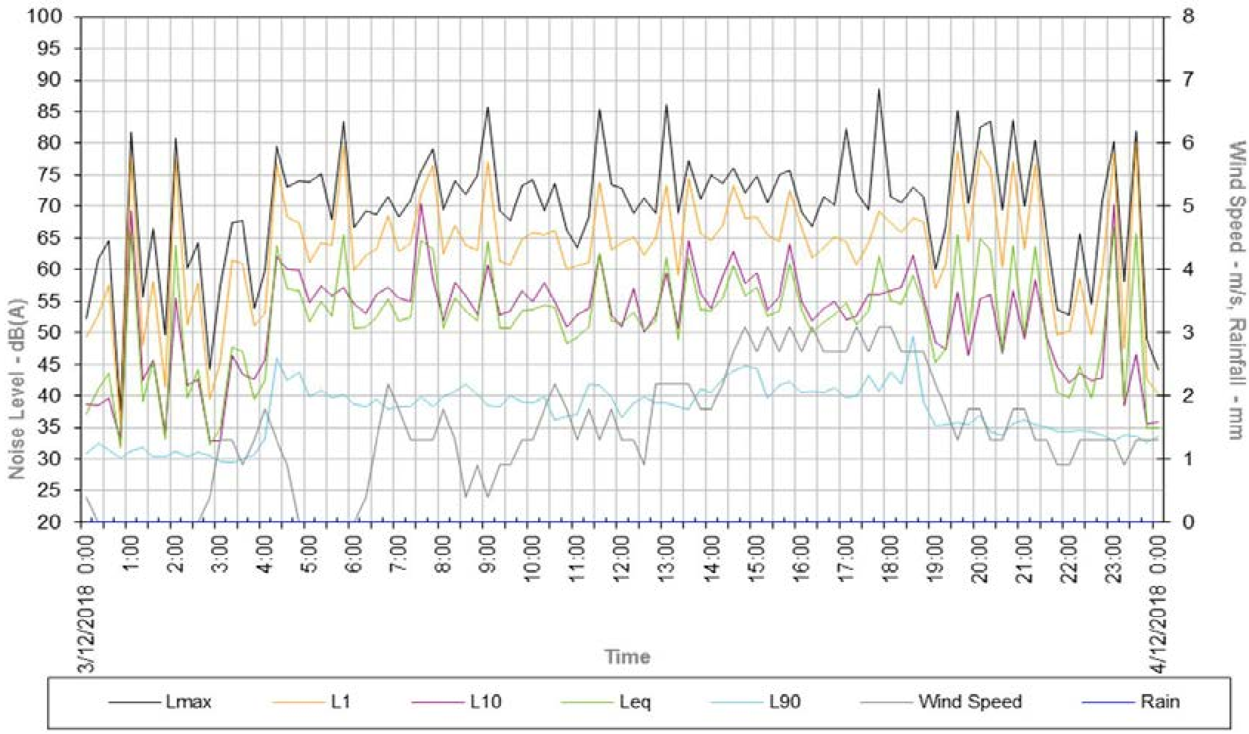




Site Noise and Weather Graphical Analysis

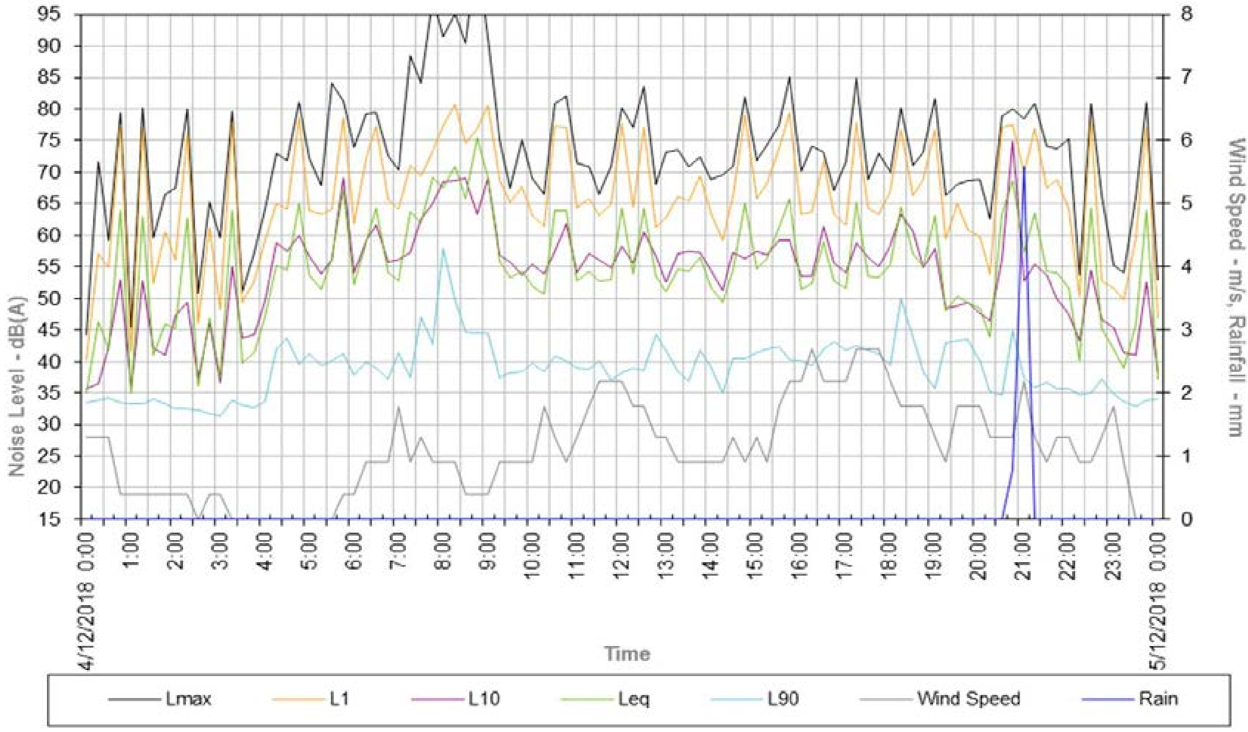
0 Hunt Street

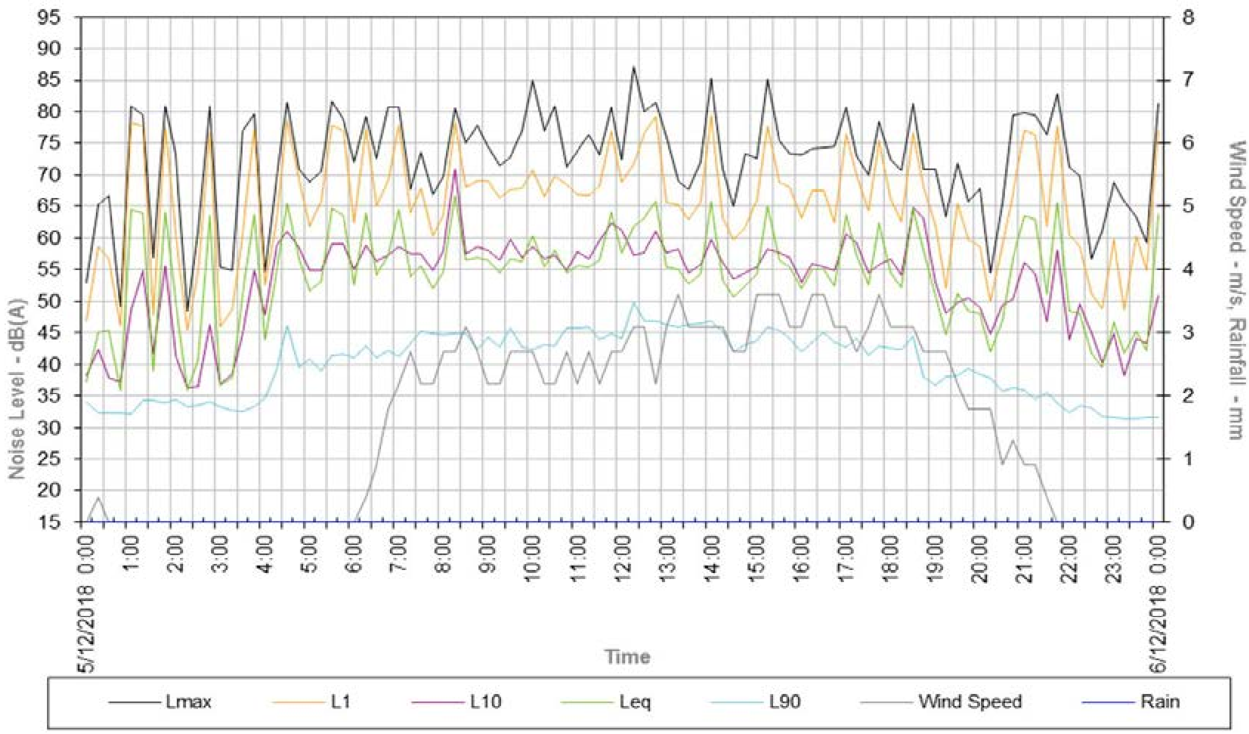




Site Noise and Weather Graphical Analysis

0 Hunt Street





Future Freight
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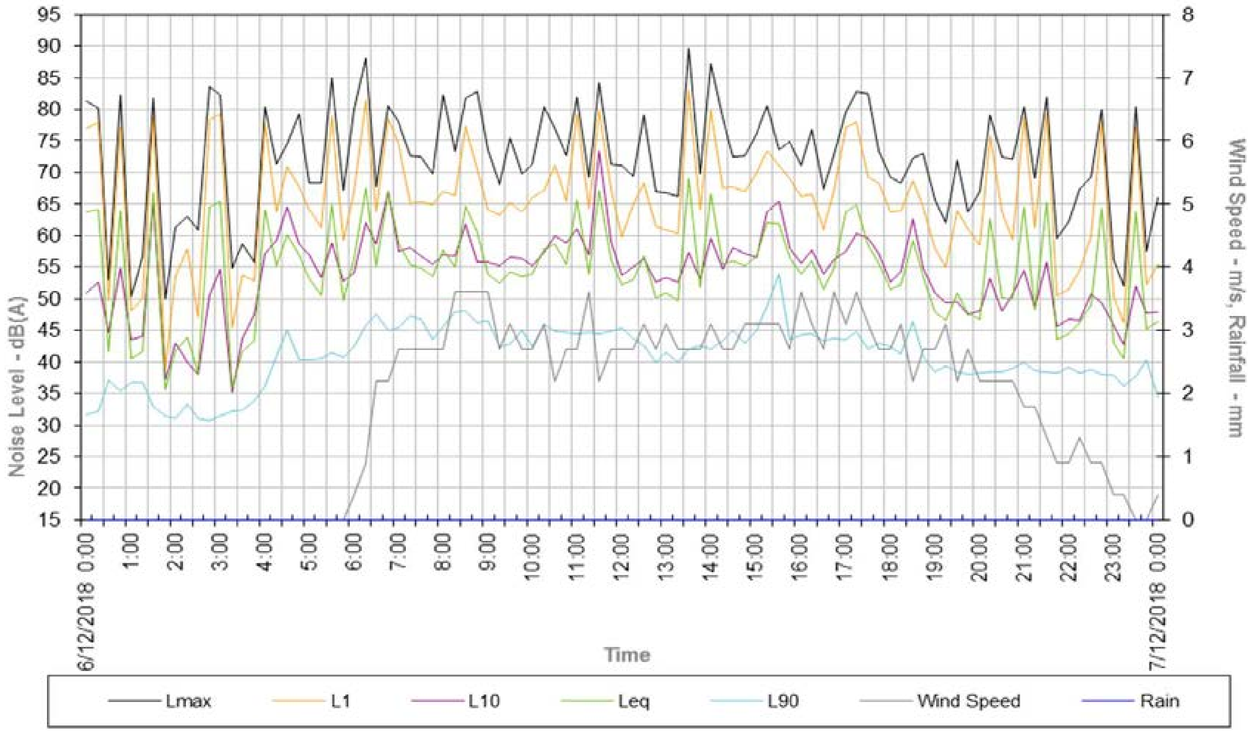
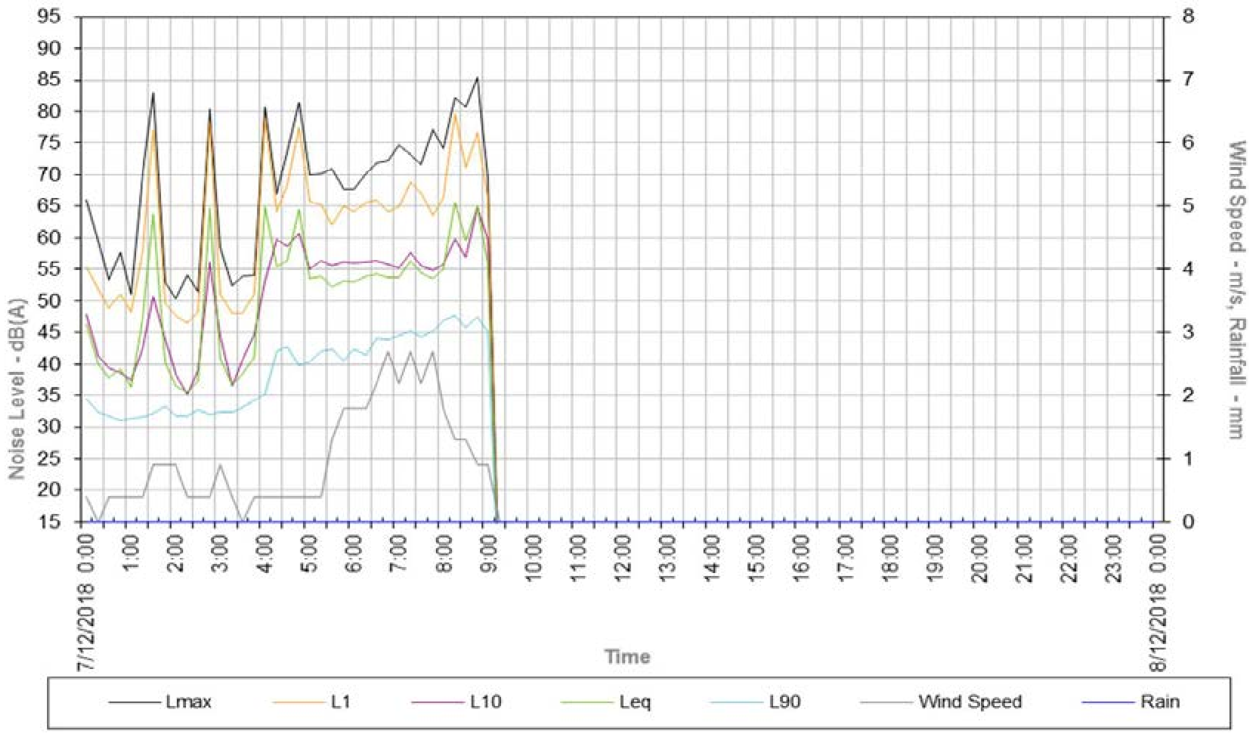
Site Noise and Weather Graphical Analysis

0 Hunt Street





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Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_09

From	Friday 30/11/2018 12:00	Meas. Type	Free Field	Package	Helidon to Calvert
To	Friday 7/12/2018 10:00	Mic. Height (m)	1.8	Address	52 Victoria Street
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Forrest Hill
Instrument Serial #	12605	Operator	BR	Land Use	Residential
Inst. Cal. Date	08/03/2018	Sample Int.	15 min	Latitude	27°35'22.03"S
Pre Calibration	94	RP Lot#	N/A	Longitude	152°21'26.60"E
Post Calibration	93.9				

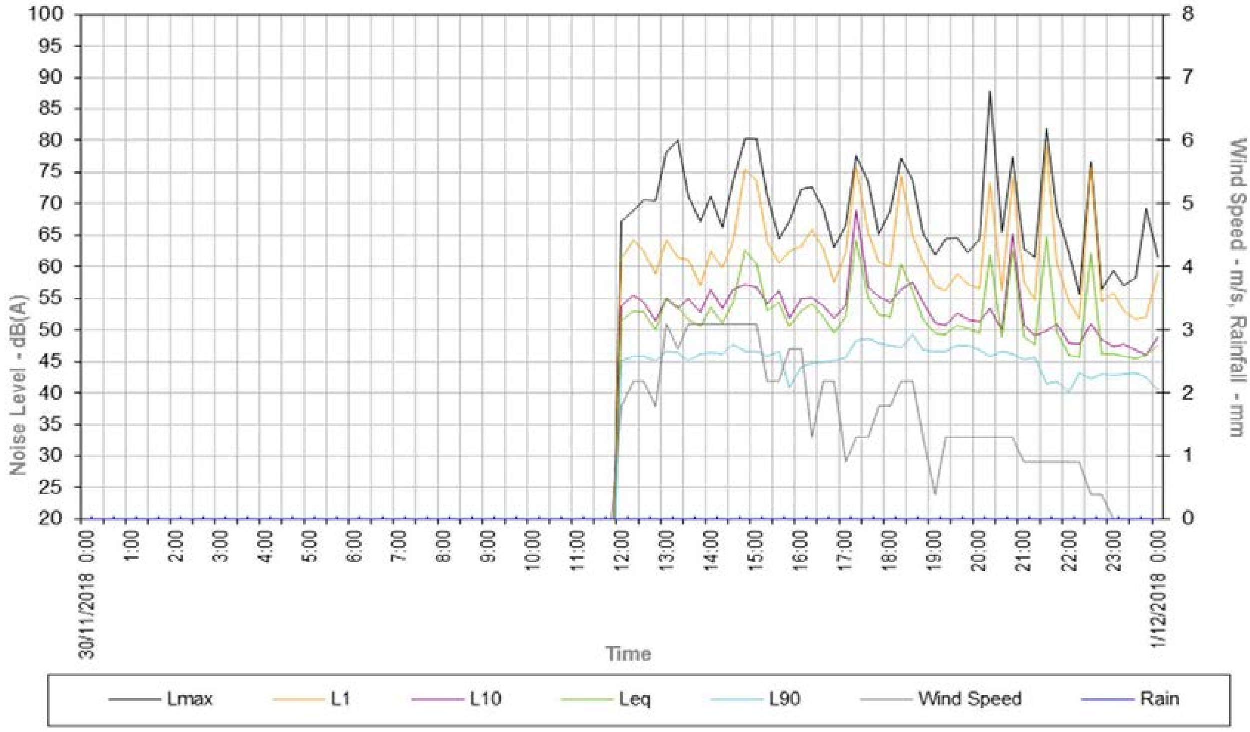
Daytime	Evening	Night
RBL **40.2 dB(A)**	RBL **39.5 dB(A)**	RBL **37.6 dB(A)**
ABLs Day (Mon-Fri 7am - 6 pm)	ABLs Evening (Mon-Fri 6 pm - 10 pm)	ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)
ABLs Day (Sat 8 am - 1 pm)	ABLs Evening (Sat 1 pm - 10 pm)	ABLs Night (Fri 6pm - 8am)
	ABLs Evening (Sun 7 am - 10 pm)	

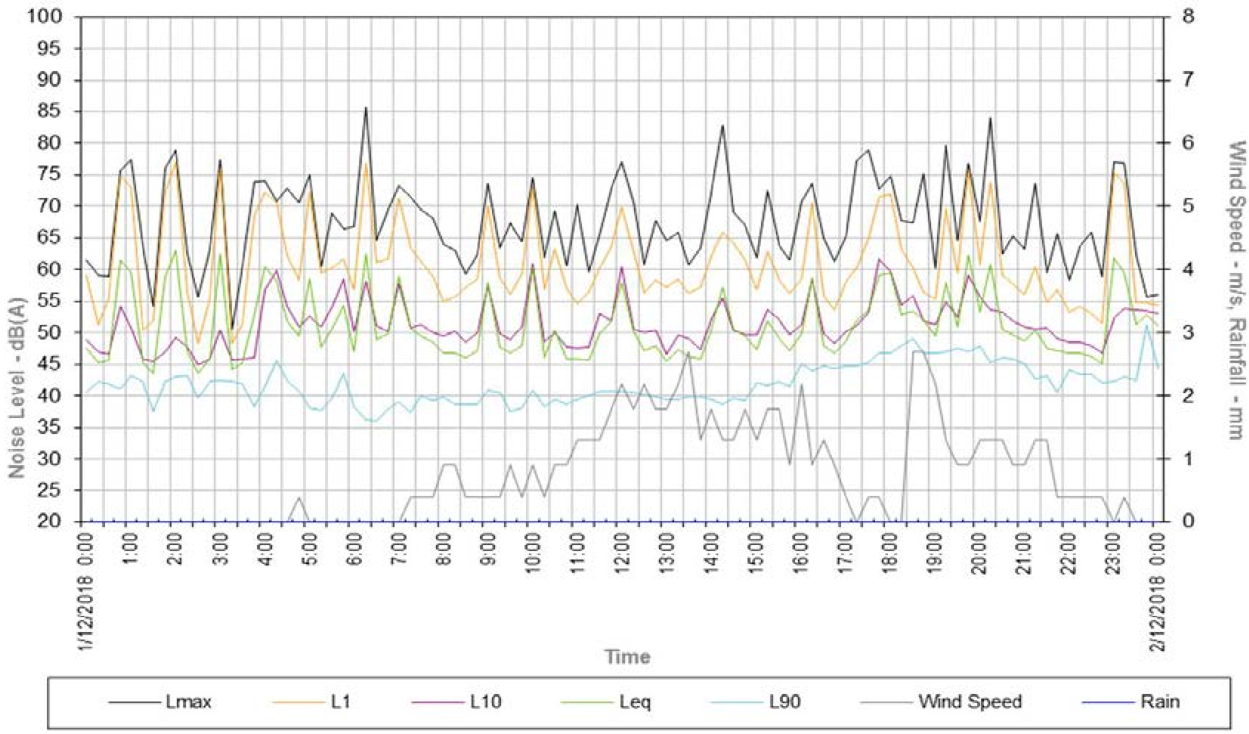
Day			Evening			Night		
Friday 30/11/2018	44.7	dB(A)	Friday 30/11/2018	41.9	dB(A)	Friday 30/11/2018	37.6	dB(A)
Saturday 1/12/2018	38.1	dB(A)	Saturday 1/12/2018	39.5	dB(A)	Saturday 1/12/2018	41.9	dB(A)
			Sunday 2/12/2018	41.3	dB(A)	Sunday 2/12/2018	42.6	dB(A)
Monday 3/12/2018	43.8	dB(A)	Monday 3/12/2018	41.5	dB(A)	Monday 3/12/2018	37.3	dB(A)
Tuesday 4/12/2018	38.5	dB(A)	Tuesday 4/12/2018	33.5	dB(A)	Tuesday 4/12/2018	39.4	dB(A)
Wednesday 5/12/2018	41.8	dB(A)	Wednesday 5/12/2018	38.9	dB(A)	Wednesday 5/12/2018	30.8	dB(A)
Thursday 6/12/2018	39.9	dB(A)	Thursday 6/12/2018	36.7	dB(A)	Thursday 6/12/2018	25.3	dB(A)
Friday 7/12/2018	40.2	dB(A)						

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

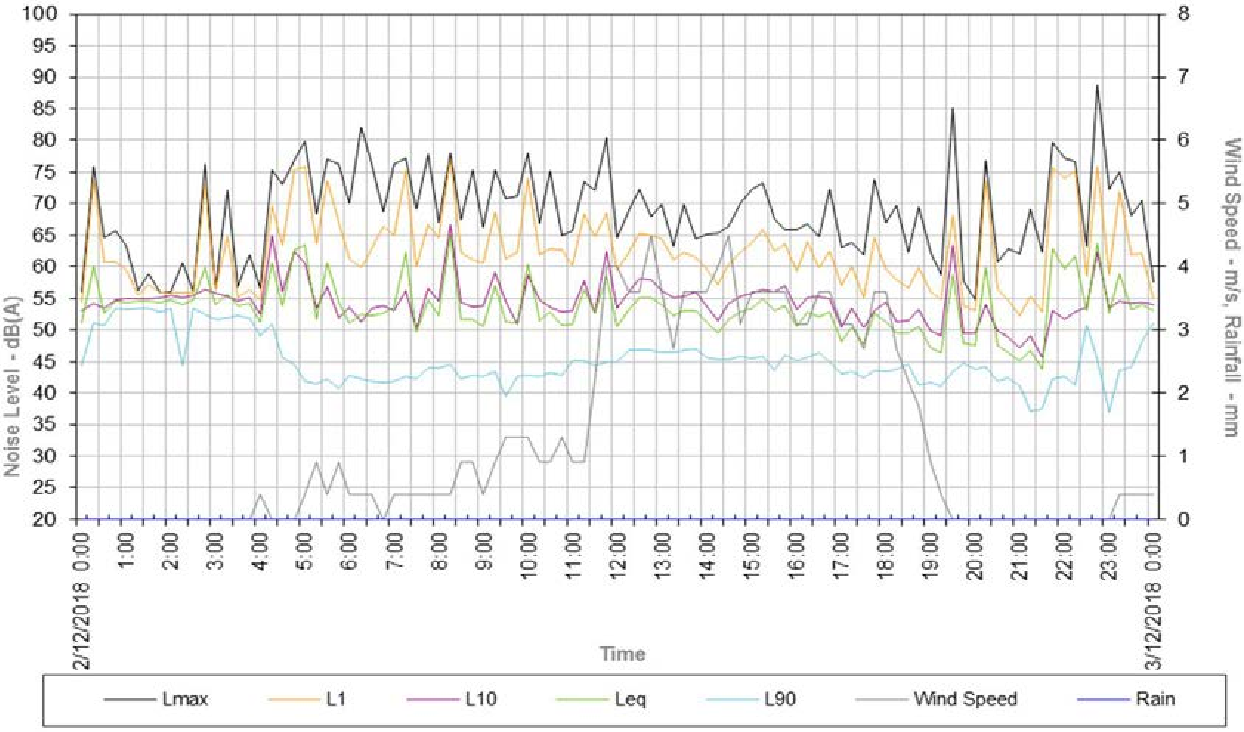
52 Victoria Street

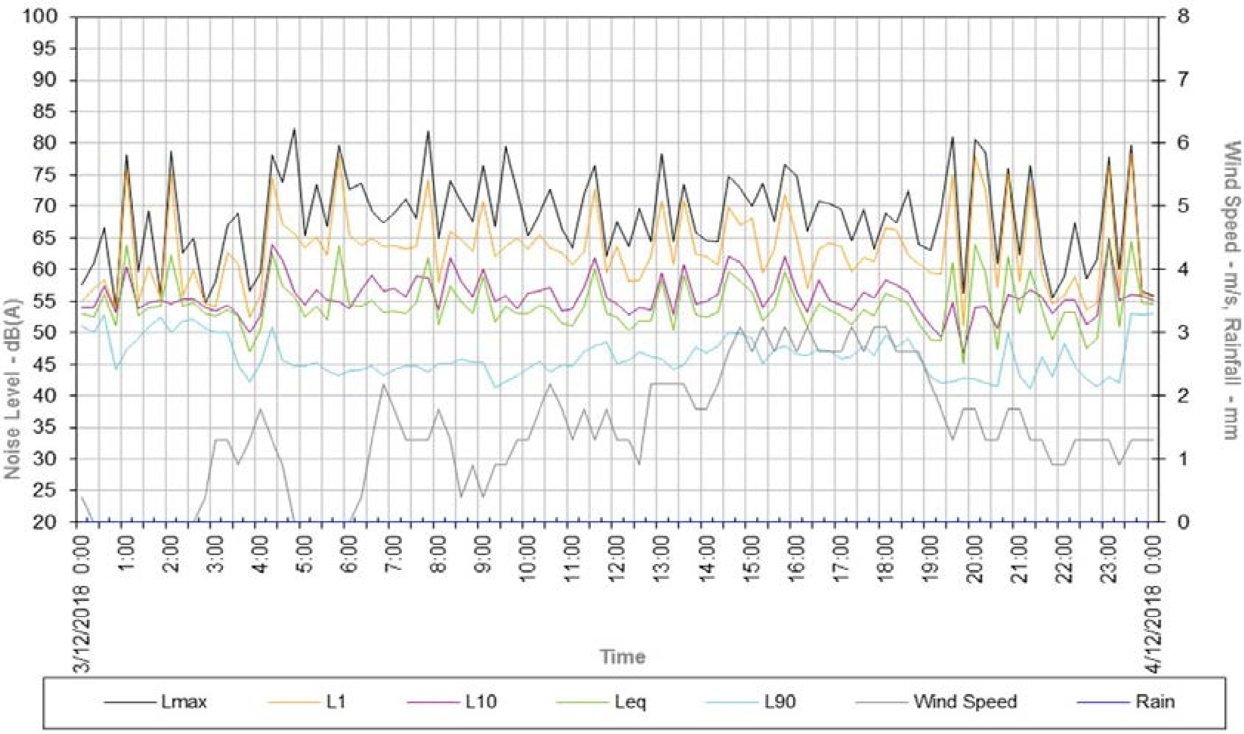




Site Noise and Weather Graphical Analysis

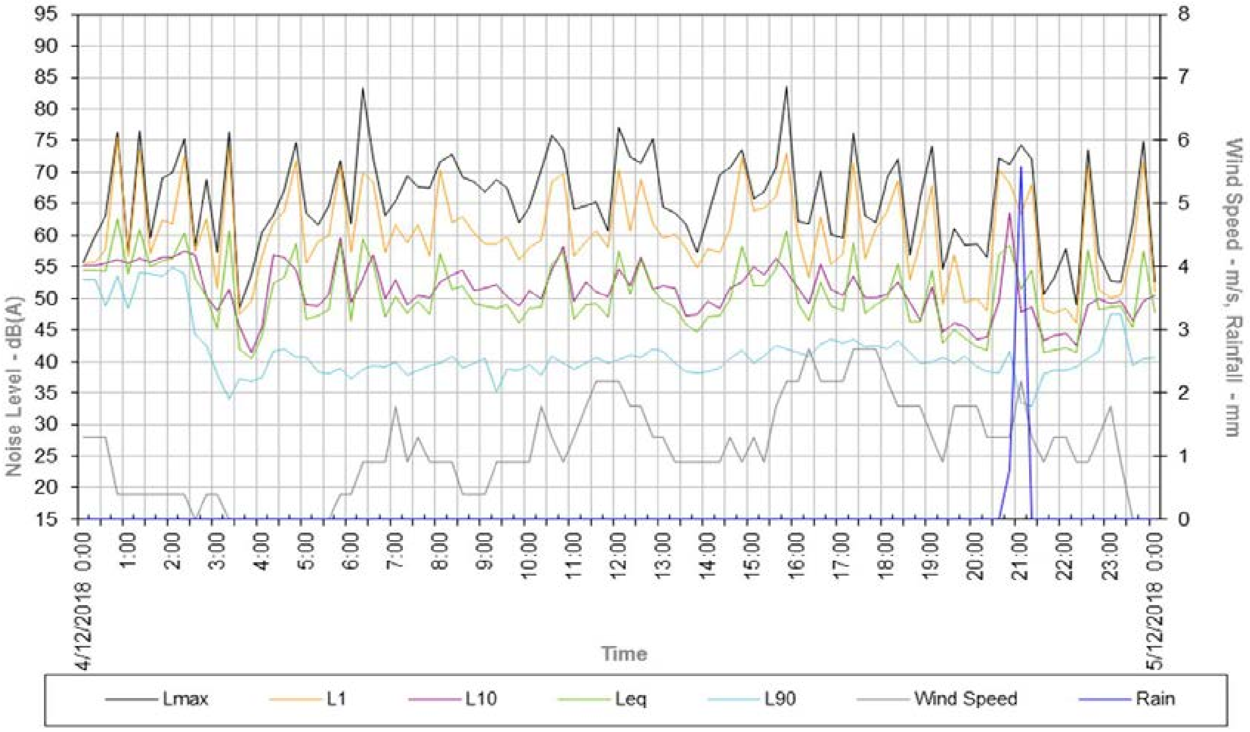
52 Victoria Street

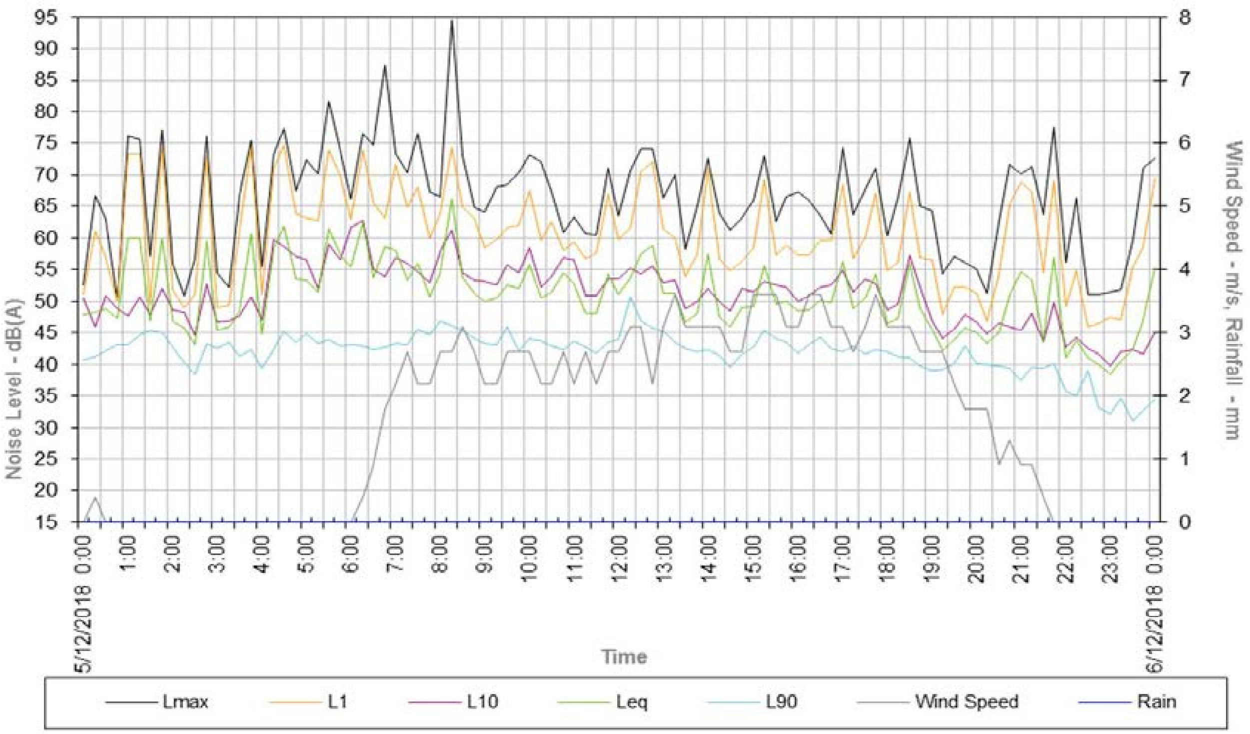




Site Noise and Weather Graphical Analysis

52 Victoria Street





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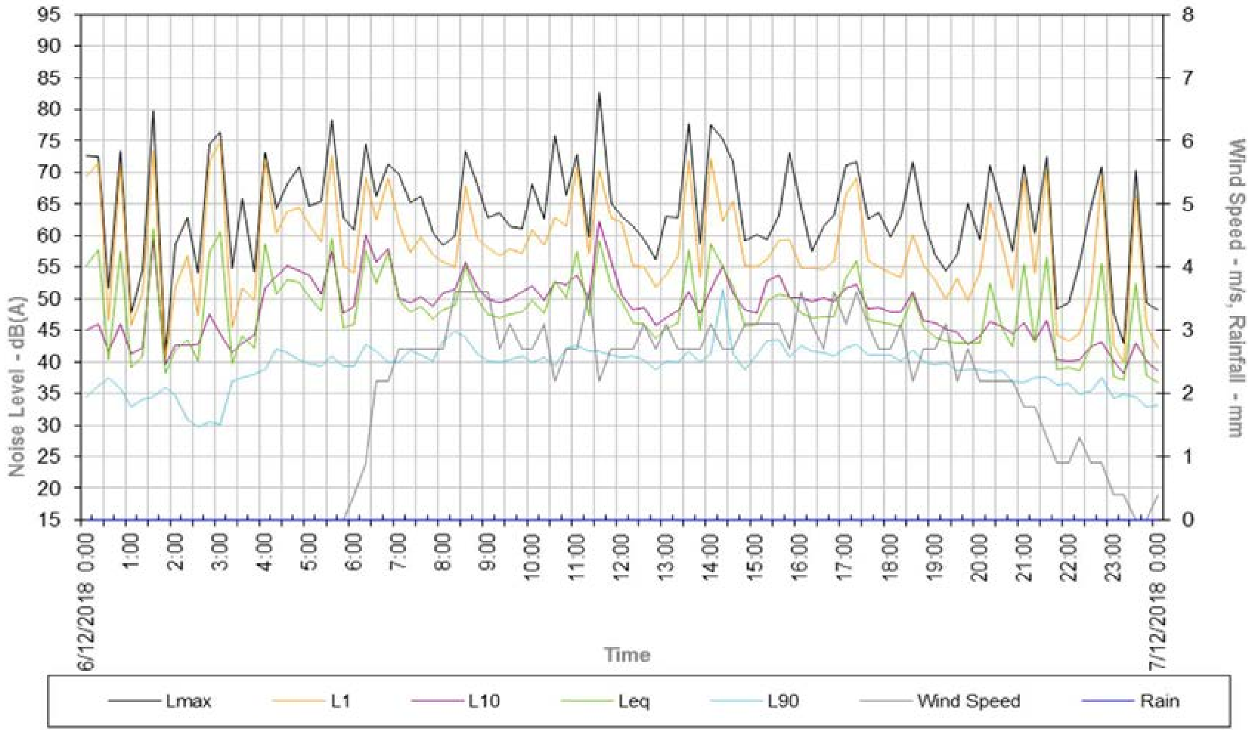
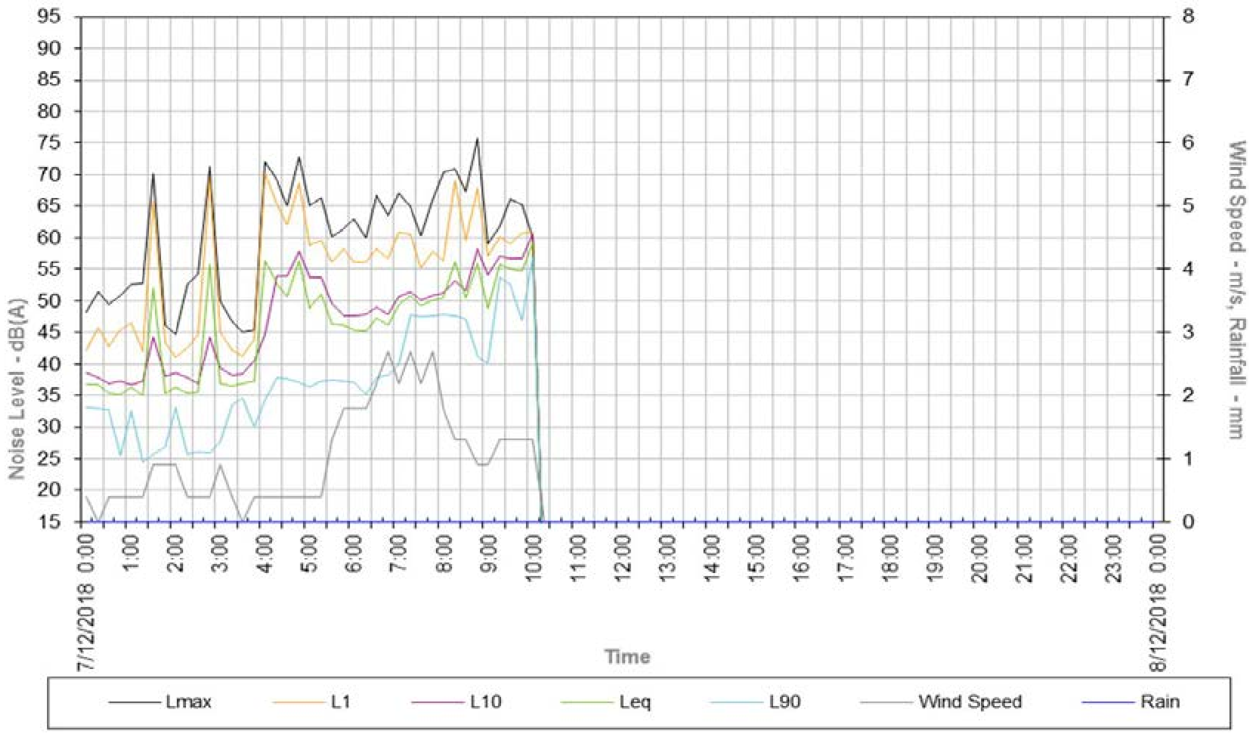
Site Noise and Weather Graphical Analysis

52 Victoria Street





Future Freight
Integrating Community, Environment and Engineering

Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_10

From	Friday 30/11/2018 9:30	Meas. Type	Free Field	Package	Helidon to Calvert
To	Friday 7/12/2018 8:45	Mic. Height (m)	1.8	Address	11 Hall Road
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Grandchester
Instrument Serial #	12606	Operator	BR	Land Use	Residential
Inst. Cal. Date	7/9/2018	Sample Int.	15 min	Latitude	27°35'46.48"S
Pre Calibration	94	RP Lot#	N/A	Longitude	152°22'6.12"E
Post Calibration	94.4				

Daytime	Evening	Night
RBL 31.6 dB(A)	RBL 32.9 dB(A)	RBL 31.6 dB(A)
ABLs Day (Mon-Fri 7am - 6 pm)	ABLs Evening (Mon-Fri 6 pm - 10 pm)	ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)
ABLs Day (Sat 8 am - 1 pm)	ABLs Evening (Sat 1 pm - 10 pm)	ABLs Night (Fri 6pm - 8am)
	ABLs Evening (Sun 7 am - 10 pm)	

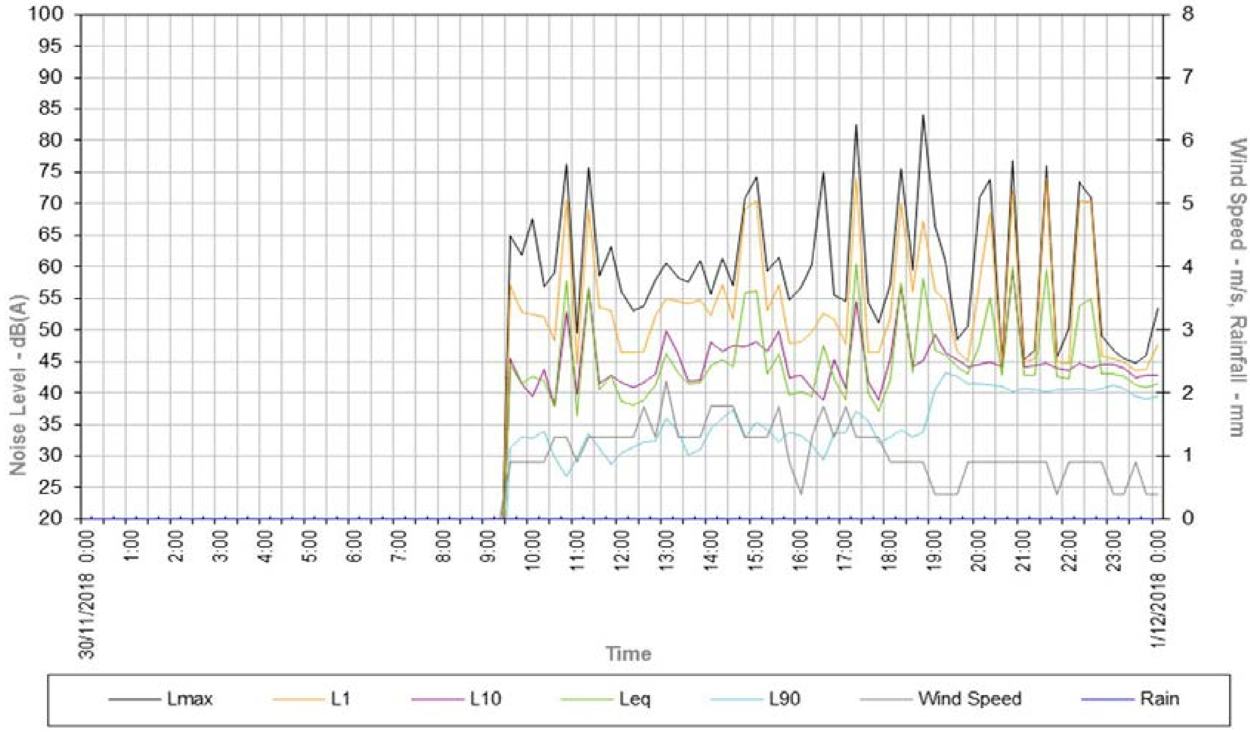
Friday 30/11/2018	29.6	dB(A)	Friday 30/11/2018	32.9	dB(A)	Friday 30/11/2018	29	dB(A)
Saturday 1/12/2018	26.8	dB(A)	Saturday 1/12/2018	30.9	dB(A)	Saturday 1/12/2018	32.0	dB(A)
			Sunday 2/12/2018	30.1	dB(A)	Sunday 2/12/2018	32.8	dB(A)
Monday 3/12/2018	33.7	dB(A)	Monday 3/12/2018	36.5	dB(A)	Monday 3/12/2018	31.6	dB(A)
Tuesday 4/12/2018	28.9	dB(A)	Tuesday 4/12/2018	32.9	dB(A)	Tuesday 4/12/2018	34.0	dB(A)
Wednesday 5/12/2018	33.5	dB(A)	Wednesday 5/12/2018	25.0	dB(A)	Wednesday 5/12/2018	27.7	dB(A)
Thursday 6/12/2018	36.0	dB(A)	Thursday 6/12/2018	35.7	dB(A)	Thursday 6/12/2018	27.7	dB(A)

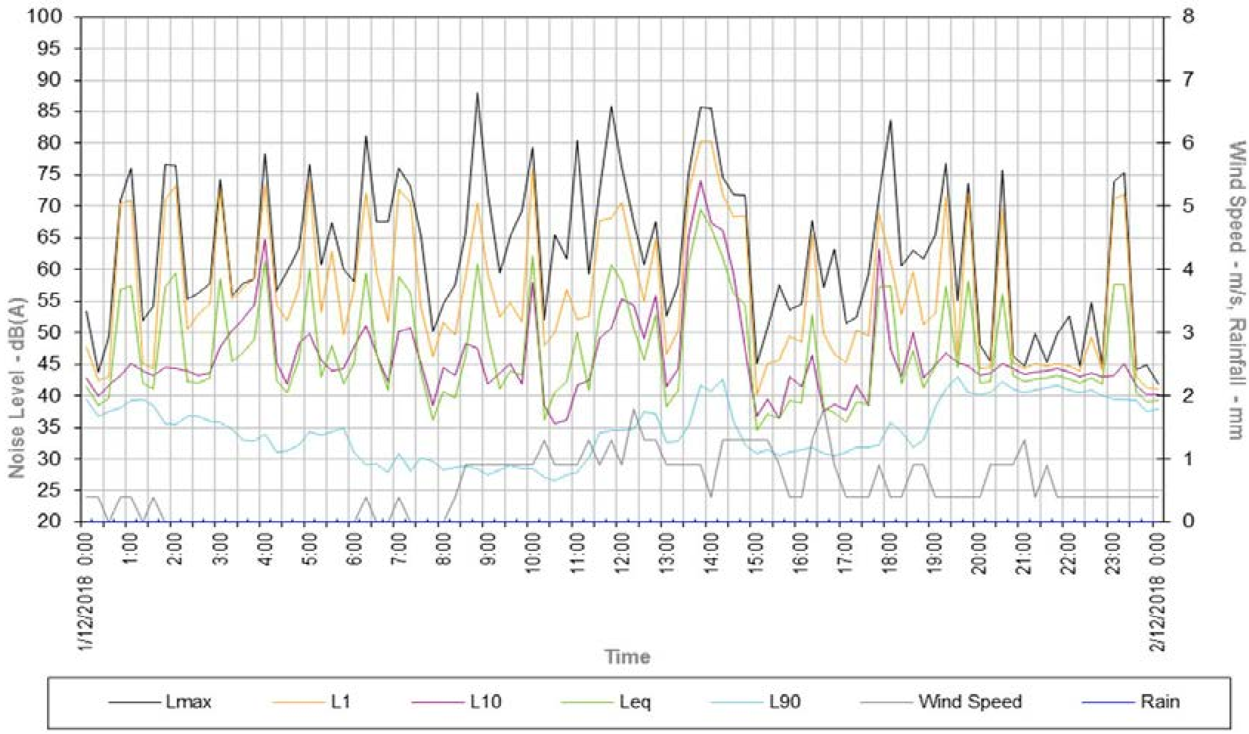
Site Diagram - Diagram

Future Freight
Integrating Community, Environment and Engineering

Site Noise and Weather Graphical Analysis

11 Hall Road

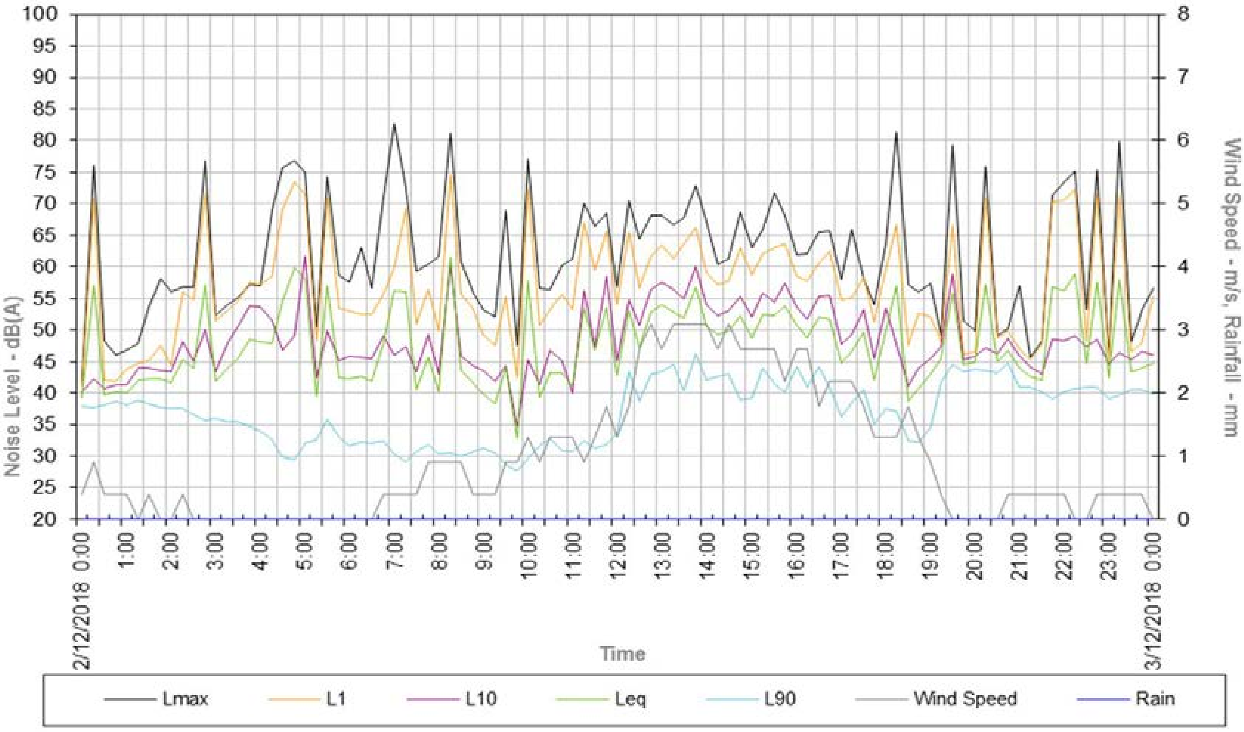


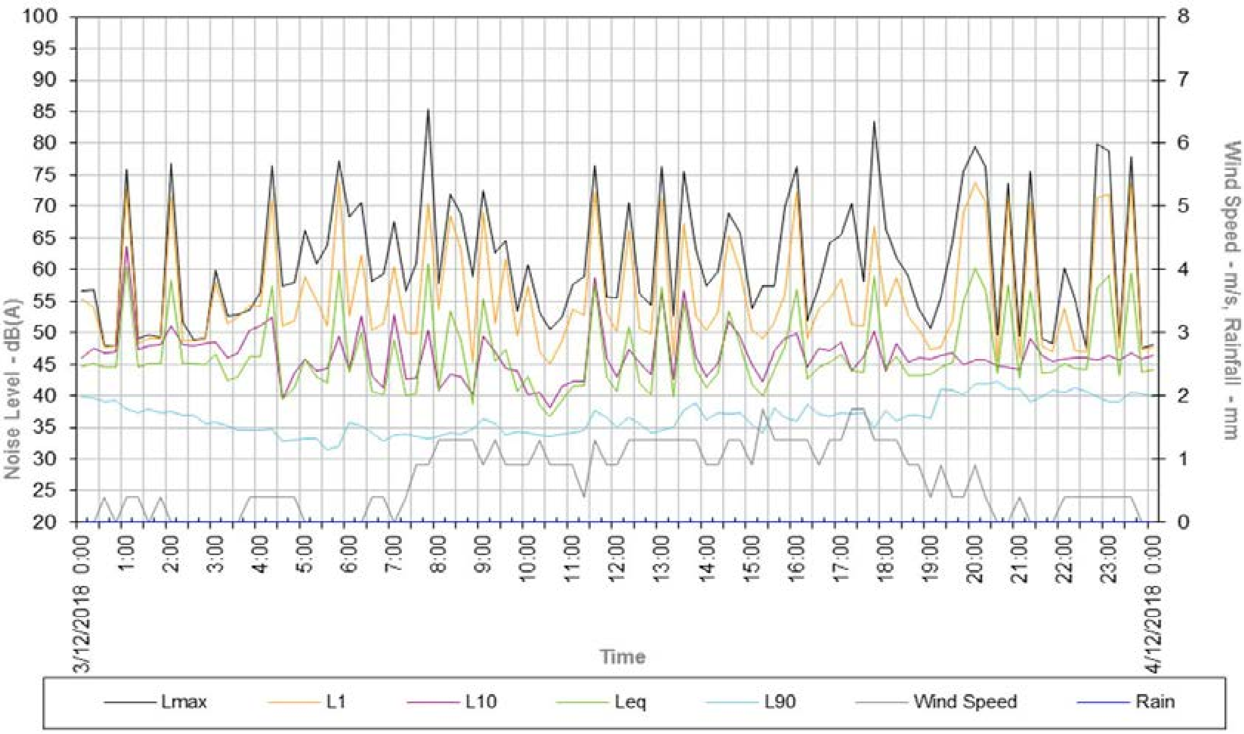


Future Freight
Integrating Community, Environment and Engineering

Site Noise and Weather Graphical Analysis

11 Hall Road

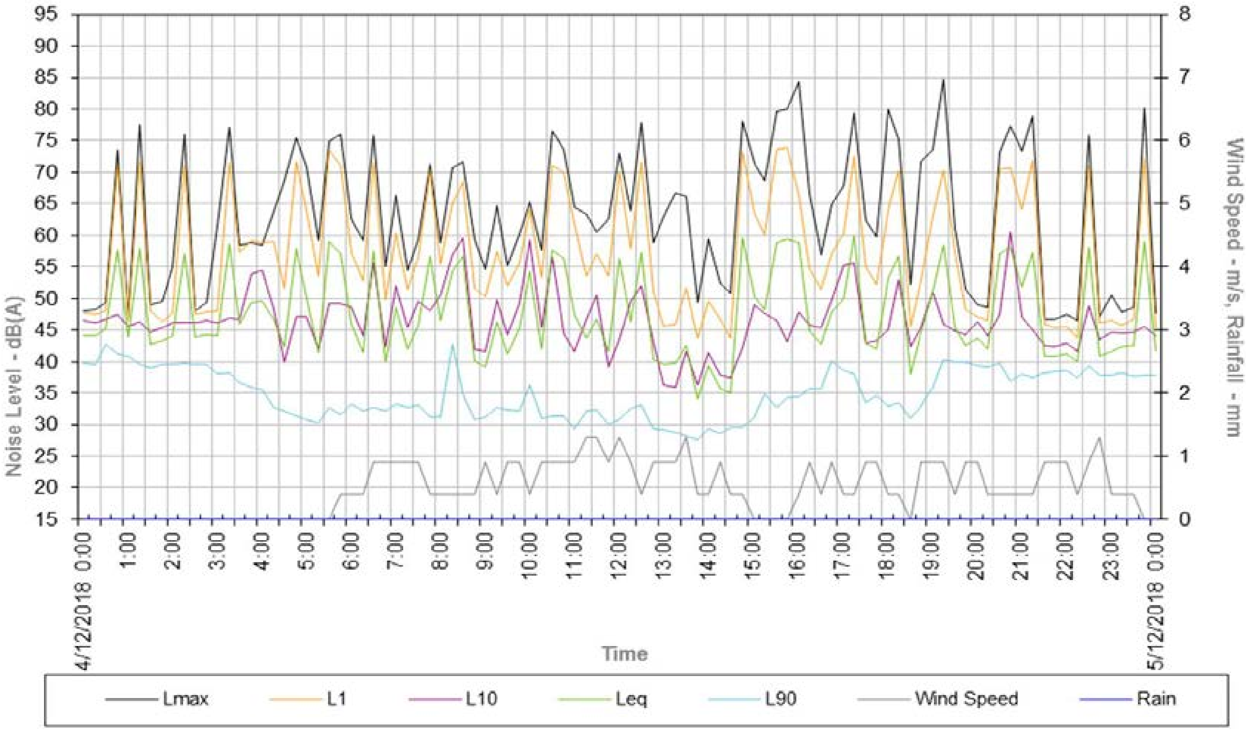


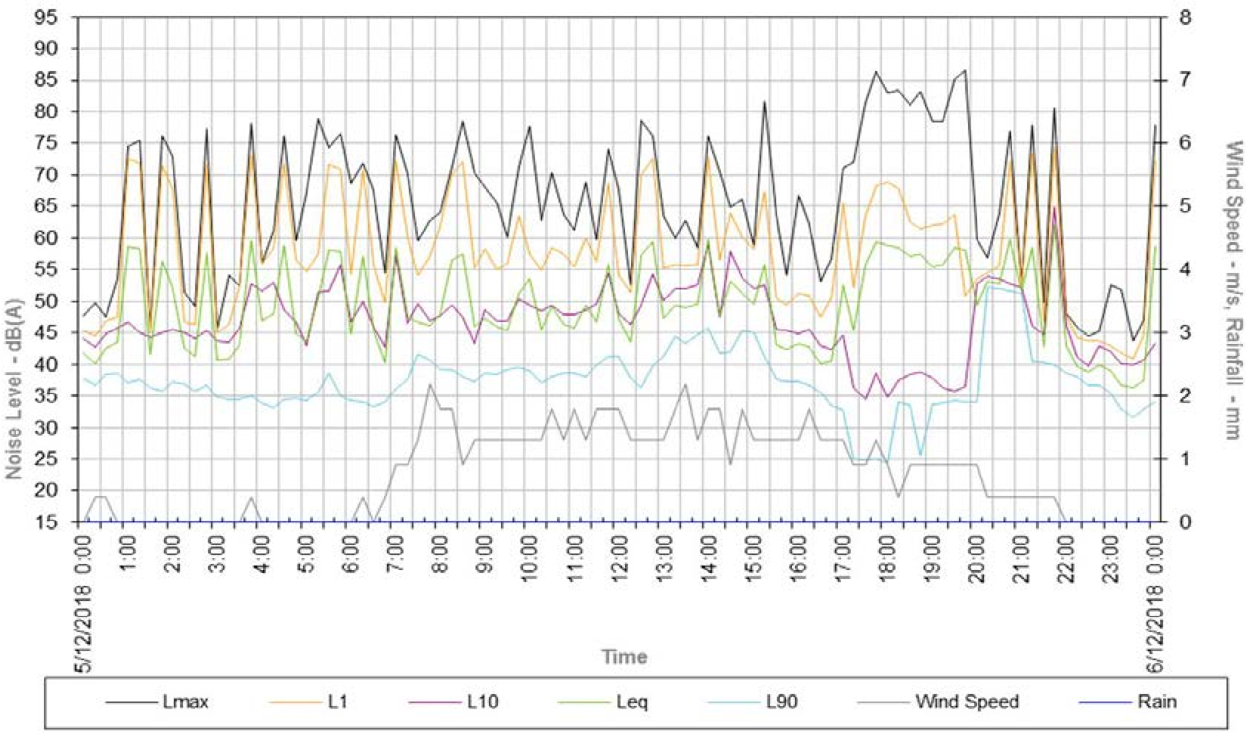


Future Freight
Integrating Community, Environment and Engineering

Site Noise and Weather Graphical Analysis

11 Hall Road





Future Freight
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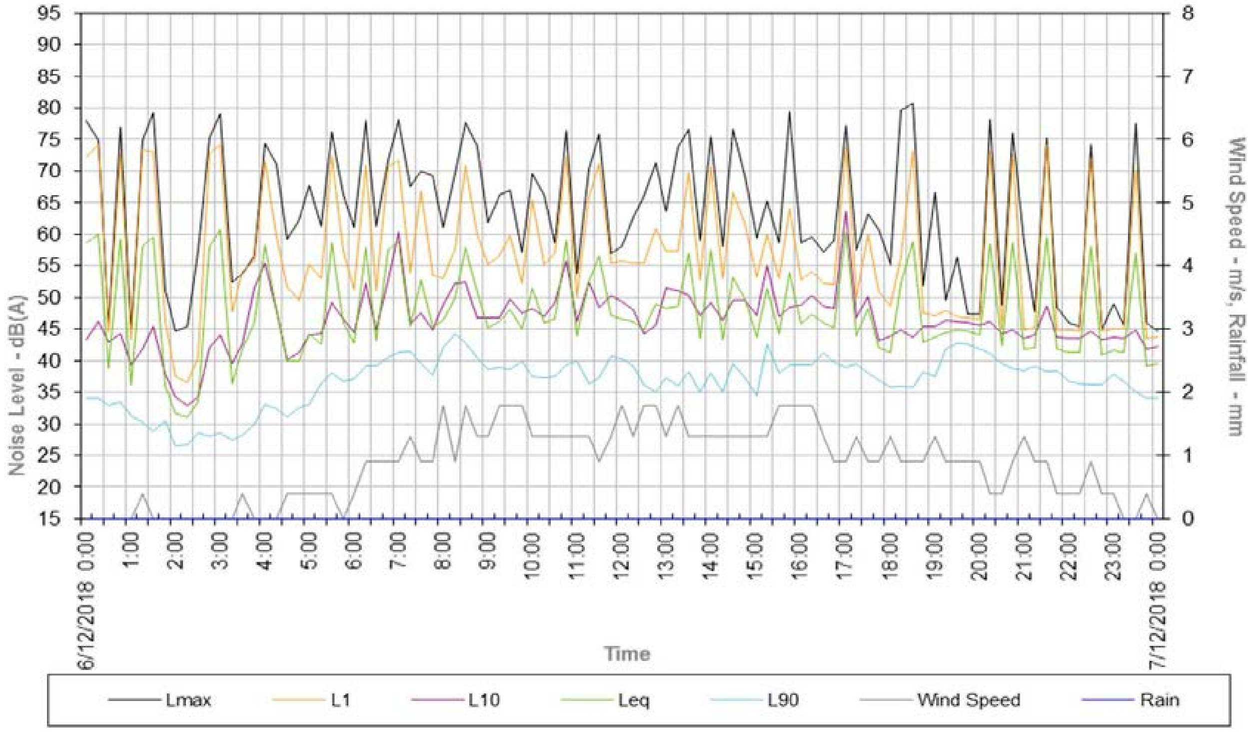
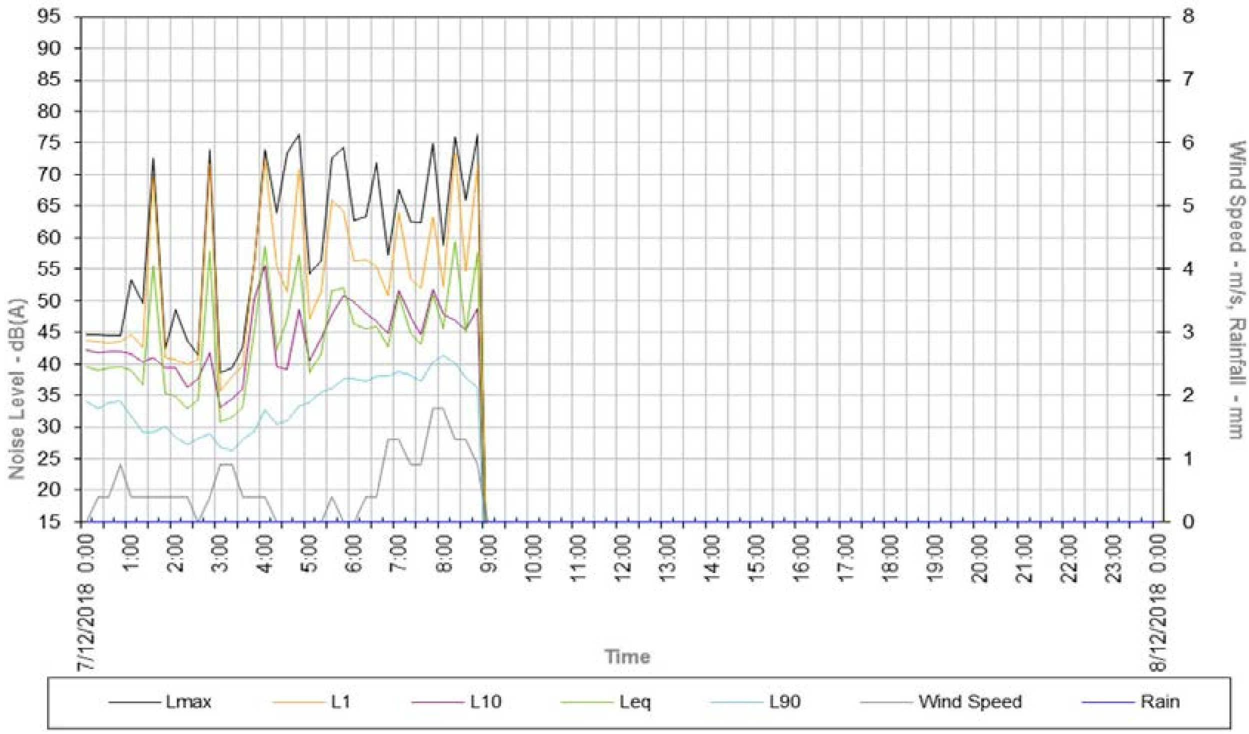
Site Noise and Weather Graphical Analysis

11 Hall Road





Future Freight
Integrating Community, Environment and Engineering

Noise Monitoring Data Sheet

Inland Rail

SITE ID
H2C_11

From	Friday 30/11/2018 12:45	Meas. Type	Free Field	Package	Helidon to Calvert
To	Friday 7/12/2018 10:30	Mic. Height (m)	1.8	Address	86 Douglas McInnes Drive
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Laidley
Instrument Serial #	12604	Operator	LAN	Land Use	Residential
Inst. Cal. Date	7/09/2018	Sample Int.	15 min	Latitude	27°38'7.85"S
Pre Calibration	94	RP Lot#	SP/196665	Longitude	152°24'43.35"E
Post Calibration	94.1				

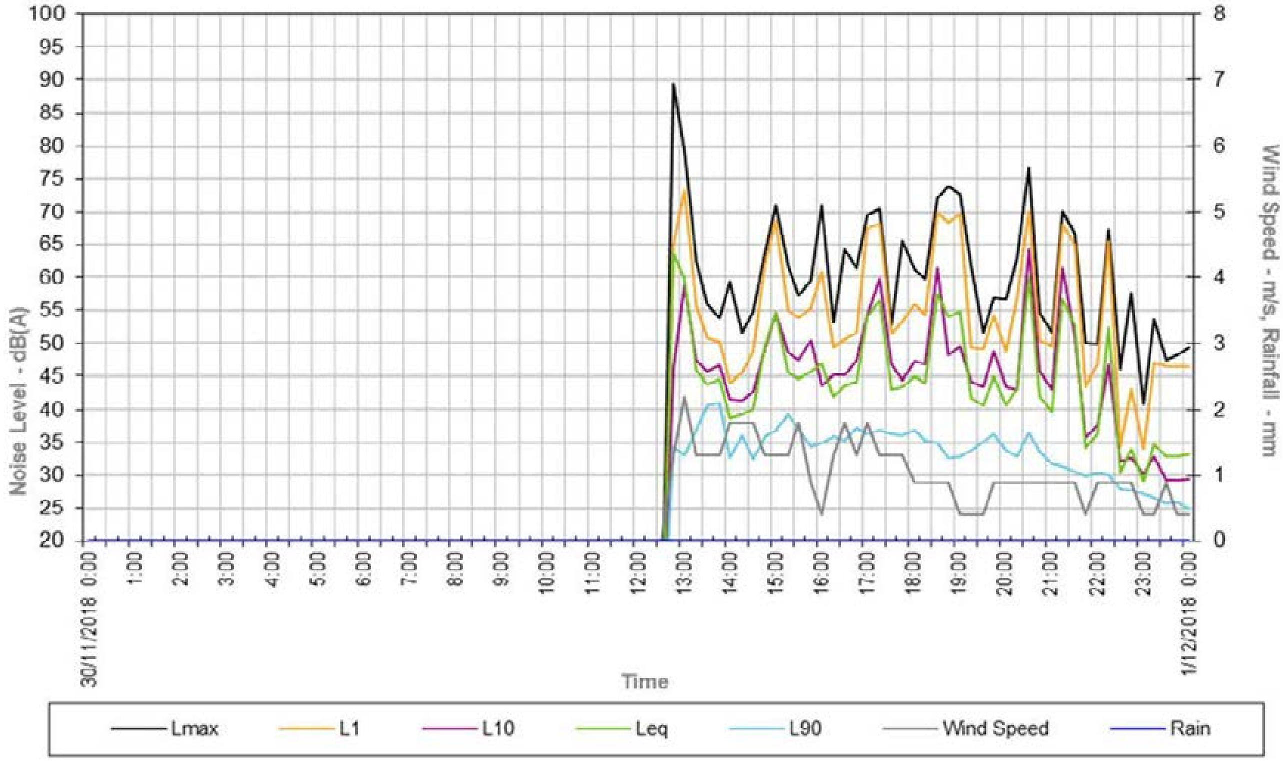
Daytime	Evening	Night
RBL **30.5 dB(A)**	RBL **29.2 dB(A)**	RBL **21.1 dB(A)**
ABLs Day (Mon-Fri 7am - 6 pm)	ABLs Evening (Mon-Fri 6 pm - 10 pm)	ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)
ABLs Day (Sat 8 am - 1 pm)	ABLs Evening (Sat 1 pm - 10 pm)	ABLs Night (Fri 6pm - 8am)
	ABLs Evening (Sun 7 am - 10 pm)	

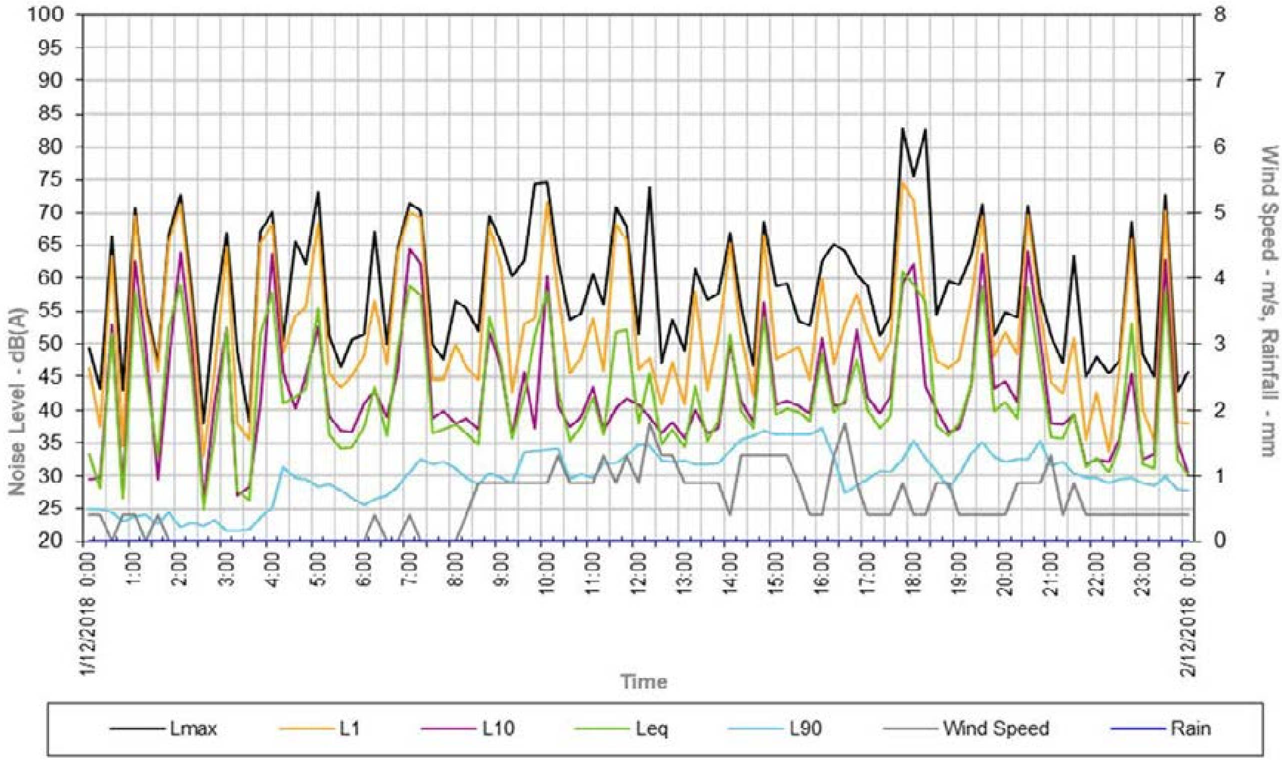
Daytime			Evening			Night		
Friday 30/11/2018	33	dB(A)	Friday 30/11/2018	30.4	dB(A)	Friday 30/11/2018	<21.1	dB(A)
Saturday 1/12/2018	28.7	dB(A)	Saturday 1/12/2018	29.2	dB(A)	Saturday 1/12/2018	21.6	dB(A)
			Sunday 2/12/2018	28.9	dB(A)	Sunday 2/12/2018	22.6	dB(A)
Monday 3/12/2018	29.7	dB(A)	Monday 3/12/2018	27.7	dB(A)	Monday 3/12/2018	<21.1	dB(A)
Tuesday 4/12/2018	29.2	dB(A)	Tuesday 4/12/2018	29.9	dB(A)	Tuesday 4/12/2018	<21.1	dB(A)
Wednesday 5/12/2018	32	dB(A)	Wednesday 5/12/2018	30.1	dB(A)	Wednesday 5/12/2018	<21.1	dB(A)
Thursday 6/12/2018	30.8	dB(A)	Thursday 6/12/2018	27.8	dB(A)	Thursday 6/12/2018	<21.1	dB(A)
Friday 7/12/2018	30.5	dB(A)						

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

86 Douglas McInnes Drive





Noise Level - dB(A)

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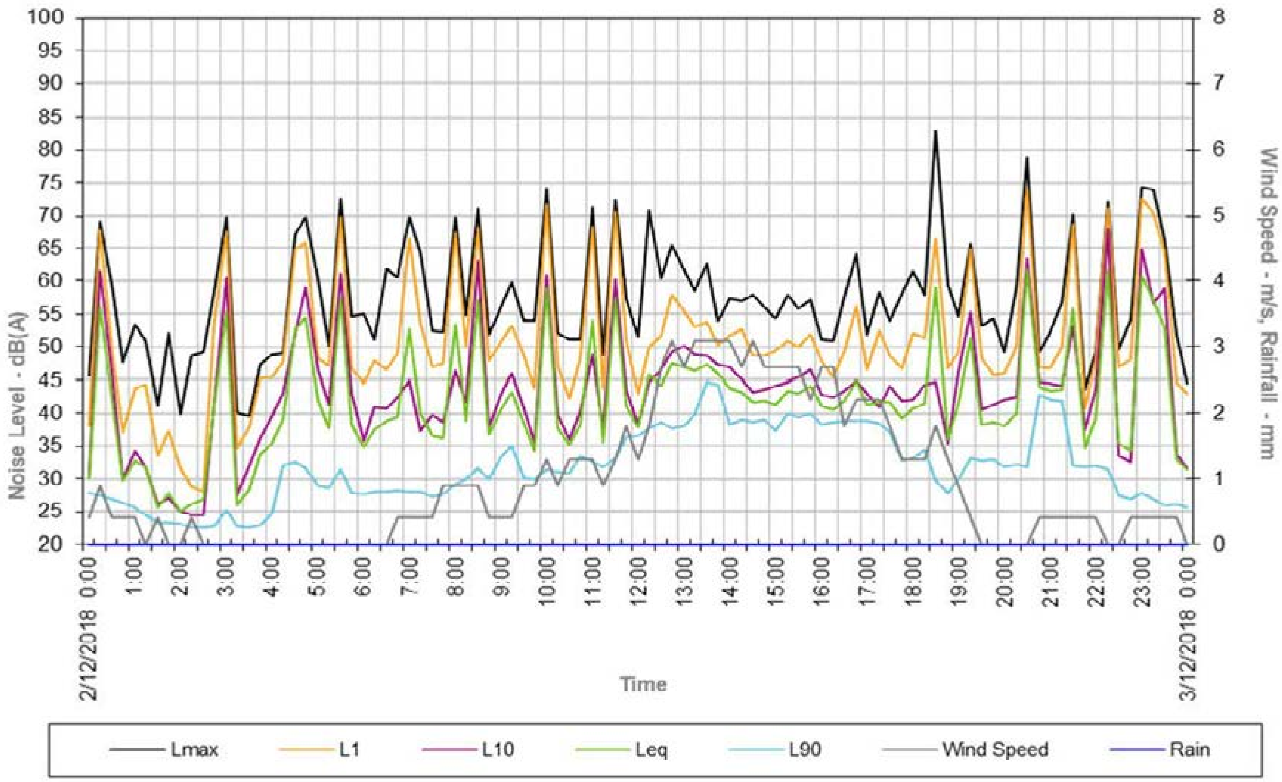
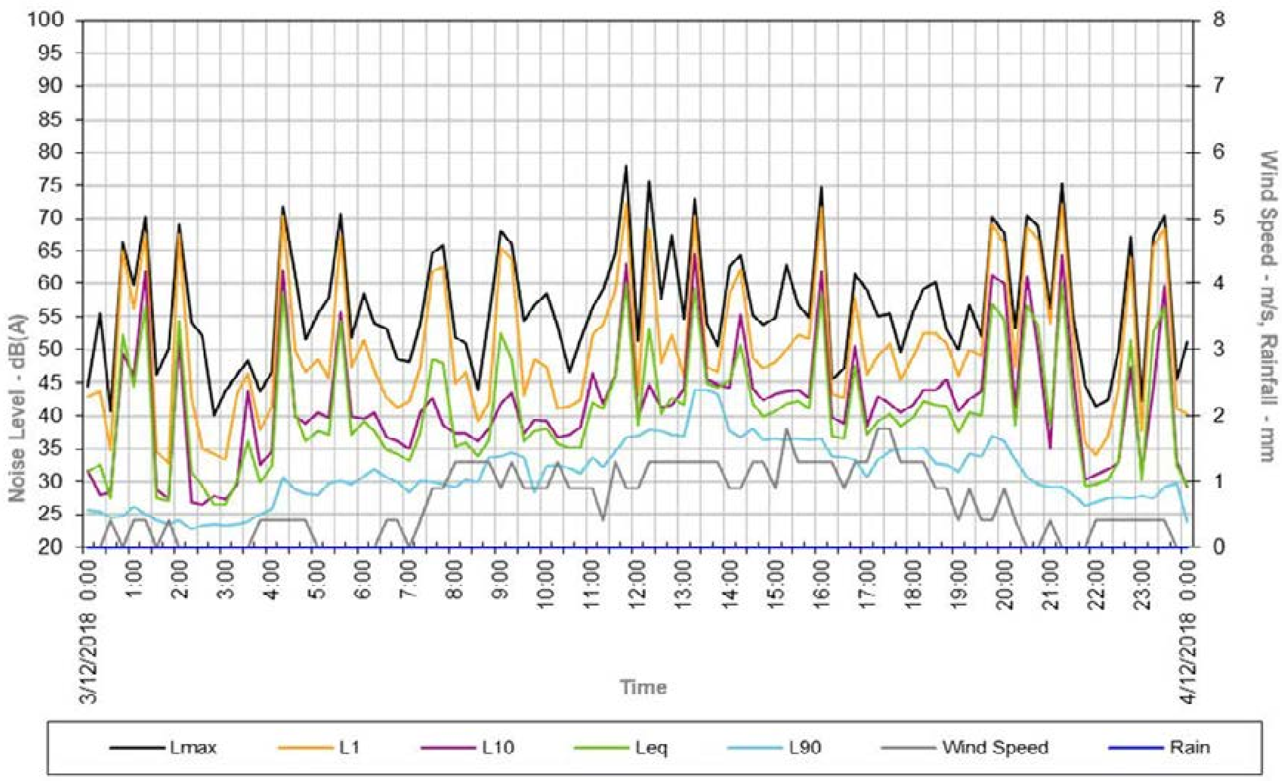
Site Noise and Weather Graphical Analysis

86 Douglas McInnes Drive

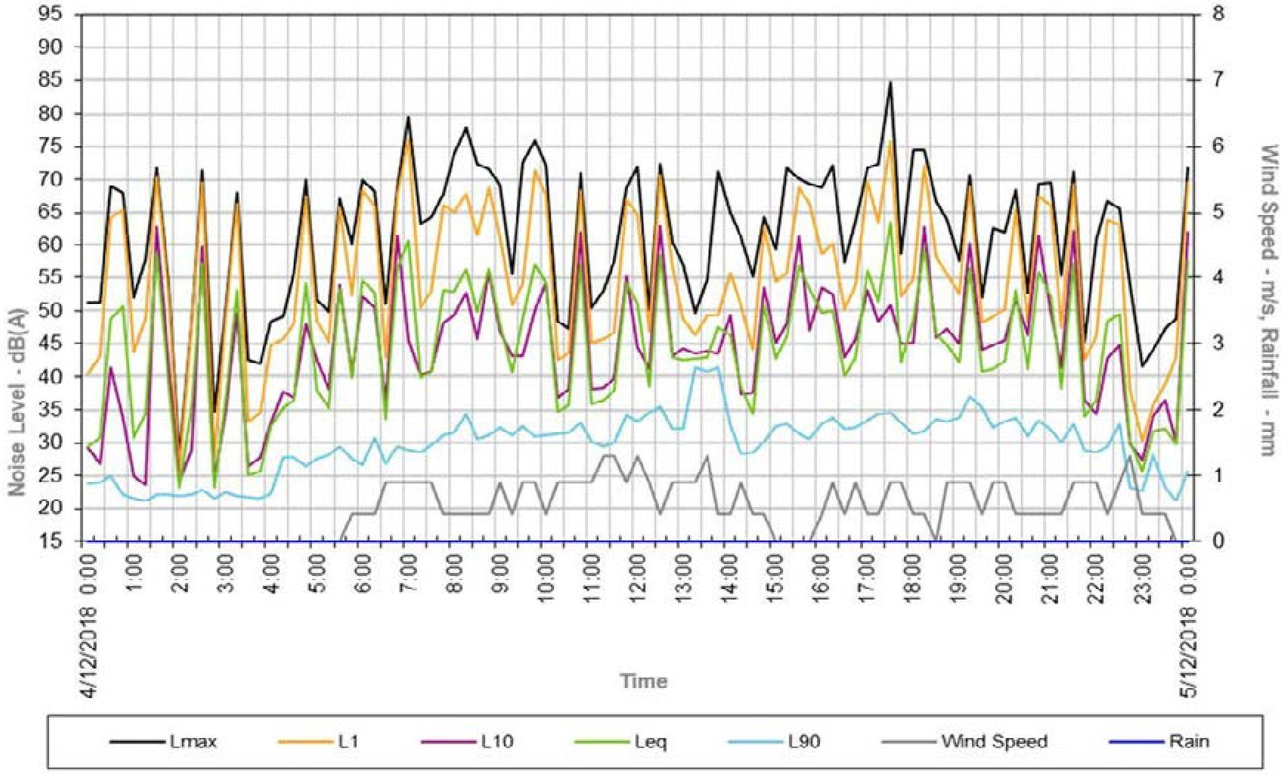


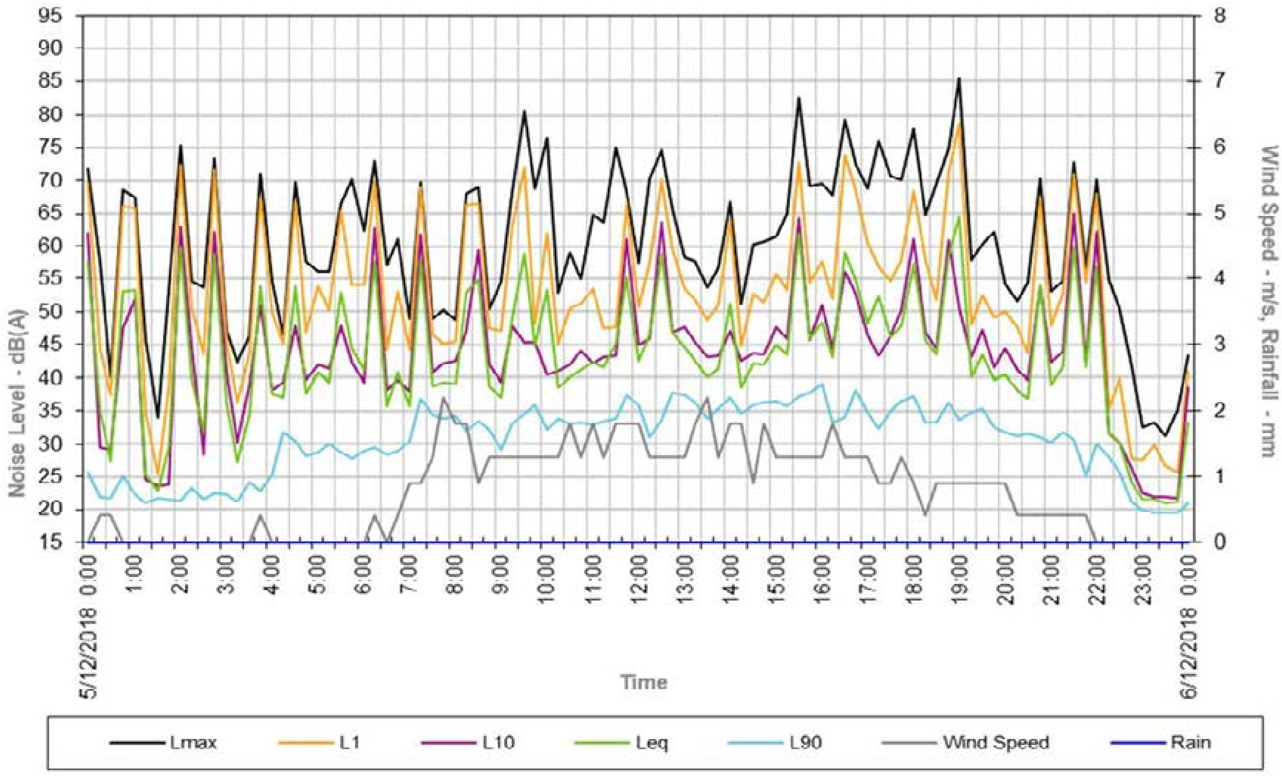


Future Freight
Integrating Community, Environment and Engineering

Site Noise and Weather Graphical Analysis

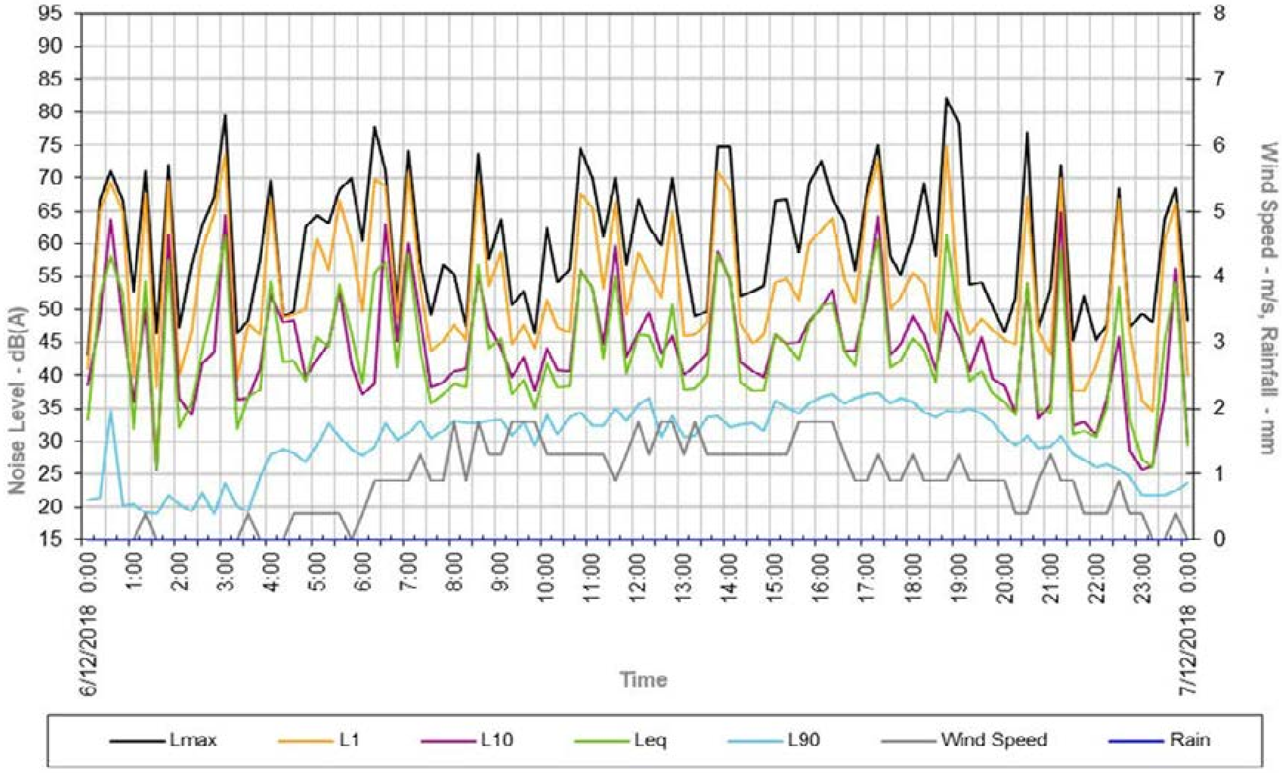
86 Douglas McInnes Drive

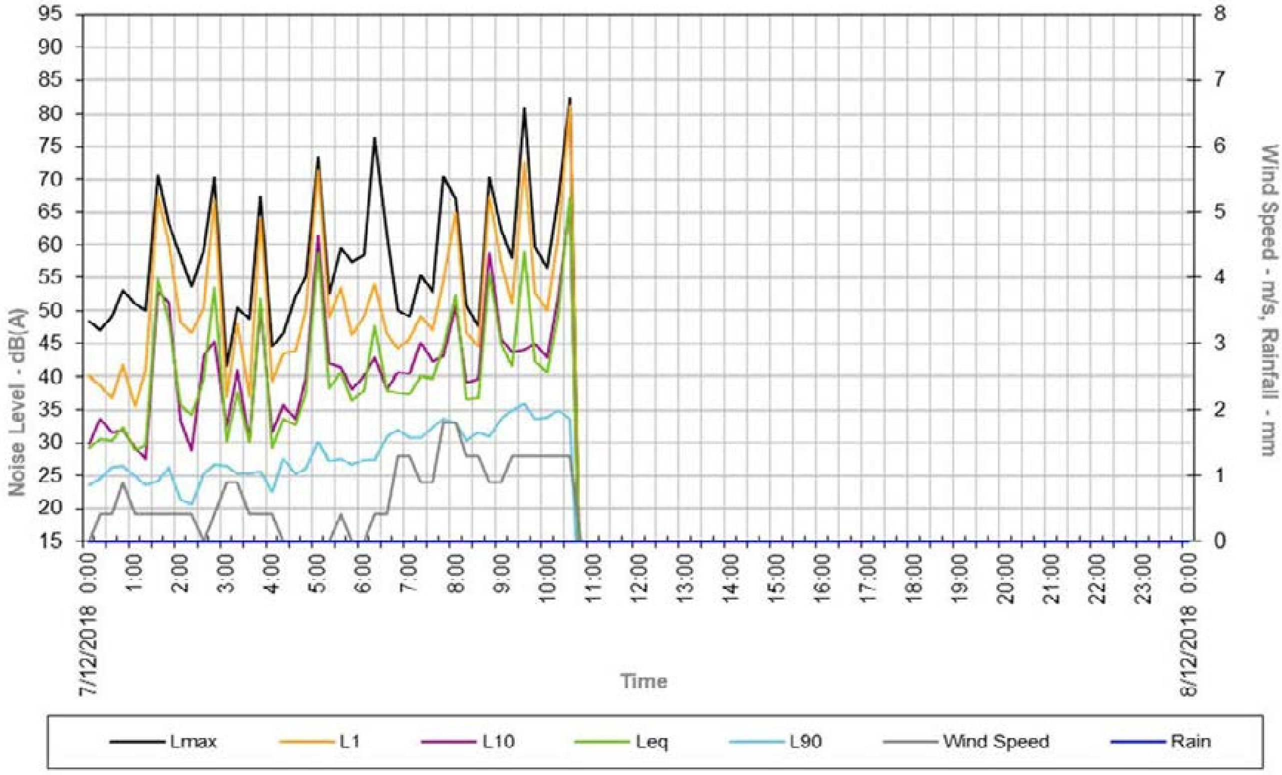




Site Noise and Weather Graphical Analysis

86 Douglas McInnes Drive





Future Freight
Integrating Community, Environment and Engineering

Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_12

From	Wednesday 28/11/2018 12:45	Meas. Type	Free Field	Package	Helidon to Calvert
To	Friday 7/12/2018 11:00	Mic. Height (m)	1.8	Address	11 Tyrell Court
Instrument Type	Rion NL-52	Weather Station	Yes	Suburb	Laidley
Instrument Serial #	00175550	Operator	LAN	Land Use	Residential
Inst. Cal. Date	16/05/2017	Sample Int.	15 min	Latitude	27°38'26.28"S
Pre Calibration	94	RP Lot#	14/RP230481	Longitude	152°25'7.84"E
Post Calibration	93.8				

Daytime

RBL **32.8 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Wednesday 28/11/2018	41.8	dB(A)
Thursday 29/11/2018	32.8	dB(A)
Friday 30/11/2018	28.9	dB(A)
Saturday 1/12/2018	28.5	dB(A)
Monday 3/12/2018	33.9	dB(A)
Tuesday 4/12/2018	30.1	dB(A)
Wednesday 5/12/2018	33	dB(A)
Thursday 6/12/2018	33.2	dB(A)
Friday 7/12/2018	32.6	dB(A)

Evening

RBL **27.5 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Wednesday 28/11/2018	38.9	dB(A)
Thursday 29/11/2018	29.0	dB(A)
Friday 30/11/2018	32.4	dB(A)
Saturday 1/12/2018	26.9	dB(A)
Sunday 2/12/2018	27.5	dB(A)
Monday 3/12/2018	26.5	dB(A)
Tuesday 4/12/2018	27.4	dB(A)
Wednesday 5/12/2018	25.6	dB(A)
Thursday 6/12/2018	28.9	dB(A)

Night

RBL **22.0 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

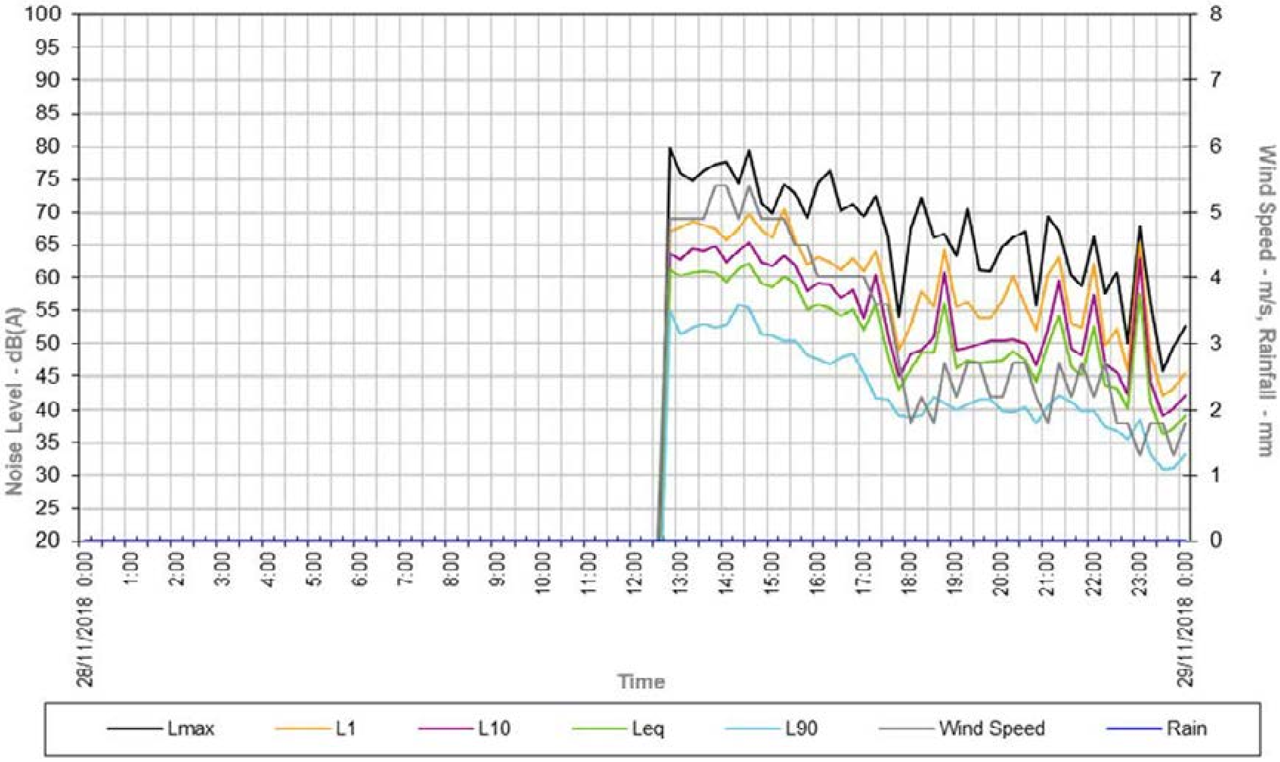
ABLs Night (Fri 6pm - 8am)

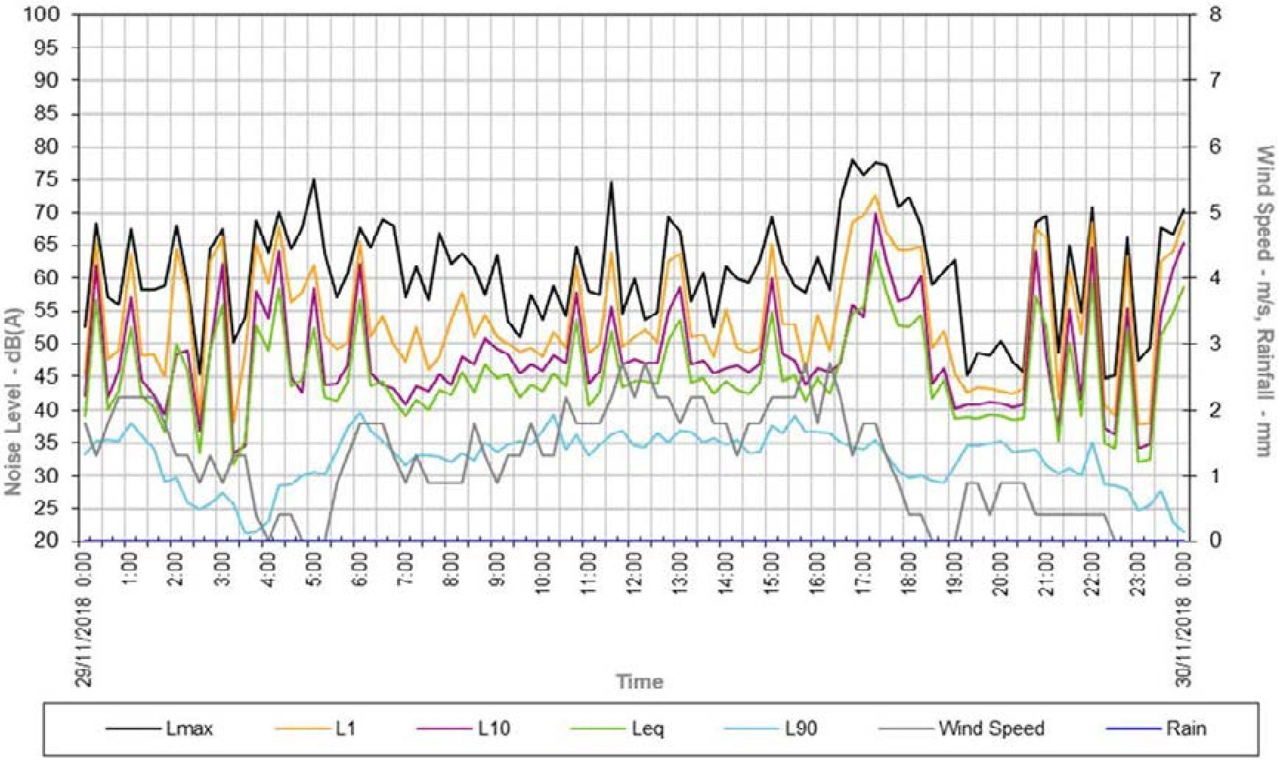
Wednesday 28/11/2018	24.3	dB(A)
Thursday 29/11/2018	<22	dB(A)
Friday 30/11/2018	<22	dB(A)
Saturday 1/12/2018	<22	dB(A)
Sunday 2/12/2018	<22	dB(A)
Monday 3/12/2018	<22	dB(A)
Tuesday 4/12/2018	<22	dB(A)
Wednesday 5/12/2018	<22	dB(A)
Thursday 6/12/2018	<22	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

11 Tyrell Court





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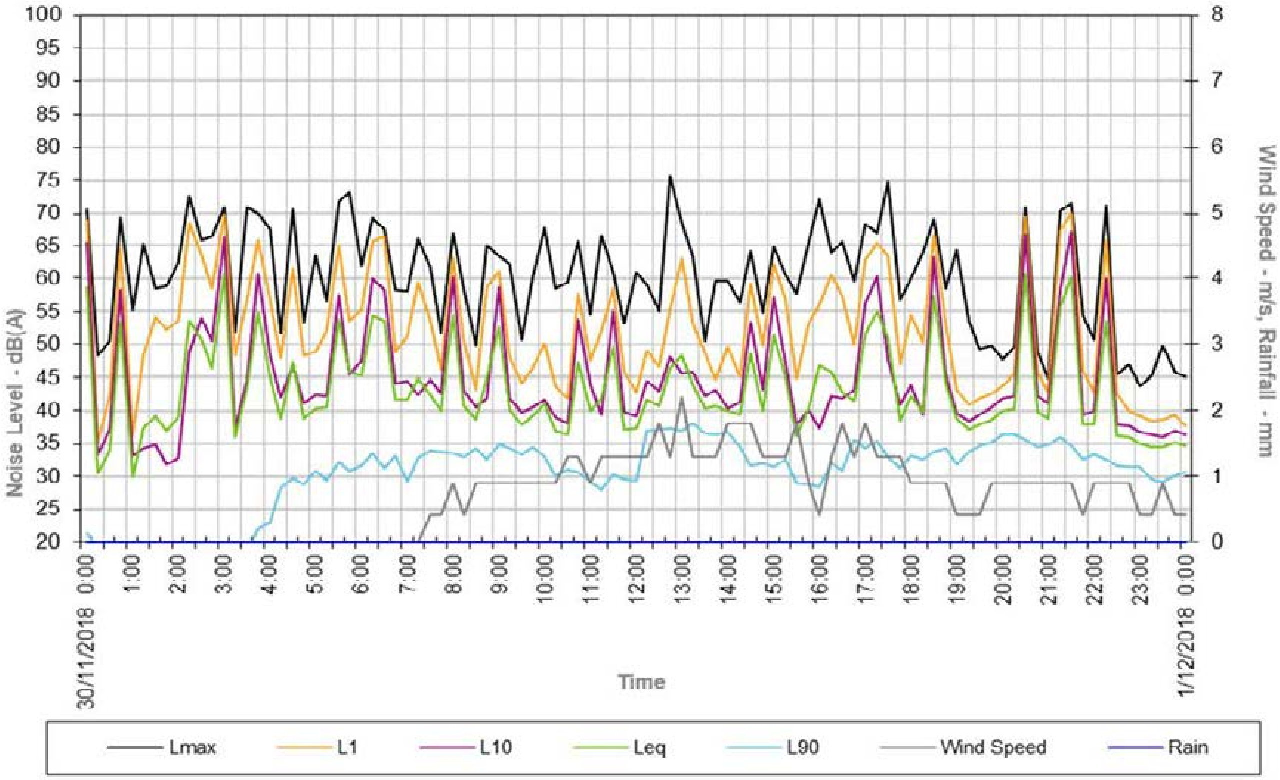
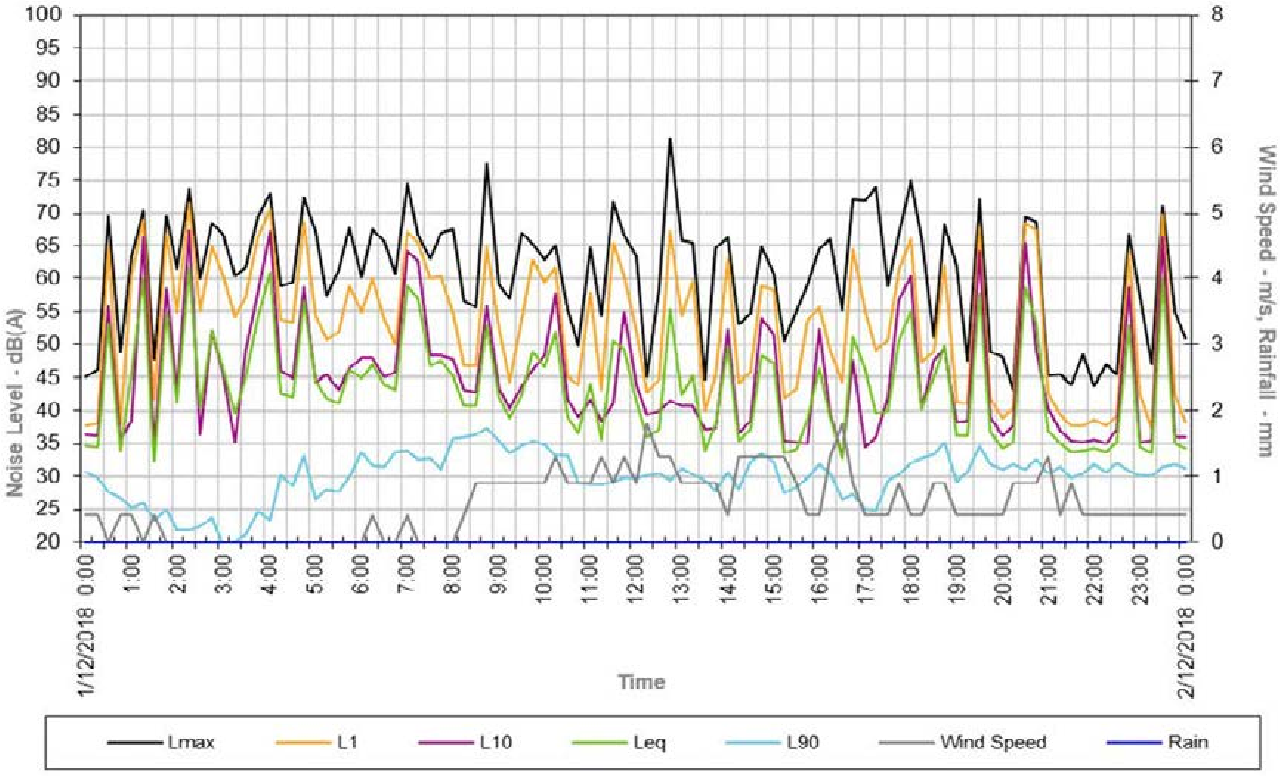
Site Noise and Weather Graphical Analysis

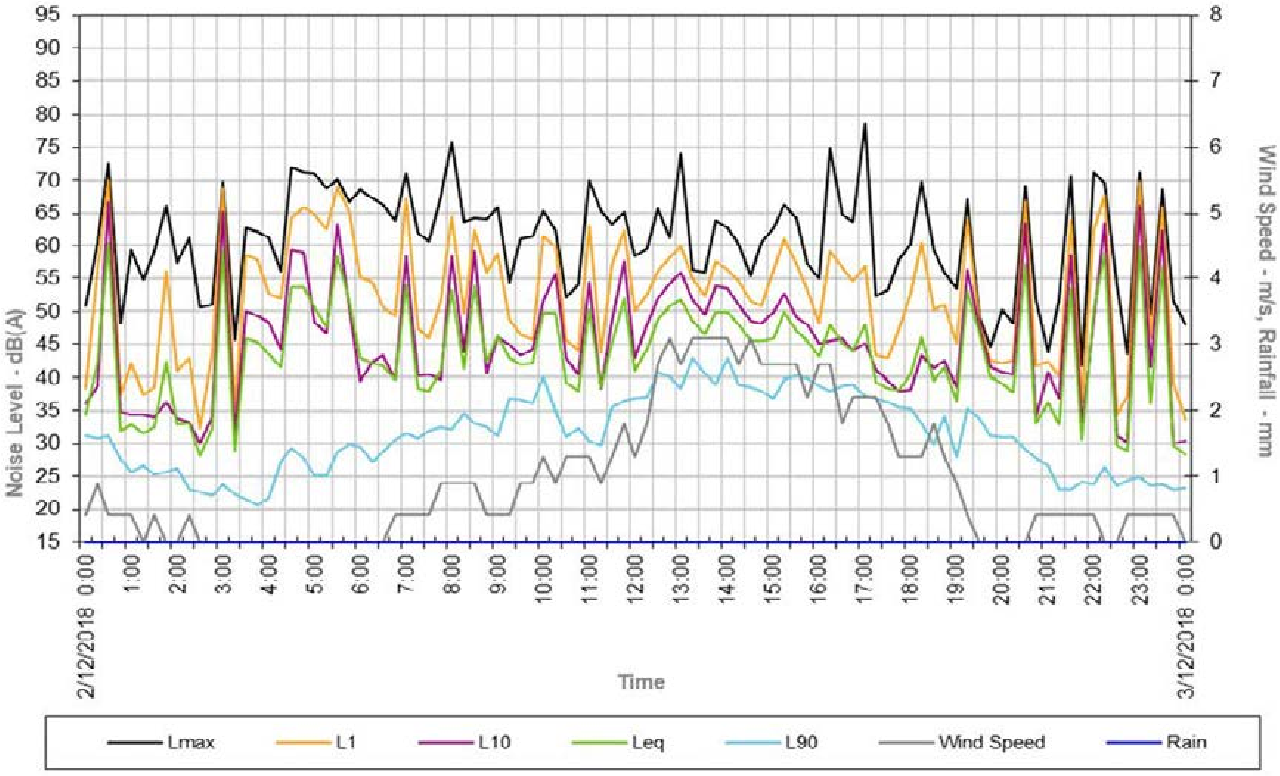
11 Tyrell Court

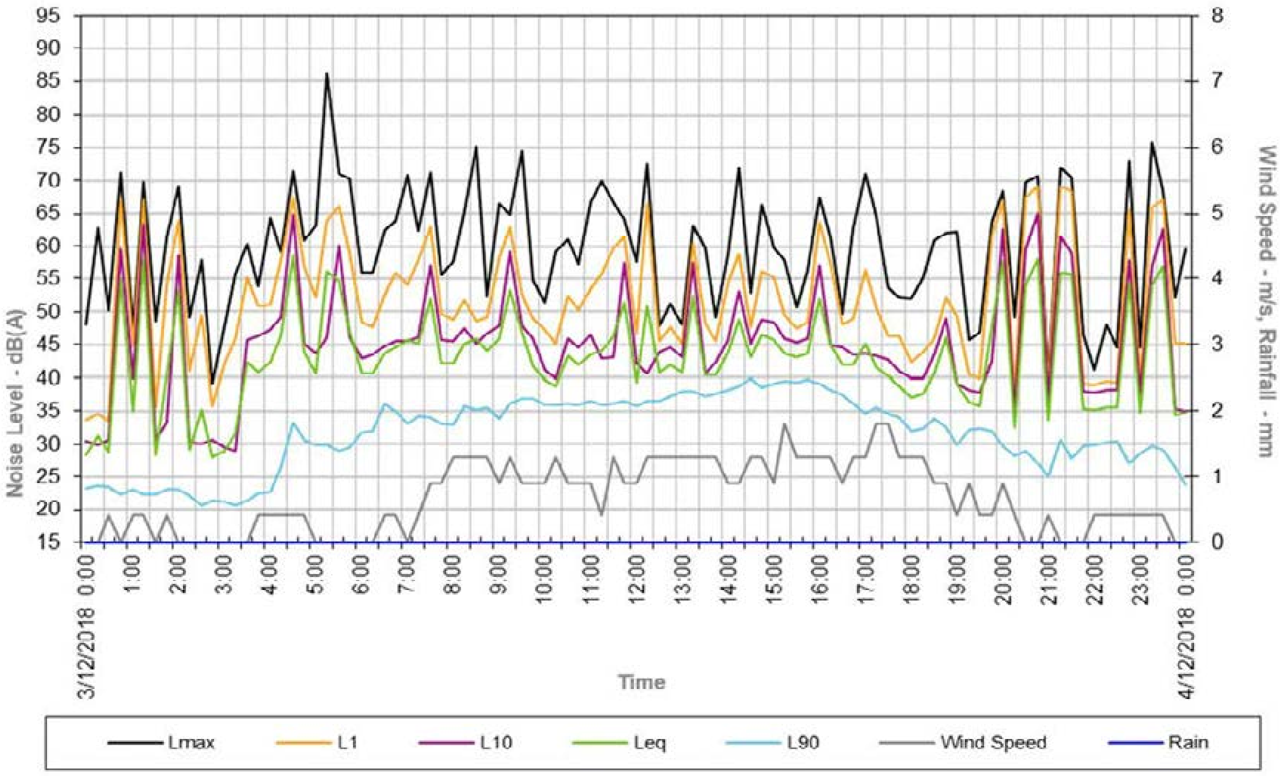




Site Noise and Weather Graphical Analysis

11 Tyrell Court





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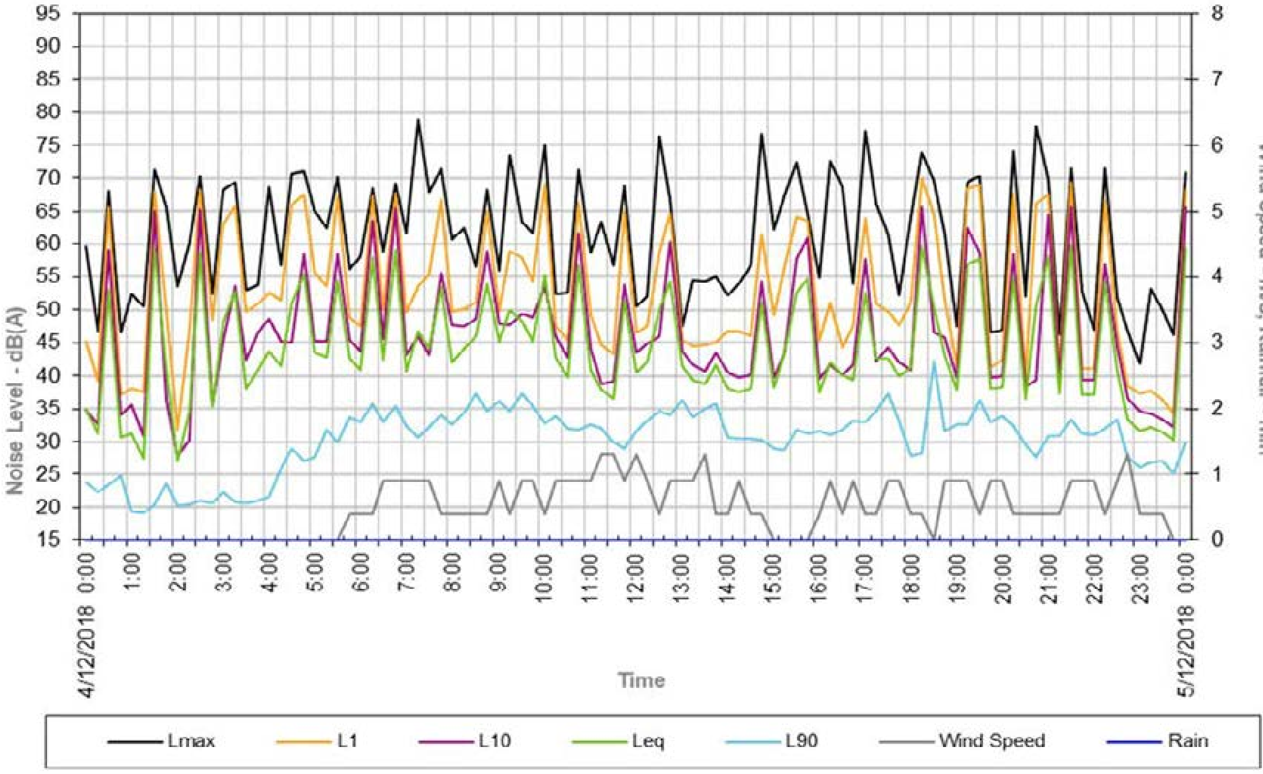
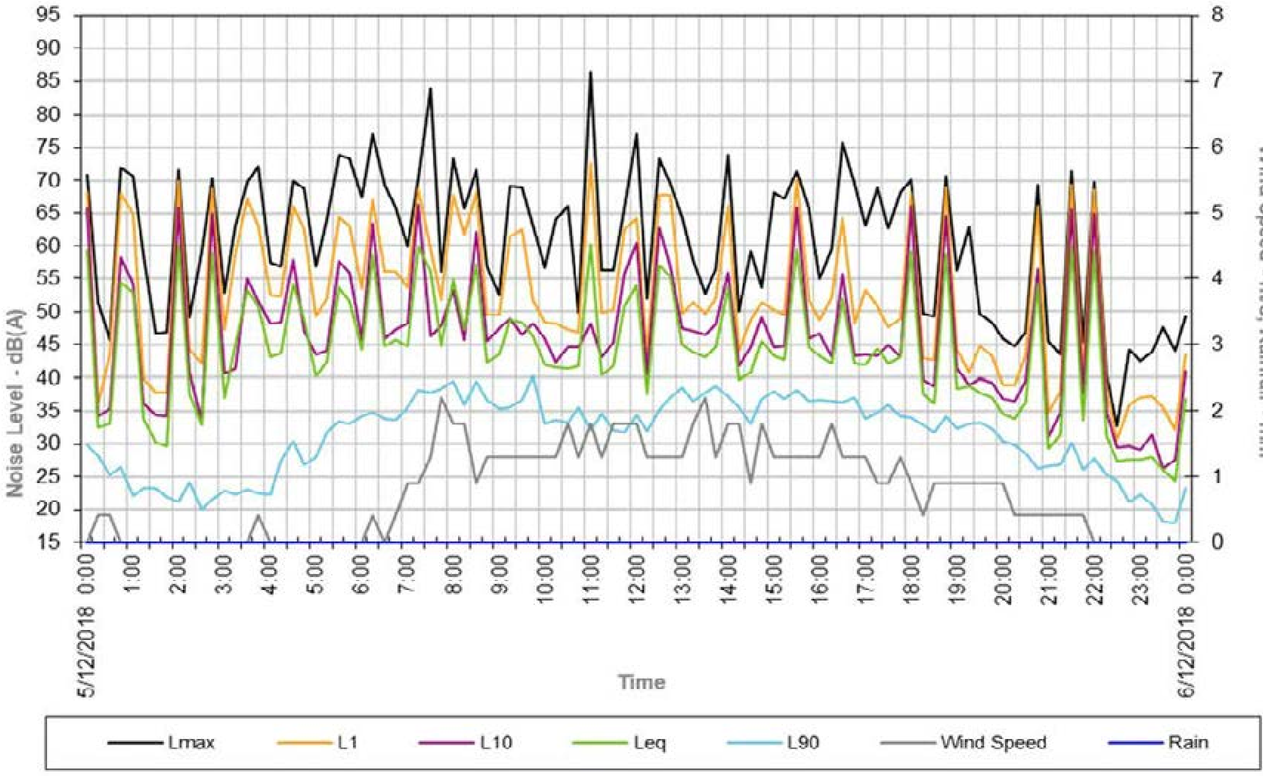
Site Noise and Weather Graphical Analysis

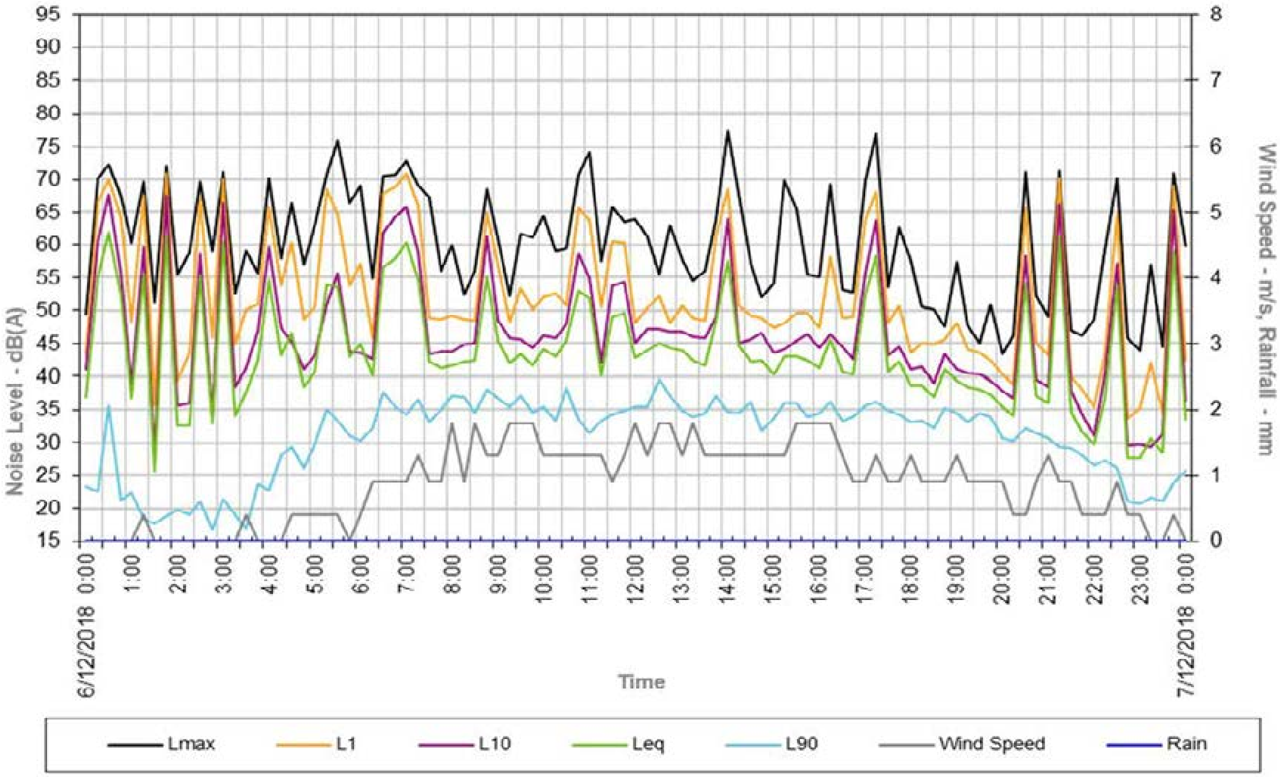
11 Tyrell Court

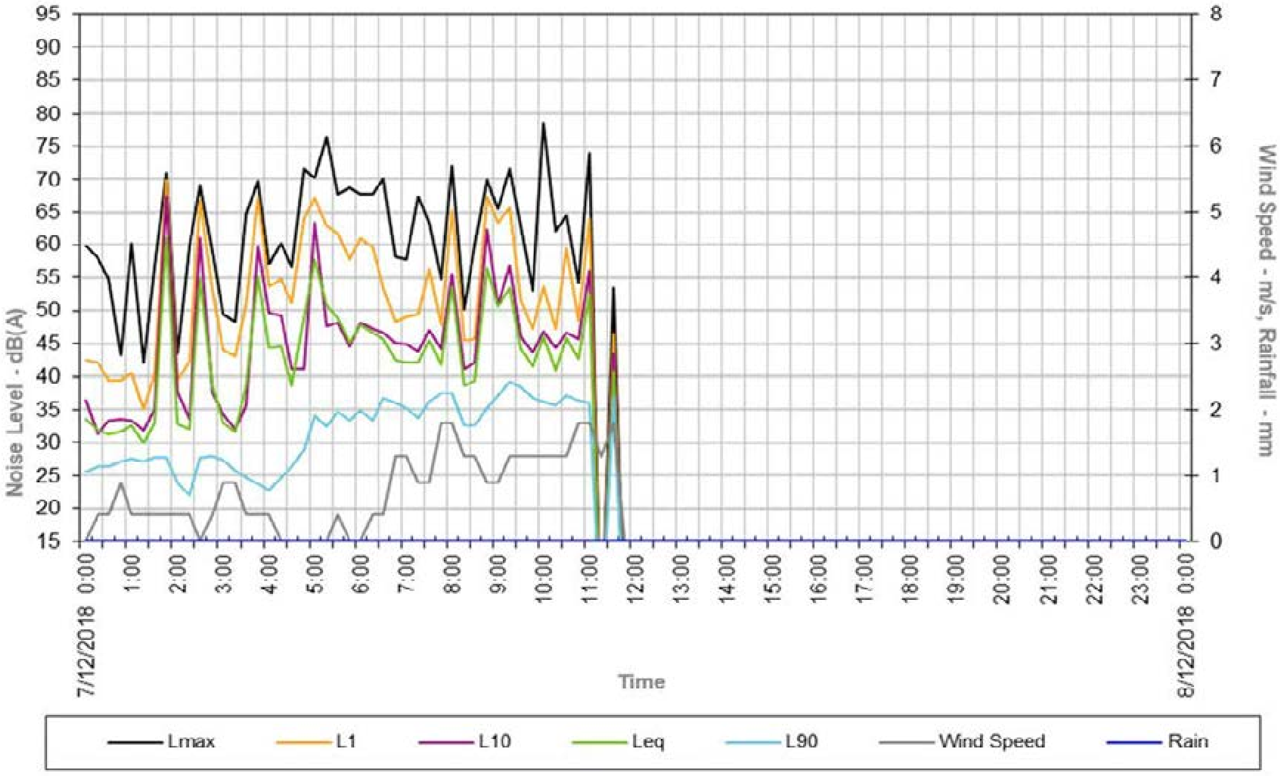




Site Noise and Weather Graphical Analysis

11 Tyrell Court





Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_13

From	Thursday 13/12/2018 14:15	Meas. Type	Free Field	Package	Helidon to Calvert
To	Thursday 20/12/2018 13:00	Mic. Height (m)	1.8	Address	52 Mountain Road
Instrument Type	Larson Davis 831	Weather Station	No	Suburb	Laidley
Instrument Serial #	3339	Operator	JR	Land Use	Residential
Inst. Cal. Date	3/7/2017	Sample Int.	15 min	Latitude	27°38'31.32"S
Pre Calibration	94.1	RP Lot#	N/A	Longitude	152°26'31.77"E
Post Calibration	93.8				

Daytime

RBL **34.2 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Thursday 13/12/2018	37.7	dB(A)
Friday 14/12/2018	34.3	dB(A)
Saturday 15/12/2018	31.8	dB(A)
Monday 17/12/2018	34.2	dB(A)
Tuesday 18/12/2018	33.4	dB(A)
Wednesday 19/12/2018	31.5	dB(A)
Thursday 20/12/2018	37.6	dB(A)

Evening

RBL **38.4 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Thursday 13/12/2018	30.5	dB(A)
Friday 14/12/2018	42.6	dB(A)
Saturday 15/12/2018	36.4	dB(A)
Sunday 16/12/2018	36.5	dB(A)
Monday 17/12/2018	38.4	dB(A)
Tuesday 18/12/2018	42.2	dB(A)
Wednesday 19/12/2018	41.3	dB(A)

Night

RBL **35.6 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

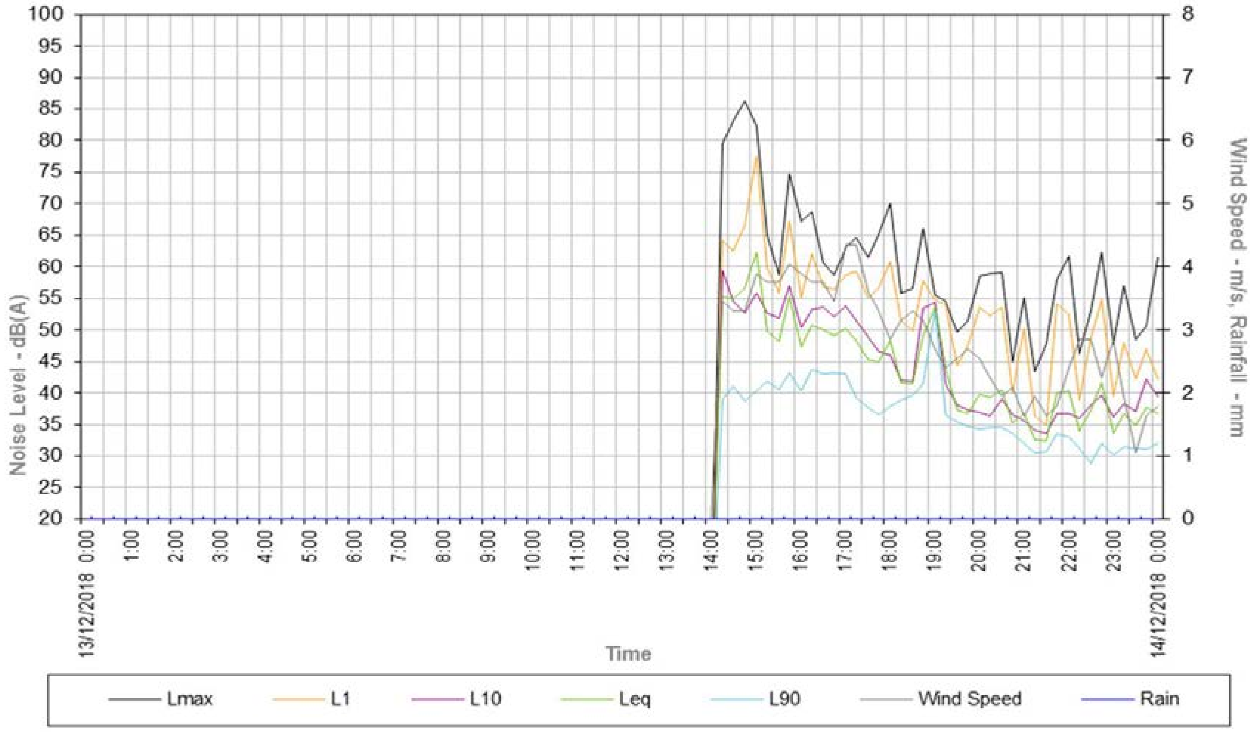
ABLs Night (Fri 6pm - 8am)

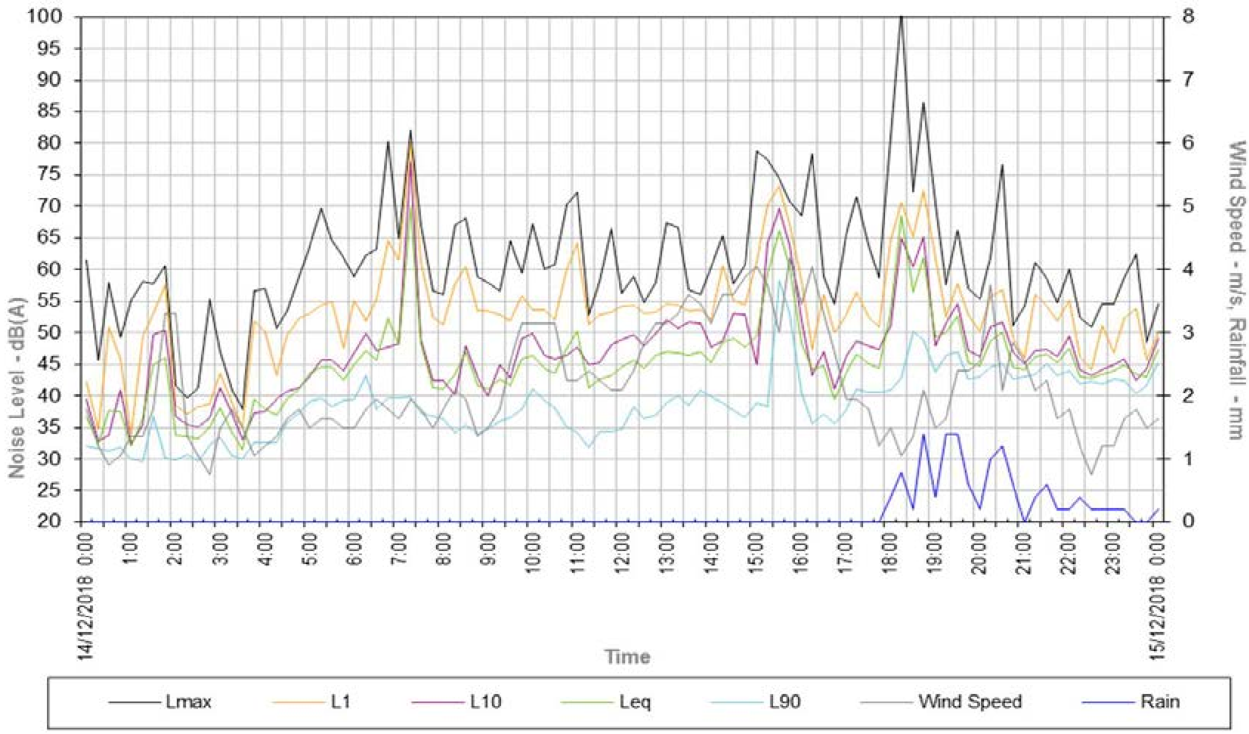
Thursday 13/12/2018	29.5	dB(A)
Friday 14/12/2018	40.4	dB(A)
Saturday 15/12/2018	35.5	dB(A)
Sunday 16/12/2018	38.8	dB(A)
Monday 17/12/2018	35.6	dB(A)
Tuesday 18/12/2018	36.5	dB(A)
Wednesday 19/12/2018	31.5	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

52 Mountain Road





Future Freight

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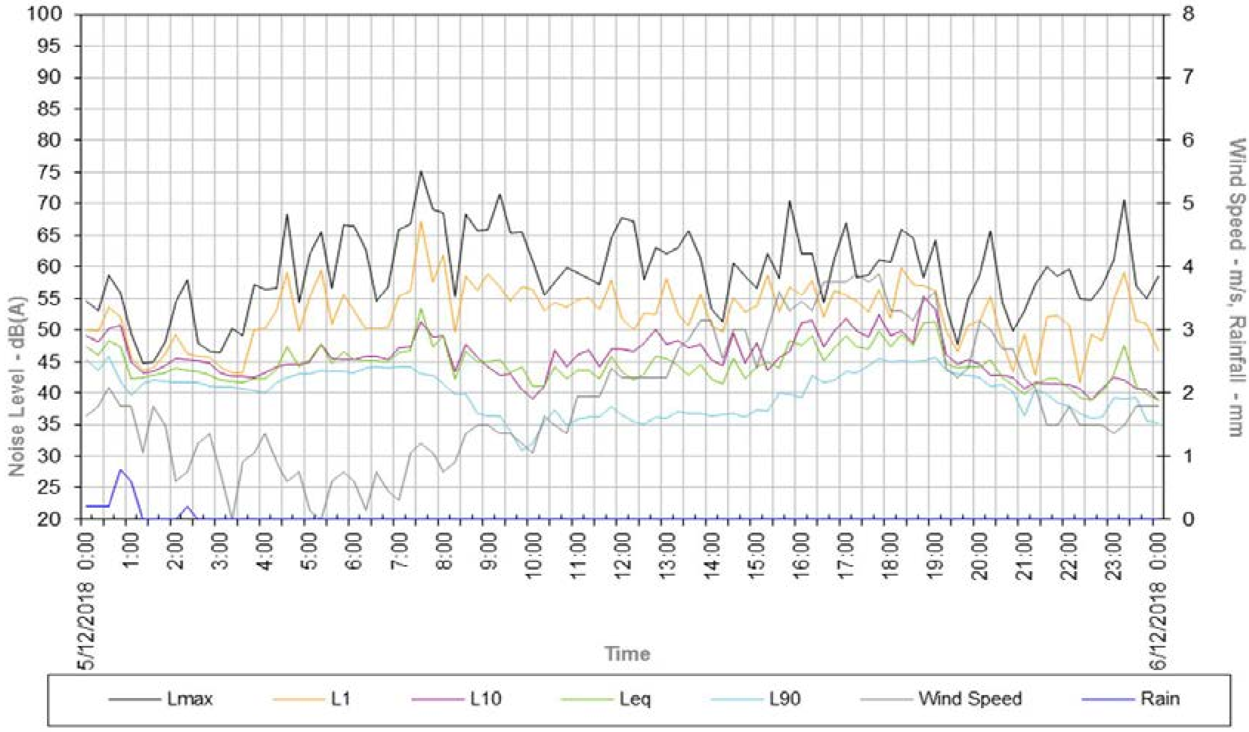
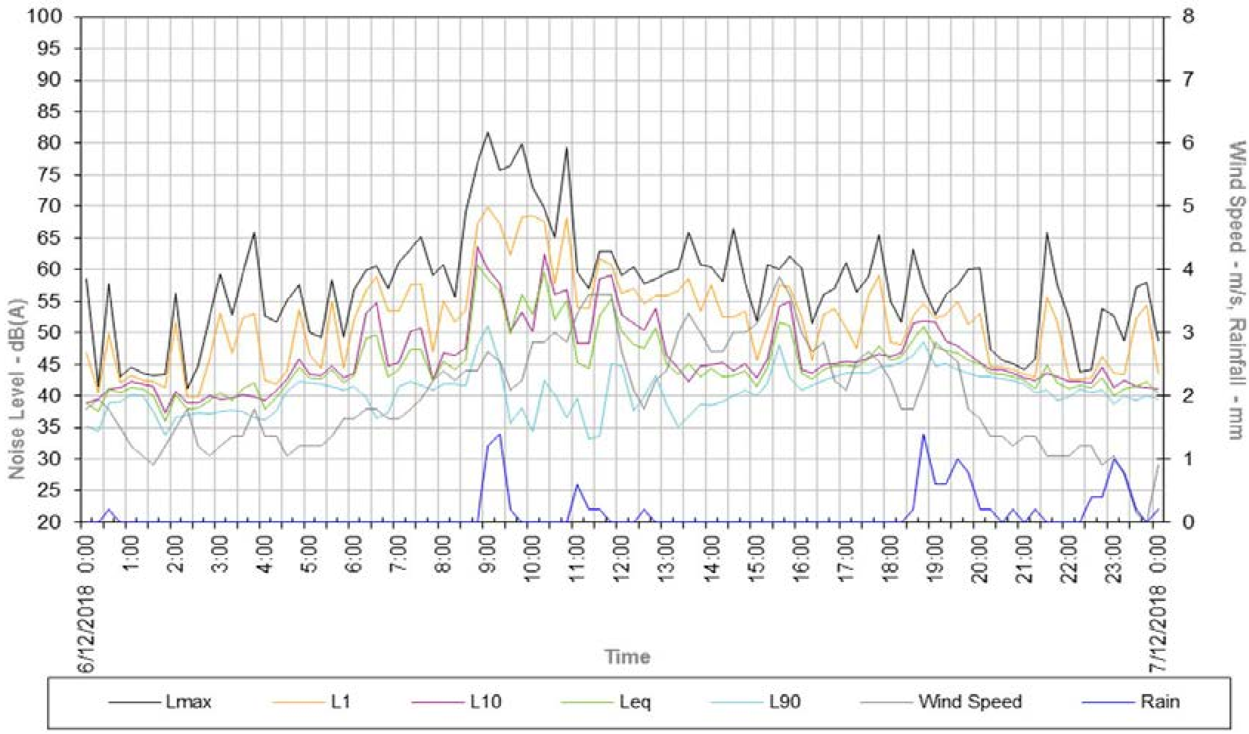
Site Noise and Weather Graphical Analysis

52 Mountain Road





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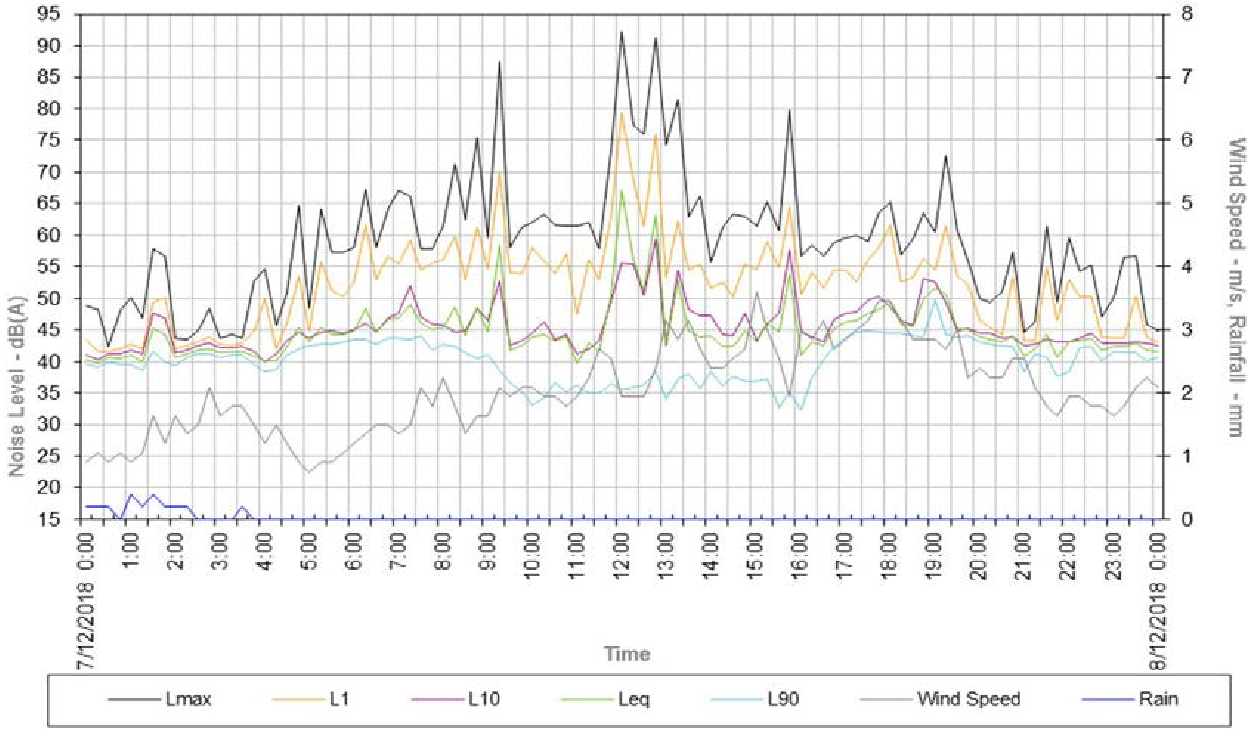
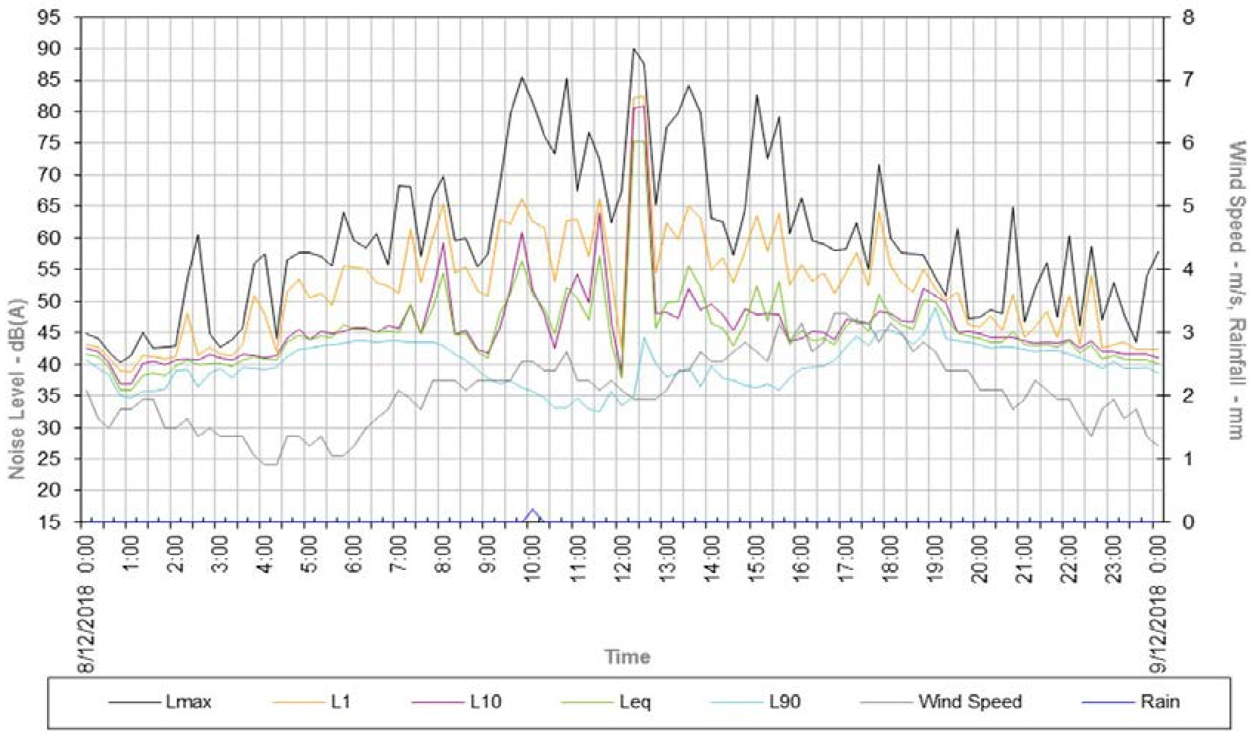
Site Noise and Weather Graphical Analysis

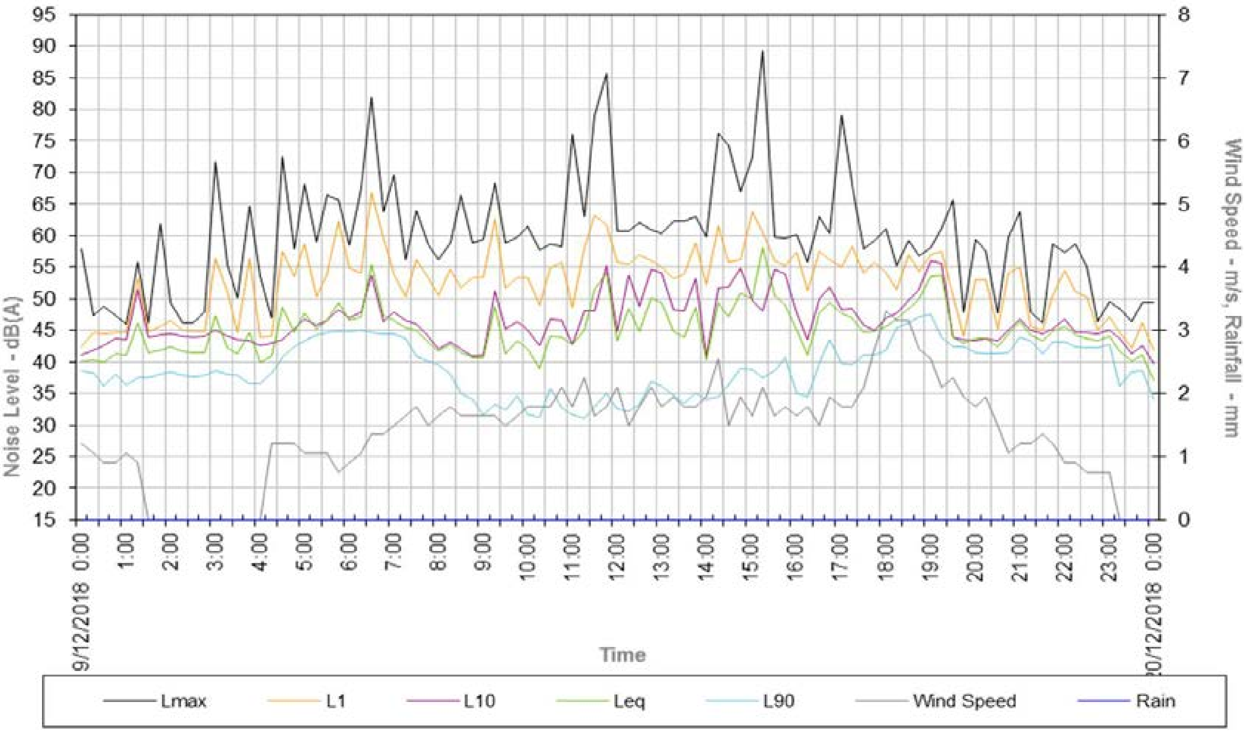
52 Mountain Road

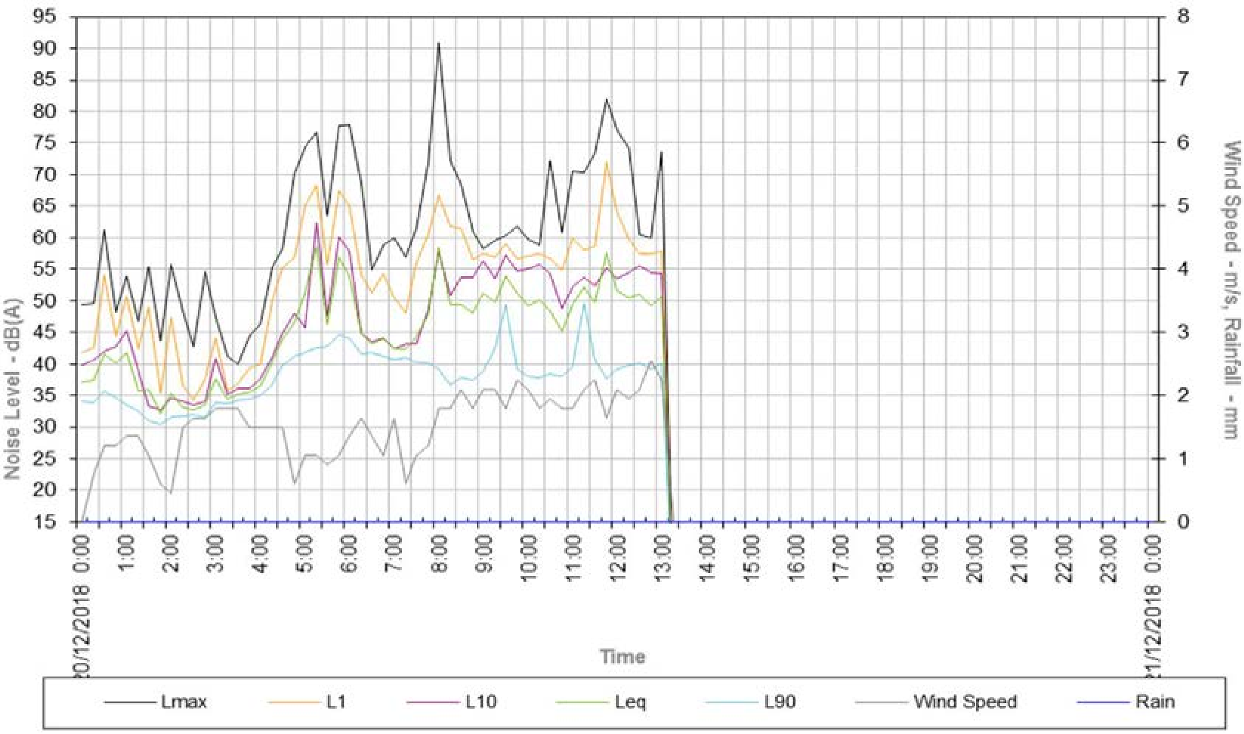




Site Noise and Weather Graphical Analysis

52 Mountain Road





Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_14

From	Wednesday 28/11/2018 14:45	Meas. Type	Free Field	Package	Helidon to Calvert
To	Wednesday 5/12/2018 14:45	Mic. Height (m)	1.8	Address	5 Long Gully Road
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Grandchester
Instrument Serial #	12609	Operator	BR	Land Use	Residential
Inst. Cal. Date	10/09/2018	Sample Int.	15 min	Latitude	27°39'41.76"S
Pre Calibration	94	RP Lot#	RP/18463	Longitude	152°27'42.02"E
Post Calibration	94.1				

Daytime		Evening		Night	
RBL	**38.1 dB(A)**	RBL	**39.7 dB(A)**	RBL	**35.0 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

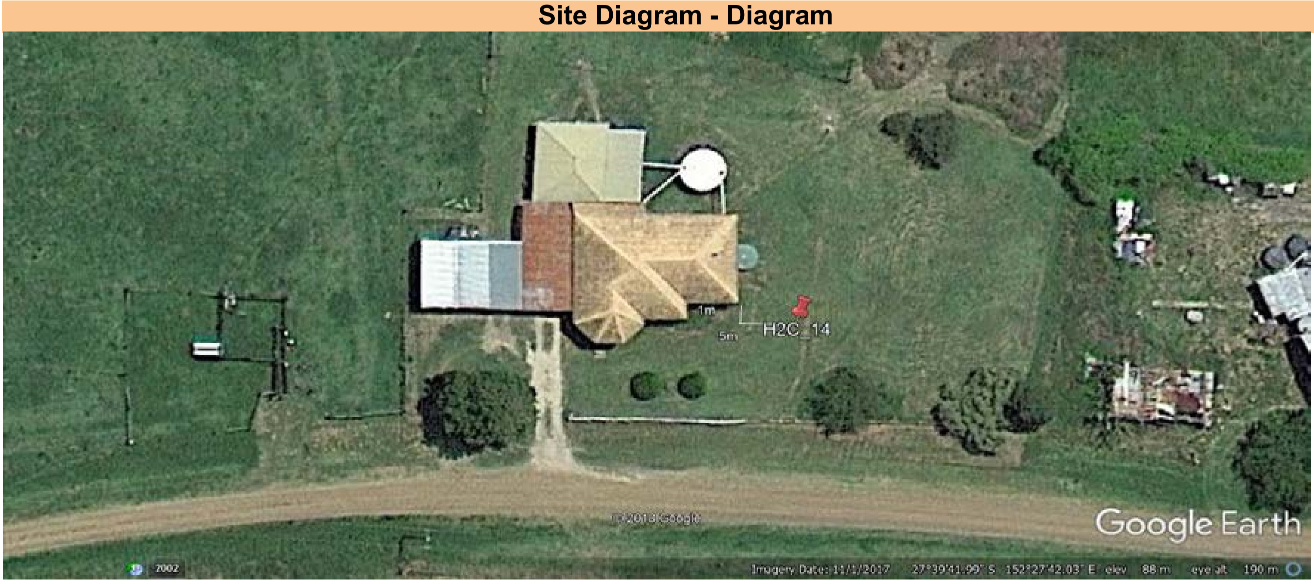
ABLs Evening (Sun 7 am - 10 pm)

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

ABLs Night (Fri 6pm - 8am)

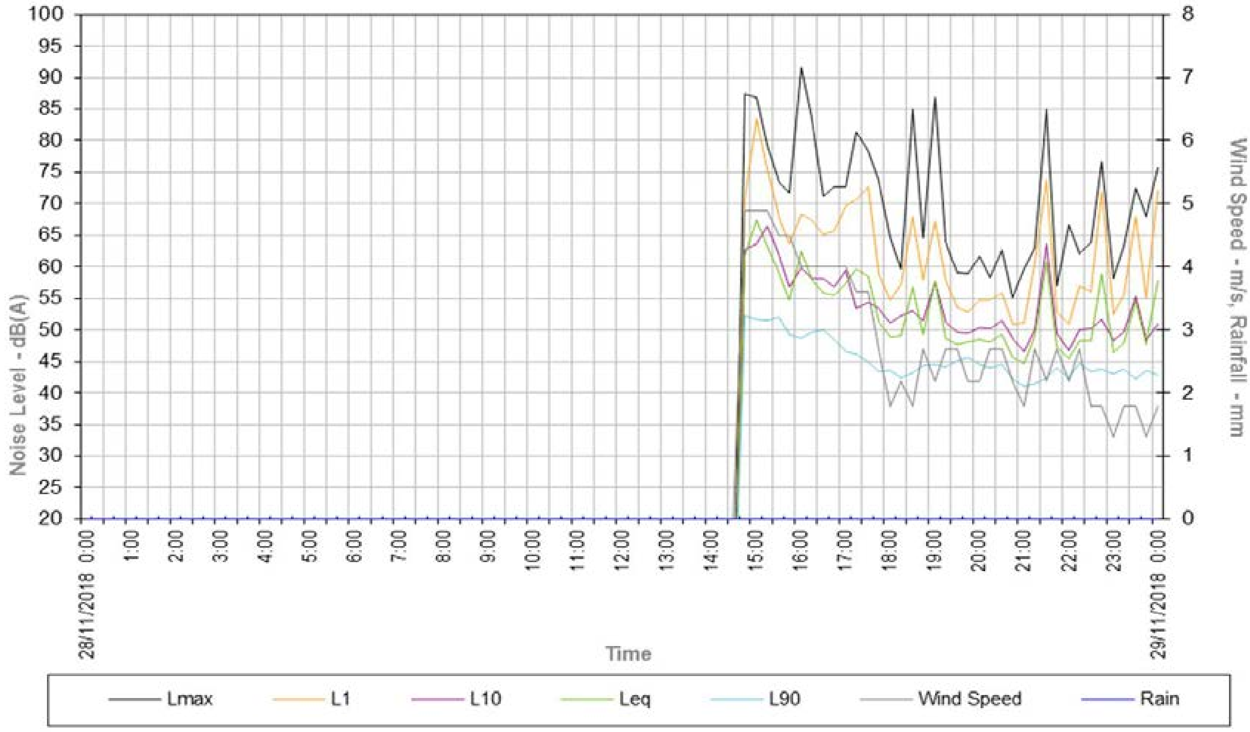
Day			Evening			Night		
Wednesday 28/11/2018	45	dB(A)	Wednesday 28/11/2018	41.5	dB(A)	Wednesday 28/11/2018	31.3	dB(A)
Thursday 29/11/2018	37.8	dB(A)	Thursday 29/11/2018	40.9	dB(A)	Thursday 29/11/2018	32.9	dB(A)
Friday 30/11/2018	35.0	dB(A)	Friday 30/11/2018	40.2	dB(A)	Friday 30/11/2018	35.0	dB(A)
Saturday 1/12/2018	34.3	dB(A)	Saturday 1/12/2018	33.6	dB(A)	Saturday 1/12/2018	35.1	dB(A)
			Sunday 2/12/2018	34.6	dB(A)	Sunday 2/12/2018	34.6	dB(A)
Monday 3/12/2018	39.2	dB(A)	Monday 3/12/2018	39.0	dB(A)	Monday 3/12/2018	36.3	dB(A)
Tuesday 4/12/2018	38.1	dB(A)	Tuesday 4/12/2018	39.7	dB(A)	Tuesday 4/12/2018	35.4	dB(A)
Wednesday 5/12/2018	43.1	dB(A)						

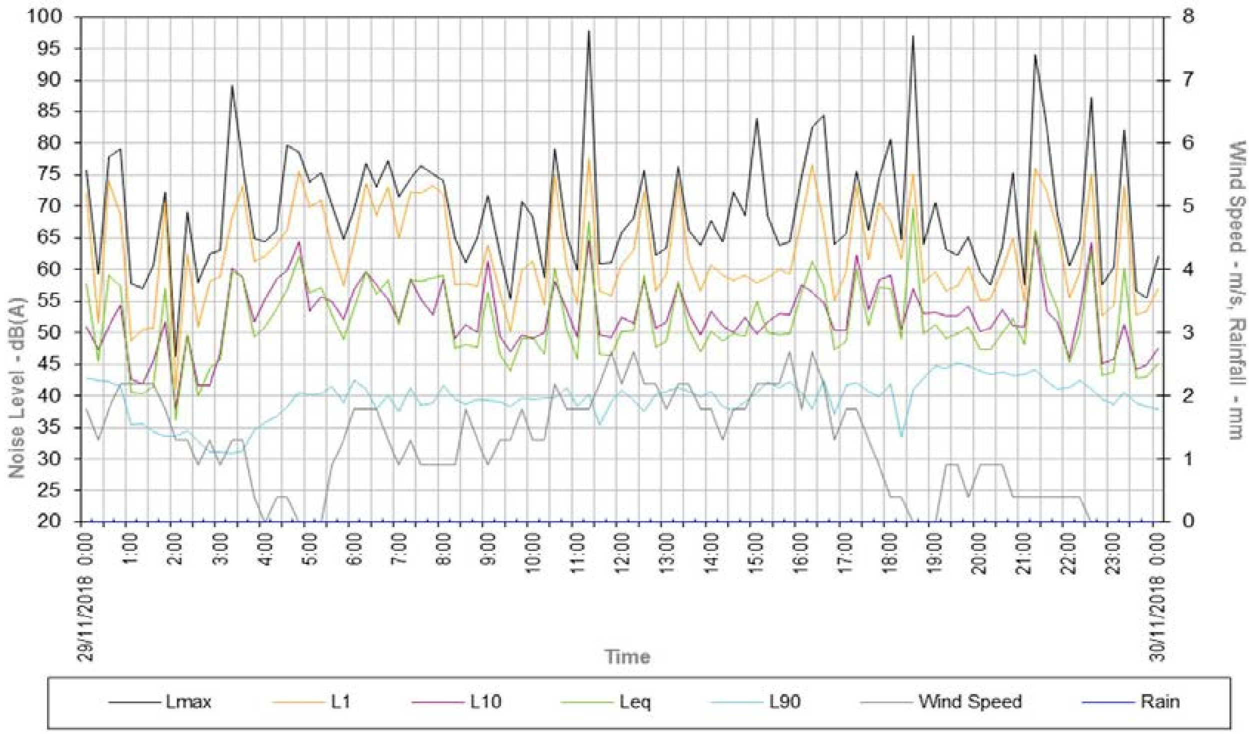
Site Diagram - Diagram



Site Noise and Weather Graphical Analysis

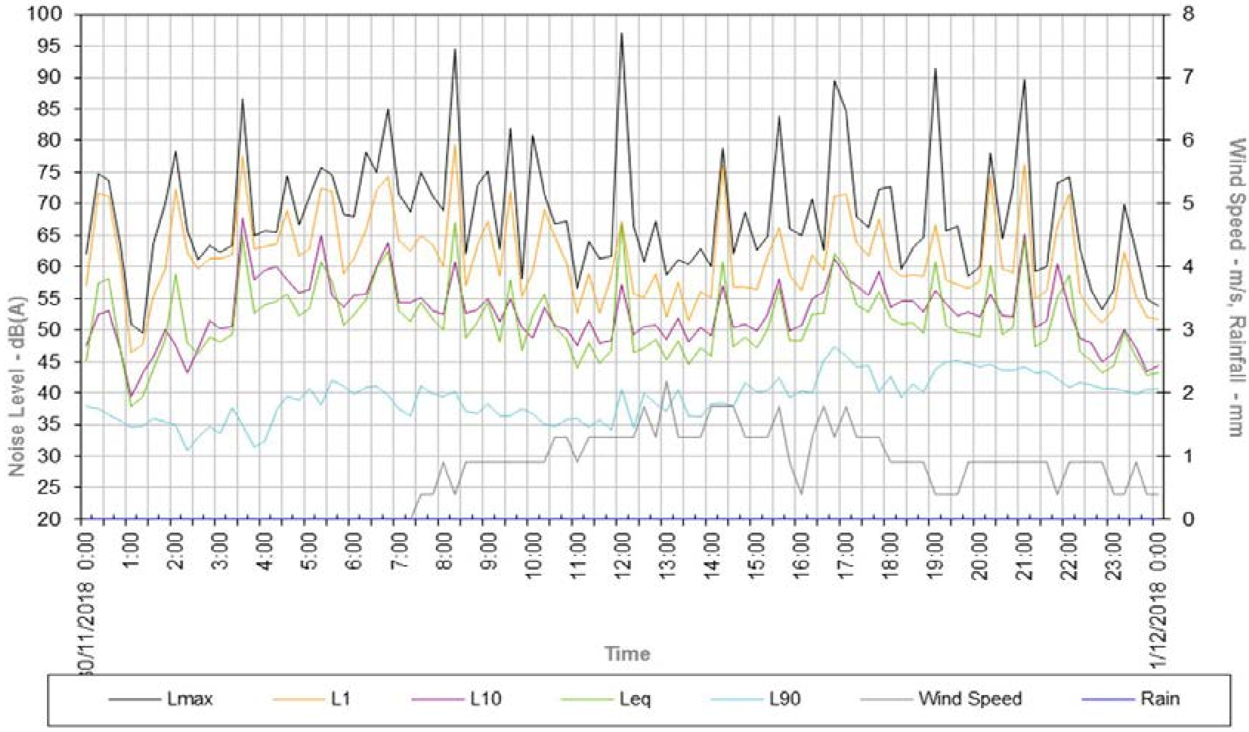
5 Long Gully Road

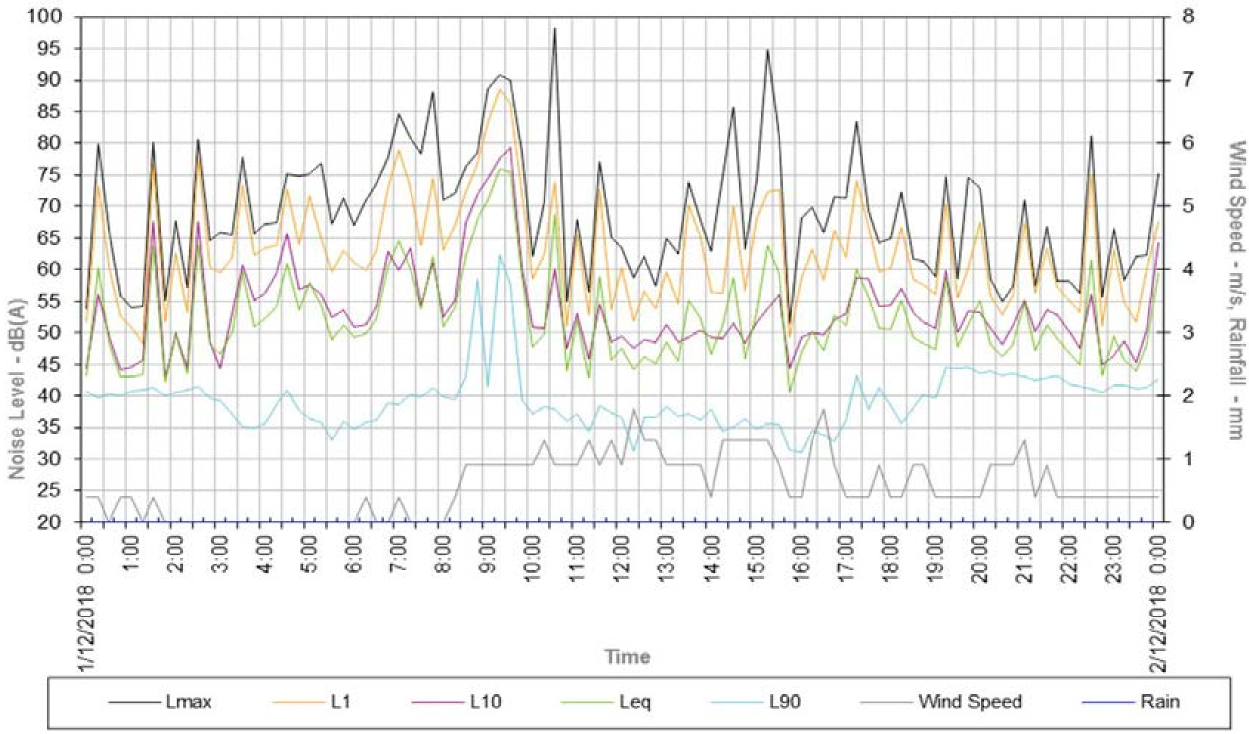




Site Noise and Weather Graphical Analysis

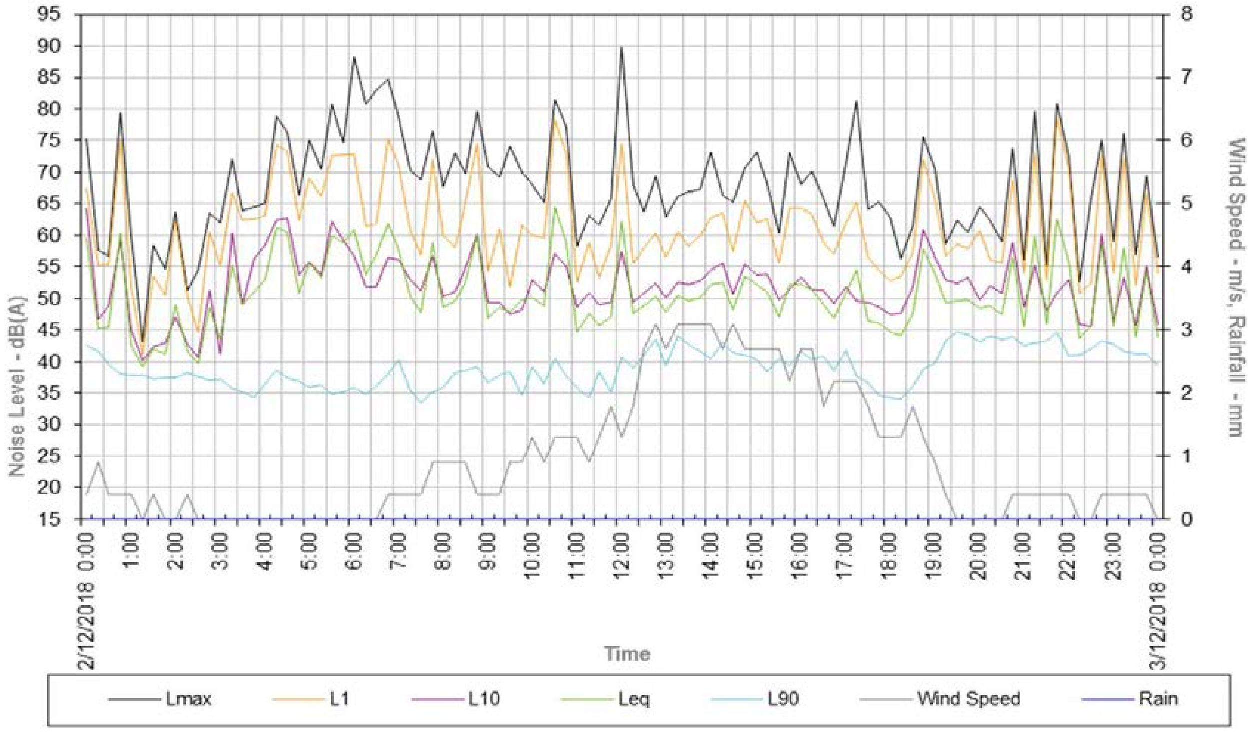
5 Long Gully Road

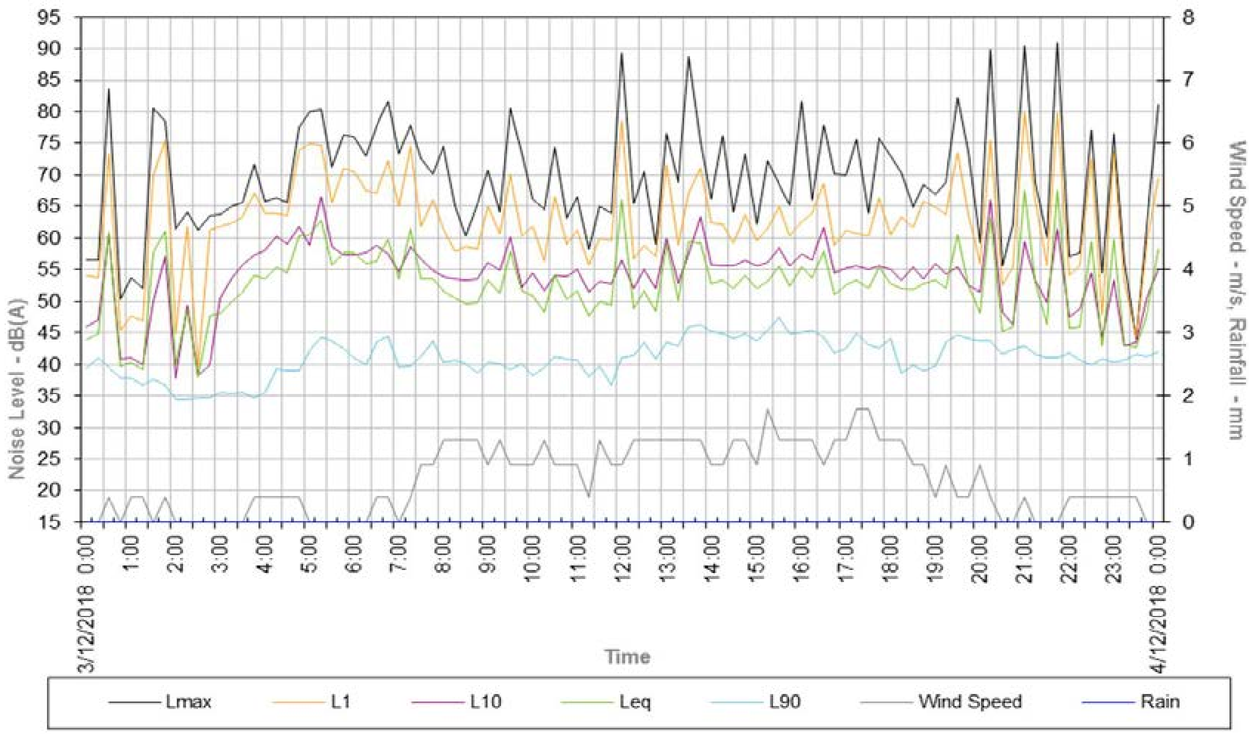




Site Noise and Weather Graphical Analysis

5 Long Gully Road





Future Freight
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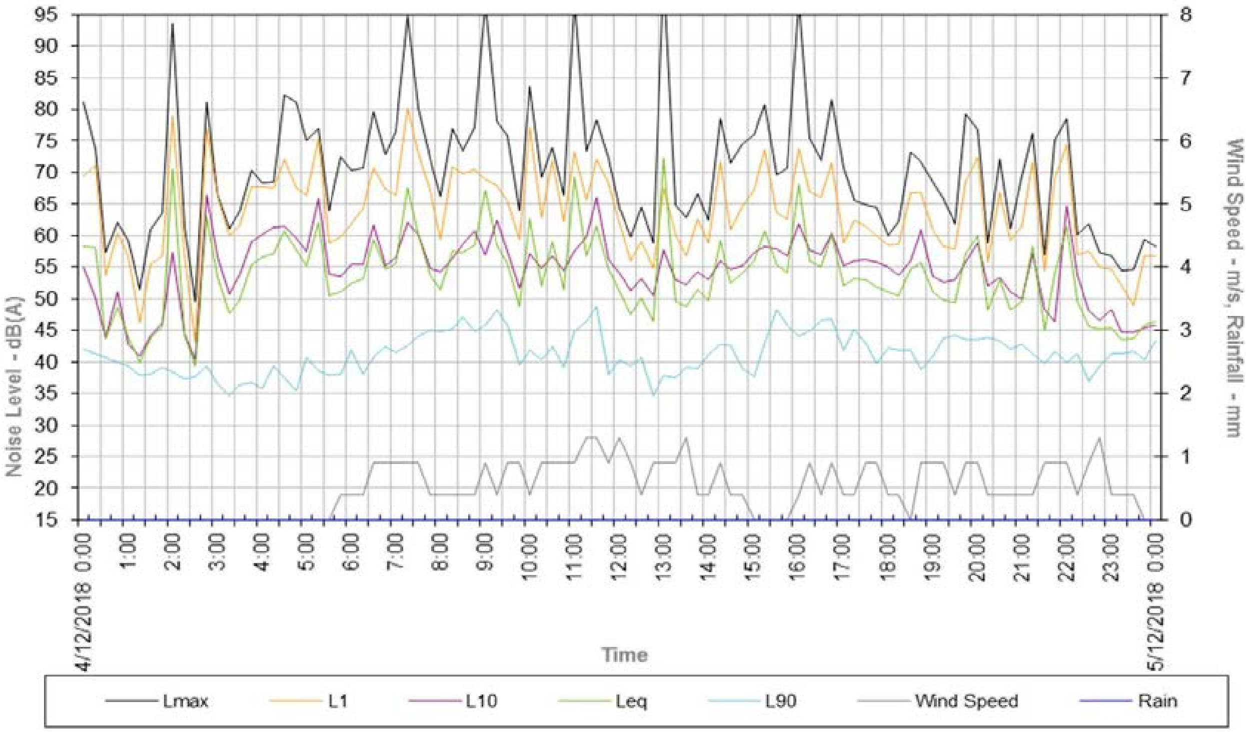
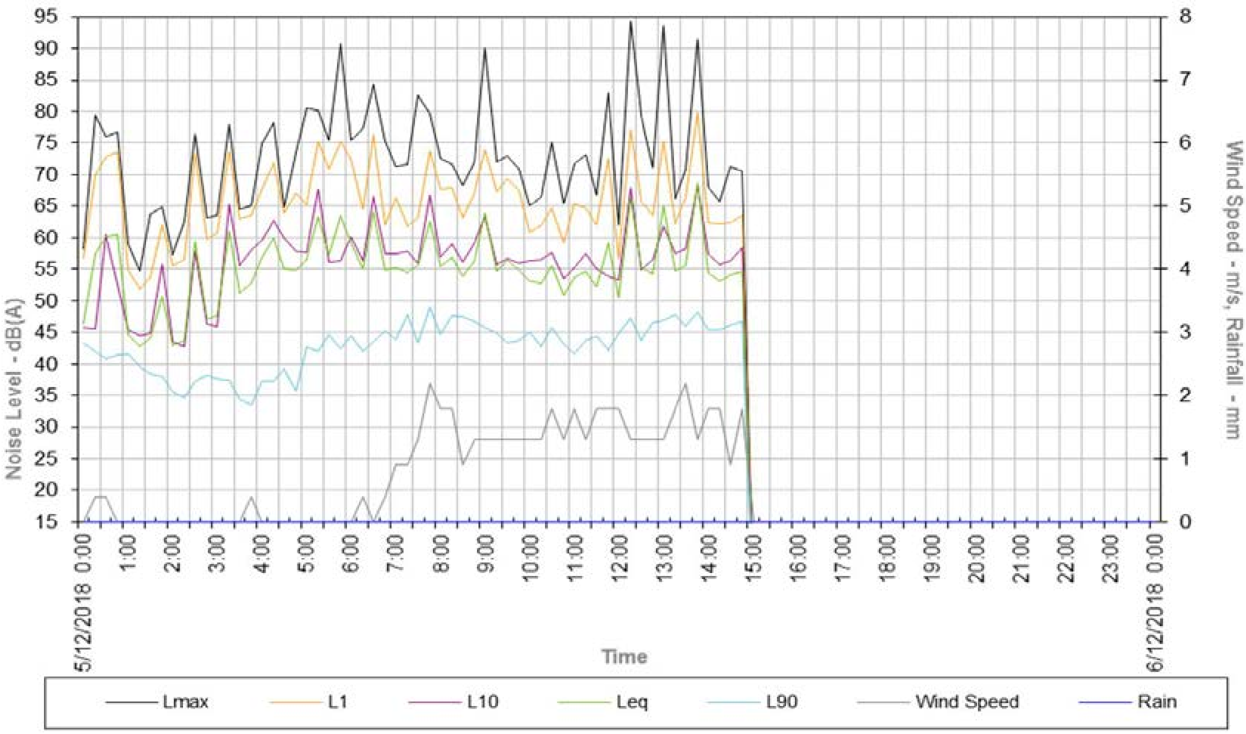
Site Noise and Weather Graphical Analysis

5 Long Gully Road





Noise Monitoring Data Sheet

Inland Rail

SITE ID

H2C_15

From	Wednesday 28/11/2018 12:00	Meas. Type	Free Field	Package	Helidon to Calvert
To	Wednesday 5/12/2018 12:45	Mic. Height (m)	1.8	Address	40 School Road
Instrument Type	01 dB DUO	Weather Station	No	Suburb	Grandchester
Instrument Serial #	12601	Operator	BR	Land Use	Residential
Inst. Cal. Date	6/9/2018	Sample Int.	15 min	Latitude	27°39'55.63"S
Pre Calibration	94	RP Lot#	20/CC3471	Longitude	152°27'57.54"E
Post Calibration	94.1				

Daytime

RBL **34.8 dB(A)**

ABLs Day (Mon-Fri 7am - 6 pm)

ABLs Day (Sat 8 am - 1 pm)

Wednesday 28/11/2018	45	dB(A)
Thursday 29/11/2018	34.8	dB(A)
Friday 30/11/2018	32.1	dB(A)
Saturday 1/12/2018	29.7	dB(A)
Monday 3/12/2018	36.2	dB(A)
Tuesday 4/12/2018	34.2	dB(A)
Wednesday 5/12/2018	36.2	dB(A)

Evening

RBL **33.9 dB(A)**

ABLs Evening (Mon-Fri 6 pm - 10 pm)

ABLs Evening (Sat 1 pm - 10 pm)

ABLs Evening (Sun 7 am - 10 pm)

Wednesday 28/11/2018	39.5	dB(A)
Thursday 29/11/2018	31.1	dB(A)
Friday 30/11/2018	31.2	dB(A)
Saturday 1/12/2018	32.0	dB(A)
Sunday 2/12/2018	34.2	dB(A)
Monday 3/12/2018	38.0	dB(A)
Tuesday 4/12/2018	33.9	dB(A)

Night

RBL **25.1 dB(A)**

ABLs Night (Mon - Thu, Sat - Sun 6pm - 7am)

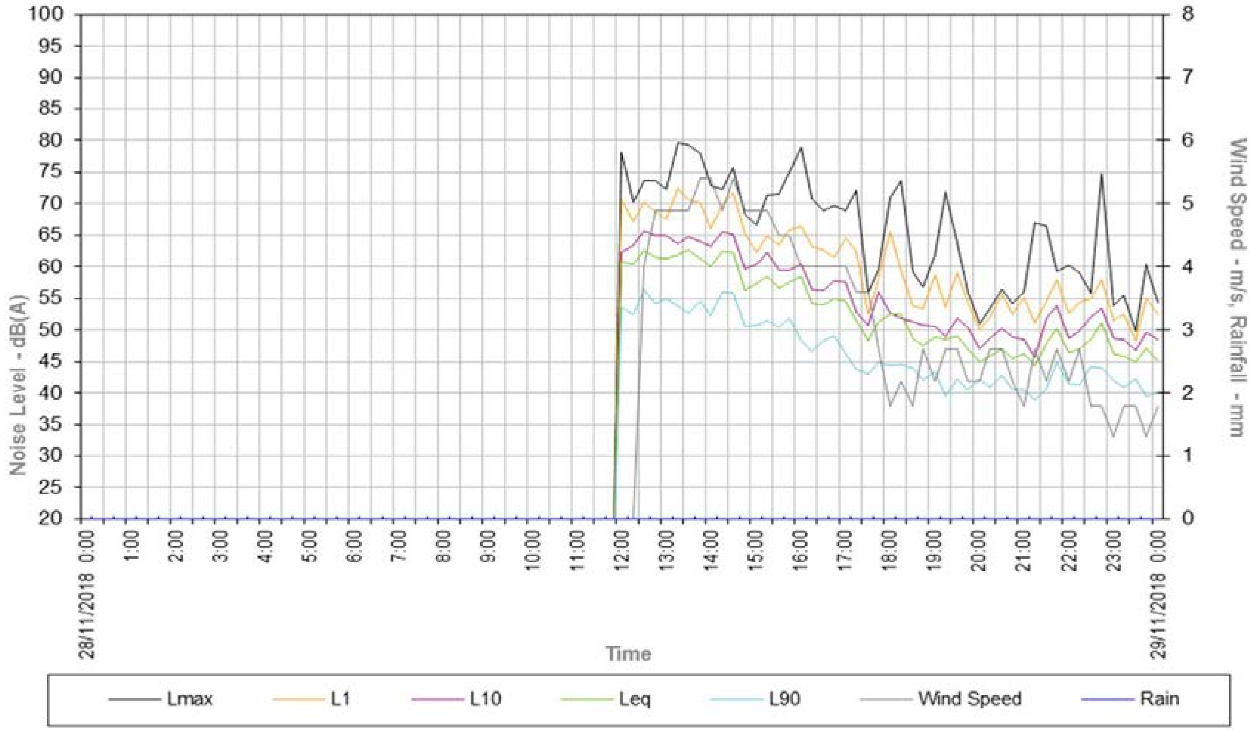
ABLs Night (Fri 6pm - 8am)

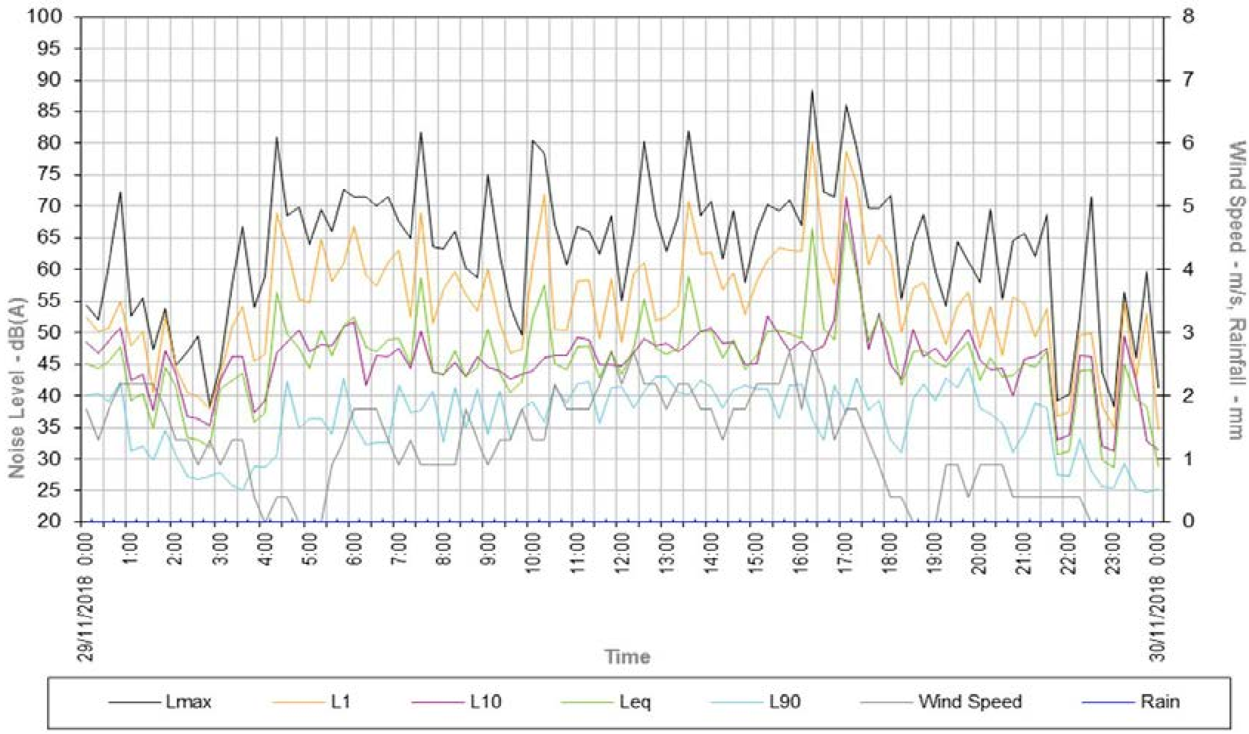
Wednesday 28/11/2018	27.1	dB(A)
Thursday 29/11/2018	23.1	dB(A)
Friday 30/11/2018	24.6	dB(A)
Saturday 1/12/2018	25.1	dB(A)
Sunday 2/12/2018	24.9	dB(A)
Monday 3/12/2018	26.1	dB(A)
Tuesday 4/12/2018	27.8	dB(A)

Site Diagram - Diagram

Site Noise and Weather Graphical Analysis

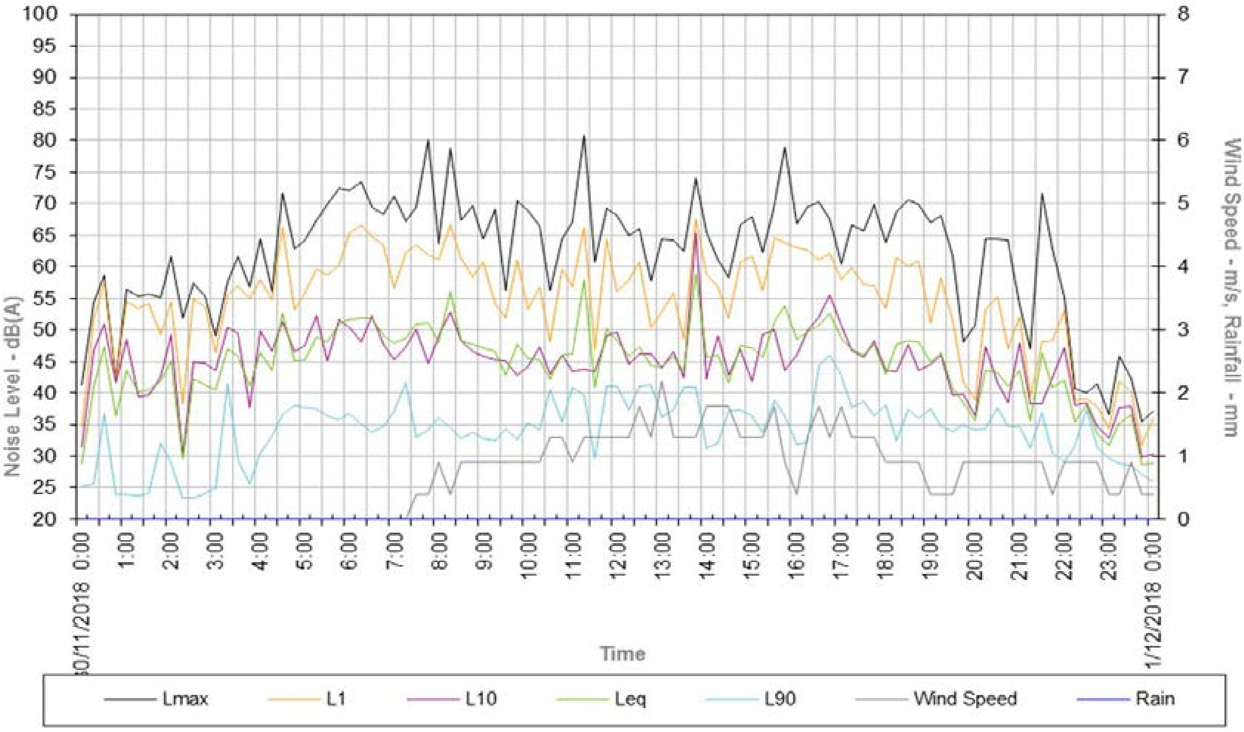
40 School Road

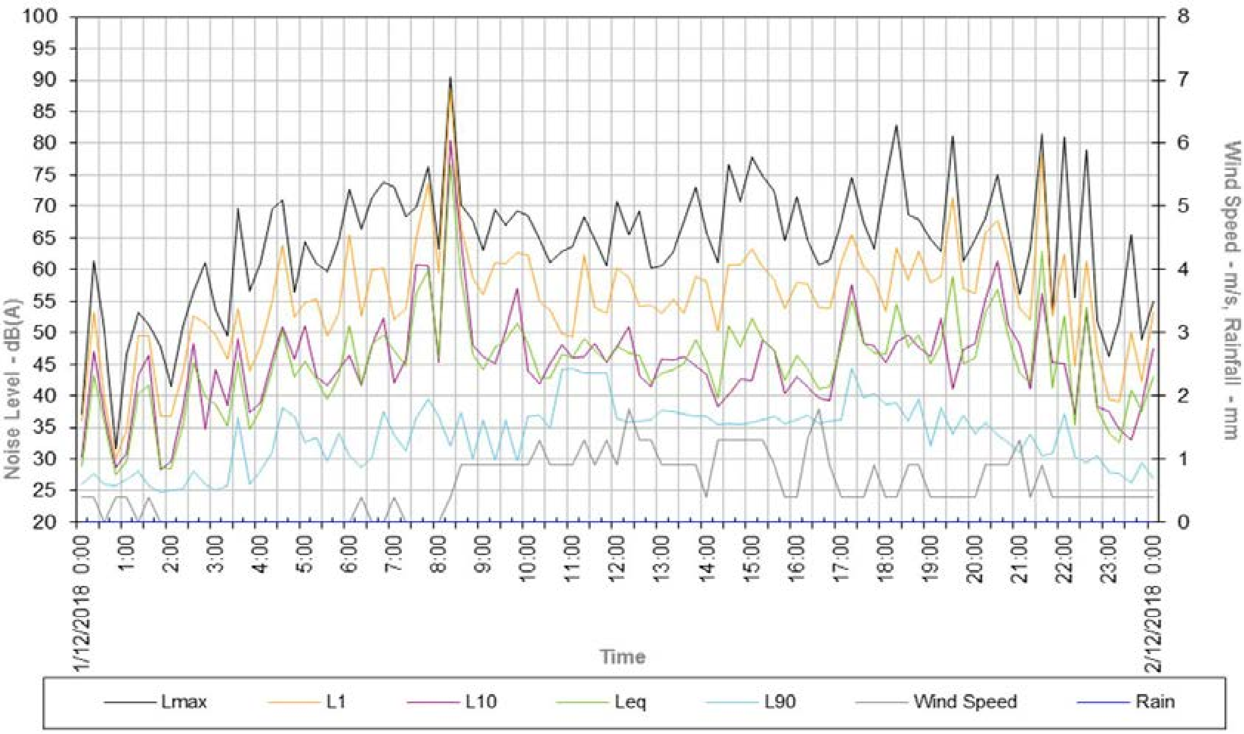




Site Noise and Weather Graphical Analysis

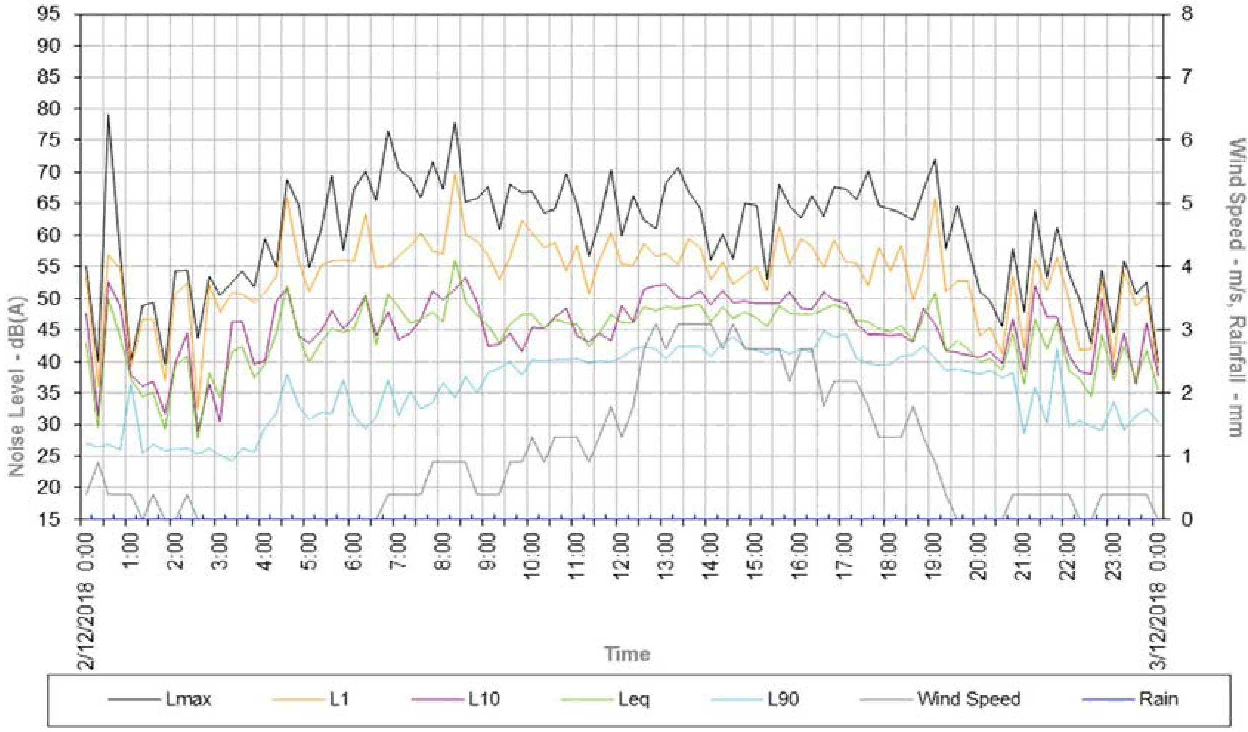
40 School Road

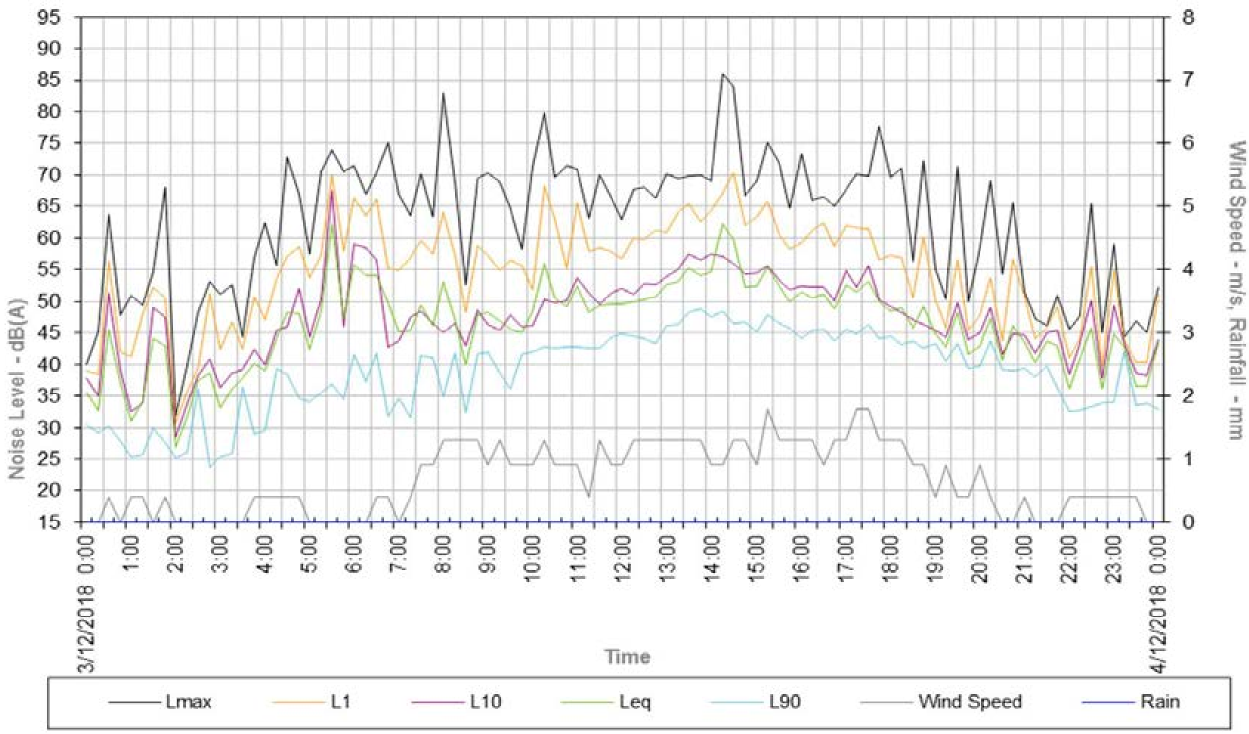




Site Noise and Weather Graphical Analysis

40 School Road





Future Freight
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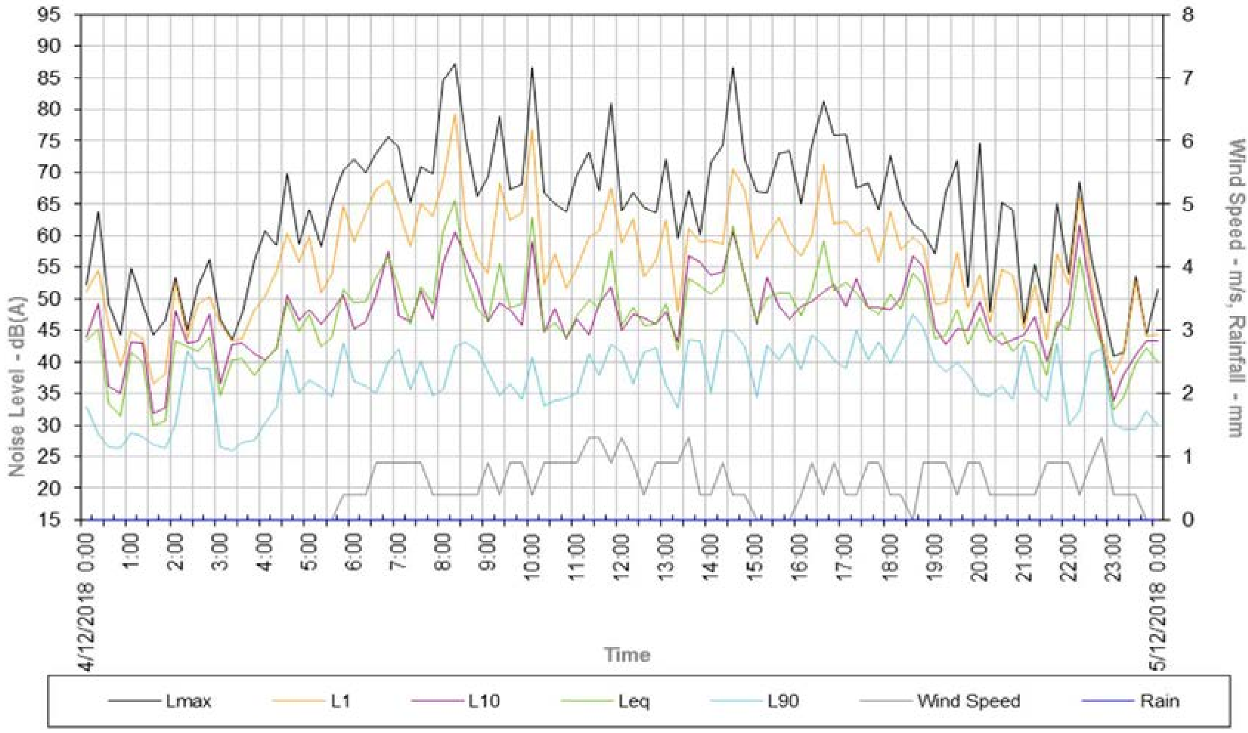
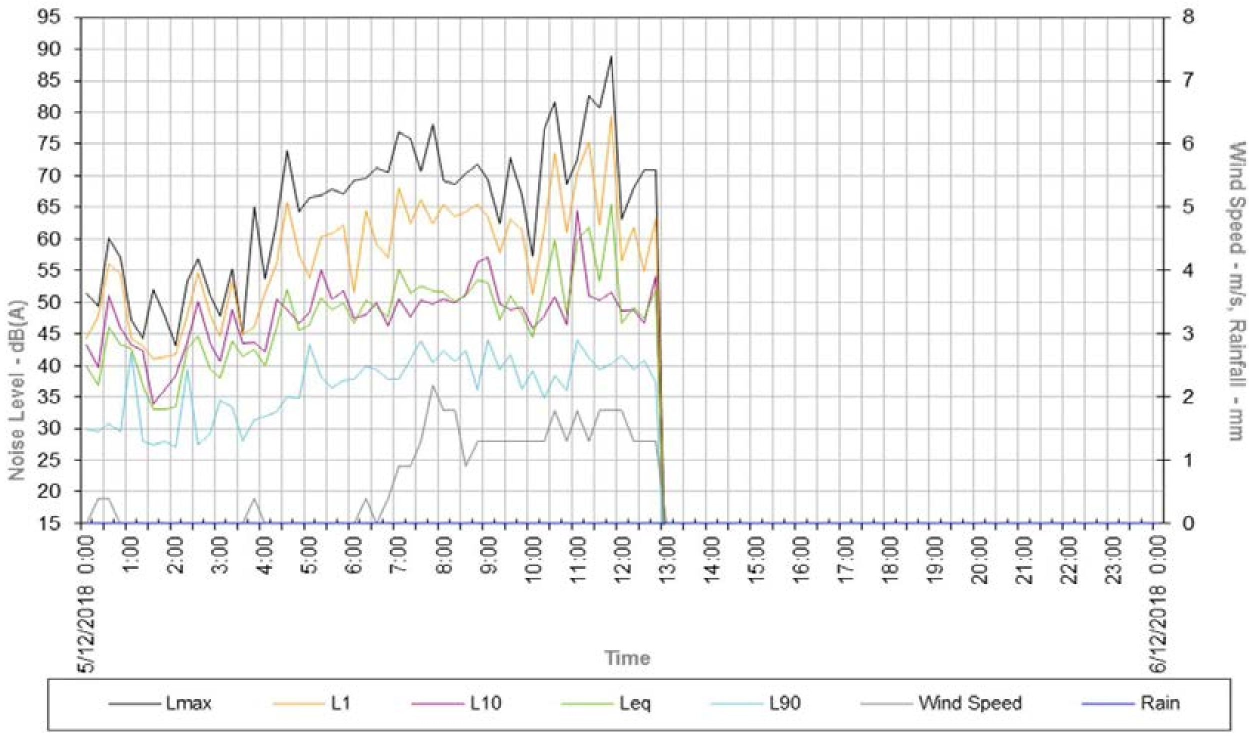
Site Noise and Weather Graphical Analysis

40 School Road





CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22046 & FILT 4358**

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	27537
Microphone Type:	7052E	**Serial No:**	50504
Filter Type:	1/3 Octave	**Serial No:**	27537
Comments:	All tests passed for class 1. (See over for details)		
Owner:	AECOM Australia Pty Ltd Level 8, 540 Wickham Street Fortitude Valley QLD 4006		
Ambient Pressure:	999 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	40% ±5%
Date of Calibration:	19/01/2018	**Issue Date:**	23/01/2018
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: .... **AUTHORISED SIGNATURE:** ....

Jack Kielt

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

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Sound Level Meter

IEC 61672-3.2013

Calibration Certificate

Calibration Number C17228

Client Details	AECOM Australia Pty Ltd Level 8, 540 Wickham Street Fortitude Valley QLD 4006
Equipment Tested/ Model Number :	Rion NL-52EX
Instrument Serial Number :	00175550
Microphone Serial Number :	10978
Pre-amplifier Serial Number :	65652

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	21°C	**Ambient Temperature :**	21.5°C
Relative Humidity :	46.9%	**Relative Humidity :**	48%
Barometric Pressure :	99.68kPa	**Barometric Pressure :**	99.65kPa

Calibration Technician :	Vicky Jaiswal	**Secondary Check:**	Riley Cooper
Calibration Date :	16/05/2017	**Report Issue Date :**	17/05/2017

Approved Signatory : PP Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

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Sound Level Meter

IEC 61672-3.2013

Calibration Certificate

Calibration Number C17203

Client Details AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley QLD 4006

Equipment Tested/ Model Number :	Rion NL-52EX
Instrument Serial Number :	01265386
Microphone Serial Number :	10721
Pre-amplifier Serial Number :	65288

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	21.3°C	**Ambient Temperature :**	22.2°C
Relative Humidity :	52.5%	**Relative Humidity :**	50.1%
Barometric Pressure :	100.31kPa	**Barometric Pressure :**	100.3kPa

Calibration Technician :	Vicky Jaiswal	**Secondary Check:**	Riley Cooper
Calibration Date :	12/05/2017	**Report Issue Date :**	15/05/2017

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22339 & FILT 4560**

Equipment Description: Sound Level Meter

Manufacturer: NTi

Model No: XL2-TA **Serial No:** A2A-09320-E0

Microphone Type: MC-230 **Serial No:** 7716

Filter Type: 1/3 Octave **Serial No:** A2A-09320-E0

Comments: All tests passed for class 1.
(See over for details)

Owner: AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley QLD 4006

Ambient Pressure: 1003 hPa ±1.5 hPa

Temperature: 23 °C ±2° C **Relative Humidity:** 55% ±5%

Date of Calibration: 14/03/2018 **Issue Date:** 16/03/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ...AV... **AUTHORISED SIGNATURE:** ....
Jack Kielt

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Calibration Report on:

DUO

Class 1 Sound Level Meter

Model: 01dB

Serial Number: 11107

Accredited Laboratory Number: 676

Accredited for compliance with ISO/IEC 17025- Calibration
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Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ *fa72129*

David Jenkins/Yan Wu

DOCUMENT CONTROL

NATA Report Number: 72129-cal-01

Calibration Report on:
DUO
Model: 01dB
Class 1 Precision Integrating Sound Level Meter
Serial Number: 11107
Submission Date: 23 Nov. 17

File: fa 72129

Report Code: 86

Prepared For:

AECOM Australia Pty Ltd
PO Box 1307
Fortitude Valley
QLD- 4006
AUSTRALIA

Prepared by:

Vipac Engineers & Scientists Ltd.
Victorian Technology Centre
275 Normanby Road
Port Melbourne Vic. 3207
AUSTRALIA
Phone: (03) 9647 9700
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Author:	**F.Antachew**	**Date** 24/11/17
Reviewed by:	**David Jenkins/Yan Wu**	**Date** 24/11/17

Revision History:

Issue No.	Date Issued	Reason/Comments
1	23 Nov. 17	Original

Distribution:

(This is Copy No:.......)

Copy No.	Issue No.	Destination	Addressee
1	1	AECOM Australia	
2	1	Vipac Melb. Library	-

Key Words: Calibration, Class 1 Sound Level Meter

Testing Officer: ______________________
Firezewed Antachew

Approved Signatory: ______________________
David Jenkins/Yan Wu

fa72129

SCOPE OF CALIBRATION (Class 1 Sound Level Meter)

Inherent Weighted System Noise Level *- in accordance with IEC 61672-3 (10.1, 10.2)*	*-Complies*
Acoustical Signal Tests of Frequency Weightings *- in accordance with IEC 61672-3 (11.1, 11.8)*	*- Not Complies at 8Khz*
Electrical Signal Tests of Frequency Weightings *- in accordance with IEC 61672-3 (12.1)*	*- Not Complies at 8Khz*
Frequency and Time Weightings *- in accordance with IEC 61672-3 (13.1, 13.3)*	*-Complies*
Level Linearity *- in accordance with IEC 61672-3 (14.1)*	*-Complies*
Level Linearity Including Range Control *- in accordance with IEC 61672-3 (15.1)*	*-N/A*
Tone Burst Response *- in accordance with IEC 61672-3 (16.5, 16.6, 16.7)*	*-Complies*
Peak C Sound Level *- in accordance with IEC 61672-3 (17.1)*	*-Complies*
Overload Indication *- in accordance with IEC 61672-3 (18.1)*	*-Complies*

(Tests marked N/A indicates the sound level meter does not have this function)

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ **fa72129**

David Jenkins/Yan Wu

TEST APPARATUS

USAGE	*TYPE*	*Calibration Date*
Signal Source	*HP 3314A Function Generator* *Serial Number: 2505A04840*	*N/A*
	Brüel & Kjær Type 1022 BFO *Serial Number: 443540*	*N/A*
RMS Voltmeter	*Solartron Type 7151* *Serial Number: 200 556*	*13 Jan 17*
Frequency Meter	*Racal Dana Type 1991* *Serial Number: 4893*	*16 Jan 17*
Acoustic Calibrator	*Brüel & Kjær Type 4231* *Serial Number: 2292723*	*12 Jul 17*
Signal Source	*HP 3314A Function Generator* *Serial Number: 2505A04840*	*N/A*
Calibration dates are represented to show traceability. Instruments marked "N/A" either do not require calibration or are used as indication only.		

DUT Condition: *An initial inspection shows no visible damage. Unit is in good condition.*

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ ***fa72129***

David Jenkins/Yan Wu

SOUND LEVEL METER CALIBRATION

Method Reference: *SLM Procedure LI8018-7.doc*

Start of test
Environmental Conditions:

Barometric Pressure at time of testing:	*1009mb*
Temperature at time of testing:	*27.5°C*
Relative Humidity at time of testing:	*35%*

Reference Sound Pressure Level
Sound level pressure was checked and adjusted at the start of the test with a Bruel & Kjaer 4231 (94.0 dB @ 1000 Hz) acoustic calibrator.

INHERENT WEIGHT SYSTEM NOISE LEVEL

Internal Electrical Noise (with dummy microphone)

"A" Weighting = 6.3 dBA

"C" Weighting = 6.1 dBC

"Lin" Weighting = 12.5 dB

System Noise (with microphone)
Microphone Model: *40CD* ***S/N:*** *181918*
Preamp Model: *PRE22* ***S/N:*** *1610396*

"A" Weighting = 15.4 dBA

Class 1 Sound Level Meter Settings:

1) *Time weighting = Slow*
2) *Range 0 – 50*
3) *Time Averaging Leq >=30 Seconds*

Testing Officer: ______________________

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Approved Signatory: ______________________ ***fa72129***

David Jenkins/Yan Wu

Acoustical Signal Tests of Frequency Weightings

A Weighting Response Electrostatic Actuator Test									
Freq (Hz)	Mic actuator Response (dB)	Applied Voltage (V)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
125	0.0	30.547	70.0	70.1	0.1	1.5	-1.5		0.20
1000	0.00	4.786	70.0	70.0	0.0	-	-		0.20
8000	3.2	7.852	70.0	65.7	-4.3	2.1	-3.1	*	0.20

C Weighting Response. Electrostatic Actuator Test									
Freq (Hz)	Mic actuator Response (dB)	Applied Voltage (V)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
125	0.0	4.622	70.0	70.1	0.1	1.5	-1.5		0.20
1000	0.00	4.517	70.0	70.0	0.0	-	-		0.20
8000	3.2	9.223	70.0	65.9	-4.1	2.1	-3.1	*	0.20

Class 1 Sound Level Meter Settings: Fast Time Weighting.

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ ***fa72129***

David Jenkins/Yan Wu

Electrical Signal Tests of Frequency Weightings

A Weighting Response

Freq (Hz)	A Weighting Resp. (dB)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
63	26.2	113.557	75.0	75.2	-0.2	1.5	-1.5		0.20
125	16.1	35.499	75.0	75.2	0.2	1.5	-1.5		0.20
250	8.6	14.970	75.0	75.1	0.1	1.4	-1.4		0.20
500	3.2	8.039	75.0	75.1	0.1	1.4	-1.4		0.20
1000	0.0 Ref	5.562	75.0	75.0	0.0	-	-		0.20
2000	-1.2	4.844	75.0	74.6	-0.4	1.6	-1.6		0.20
4000	-1	4.957	75.0	74.3	-0.7	1.6	-1.6		0.20
8000	1.1	6.313	75.0	70.5	-4.5	2.1	-3.1	*	0.20
12500	4.3	9.125	75.0	71.4	-3.6	3.0	-6.0		0.20
16000	6.6	11.891	75.0	70.3	-4.7	3.5	-17.0		0.20

C Weighting Response.

Freq (Hz)	C Weighting Resp. (dB)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
63	0.8	6.063	75.0	75.0	0.0	1.5	-1.5		0.20
125	0.2	5.658	75.0	75.2	0.2	1.5	-1.5		0.20
250	0.0	5.530	75.0	75.2	0.2	1.4	-1.4		0.20
500	0.0	5.530	75.0	75.1	0.1	1.4	-1.4		0.20
1000	0.0 Ref	5.530	75.0	75.0	0.0	-	-		0.20
2000	0.2	5.658	75.0	74.6	-0.4	1.6	-1.6		0.20
4000	0.8	6.063	75.0	74.3	-0.7	1.6	-1.6		0.20
8000	3.0	7.811	75.0	70.4	-4.6	2.1	-3.1	*	0.20
12500	6.2	11.290	75.0	71.3	-3.7	3.0	-6.0		0.20
16000	8.5	14.713	75.0	70.2	-4.8	3.5	-17.0		0.20

Linear Weighting Response

Freq (Hz)	Lin Weighting Resp. (dB)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
63	0.0	5.307	75.0	75.1	0.1	1.5	-1.5		0.20
125	0.0	5.307	75.0	75.2	0.2	1.5	-1.5		0.20
250	0.0	5.307	75.0	75.2	0.2	1.4	-1.4		0.20
500	0.0	5.307	75.0	75.1	0.1	1.4	-1.4		0.20
1000	0.0 Ref	5.307	75.0	75.0	0.0	-	-		0.20
2000	0.0	5.307	75.0	74.6	-0.4	1.6	-1.6		0.20
4000	0.0	5.307	75.0	74.3	-0.7	1.6	-1.6		0.20
8000	0.0	5.307	75.0	70.9	-4.1	2.1	-3.1	*	0.20
12500	0.0	5.307	75.0	73.5	-1.5	3.0	-6.0		0.20
16000	0.0	5.307	75.0	75.5	0.5	3.5	-17.0		0.20

Class 1 Sound Level Meter Settings: Fast Time Weighting.

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________

David Jenkins/Yan Wu

fa72129

Frequency and Time Weightings @ 1000 Hz

Frequency Weightings @ 1000 Hz

A Weighting Response.
Fast Time Weighting

Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Expanded Uncert. (±dB)
1000	47.075	Ref 94.0	94.0	0.20

C Weighting Response.
Fast Time Weighting

Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
1000	47.075	94.0	94.0	0.0	0.4	-0.4		0.20

Lin Weighting Response.
Fast Time Weighting

Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
1000	47.075	94.0	4.0	-90.0	0.4	-0.4	*	0.20

Time Weightings @ 1000 Hz

A Weighting Response. Slow Time Weighting				
Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Expanded Uncert. (±dB)
1000	47.035	Ref 94.0	94.0	0.20

A Weighting Response. Fast Time Weighting								
Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
1000	47.034	94.0	94.0	0.0	0.3	-0.3		0.20

Class 1 Sound Level Meter Settings:

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ *fa72129*

David Jenkins/Yan Wu

Level Linearity On Reference Level Range

A Weighting Response

Freq (Hz)	Applied Voltage (mV)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
8000	5708.208	130.0	129.8	-0.2	1.1	-1.1		0.20
8000	5087.446	129.0	128.8	-0.2	1.1	-1.1		0.20
8000	4534.191	128.0	127.9	-0.1	1.1	-1.1		0.20
8000	4041.102	127.0	126.8	-0.2	1.1	-1.1		0.20
8000	3601.636	126.0	125.8	-0.2	1.1	-1.1		0.20
8000	3209.961	125.0	124.9	-0.1	1.1	-1.1		0.20
8000	1805.094	120.0	119.8	-0.2	1.1	-1.1		0.20
8000	1015.079	115.0	114.9	-0.1	1.1	-1.1		0.20
8000	570.821	110.0	109.9	-0.1	1.1	-1.1		0.20
8000	320.996	105.0	104.9	-0.1	1.1	-1.1		0.20
8000	180.509	100.0	100.0	0.0	1.1	-1.1		0.20
8000	101.508	95.0	95.0	0.0	1.1	-1.1		0.20
8000	57.082	90.0	90.0	0.0	1.1	-1.1		0.20
8000	32.100	85.0	85.0	0.0	1.1	-1.1		0.20
8000	18.051	80.0	80.0	0.0	-	-		0.20
8000	10.151	75.0	75.0	0.0	1.1	-1.1		0.20
8000	5.708	70.0	70.0	0.0	1.1	-1.1		0.20
8000	3.210	65.0	65.0	0.0	1.1	-1.1		0.20
8000	1.805	60.0	59.9	-0.1	1.1	-1.1		0.20
8000	1.015	55.0	54.9	-0.1	1.1	-1.1		0.20
8000	0.905	54.0	53.9	-0.1	1.1	-1.1		0.20
8000	0.806	53.0	52.9	-0.1	1.1	-1.1		0.20
8000	0.719	52.0	51.8	-0.2	1.1	-1.1		0.20
8000	0.640	51.0	50.9	-0.1	1.1	-1.1		0.20
8000	0.571	50.0	49.8	-0.2	1.1	-1.1		0.20

Class 1 Sound Level Meter Settings:

1) *Fast Time Weighting*

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________

David Jenkins/Yan Wu

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Tone Burst Response @ 4000 Hz

A Weighting Response.
Fast Time Weighting

Duration (ms)	Frequency (Hz)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont. Ref	4000	120.0	120.0	0.0	-	-		0.20
200	4000	119.0	119.0	0.0	0.8	-0.8		0.20
2	4000	102.0	101.9	-0.1	1.3	-1.8		0.20
0.25	4000	93.0	92.8	-0.2	1.3	-3.3		0.20

A Weighting Response.
Slow Time Weighting

Duration (ms)	Frequency (Hz)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont. Ref	4000	120.0	120.0	0.0	-	-		0.20
200	4000	112.6	112.6	0.0	0.8	-0.8		0.20
2	4000	93.0	93.0	0.0	1.3	-3.3		0.20

Class 1 Sound Level Meter Settings:

1) *Lmax*

A Weighting Response.
Sound Exposure Level

Duration (ms)	Frequency (Hz)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont. Ref	4000	120.0	120.0	0.0	-	-		0.20
200	4000	113.0	113.0	0.0	0.8	-0.8		0.20
2	4000	93.0	92.9	-0.1	1.3	-1.8		0.20
0.25	4000	84.0	83.8	-0.2	1.3	-3.3		0.20

Class 1 Sound Level Meter Settings:

1) *Sel or LAE*

Testing Officer: ____________________

Firezewed Antachew

Approved Signatory: ____________________ *fa72129*

David Jenkins/Yan Wu

Peak C Sound Level @ 8000 Hz

C Weighting Response. Fast Time Weighting								
Number Of Cycles	Frequency (Hz)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont.Ref	8000	122.0	122.0	0.0	-	-		0.20
1	8000	125.4	126.8	1.4	2.4	-2.4		0.20

Peak C Sound Level @ 500 Hz

C Weighting Response. Fast Time Weighting								
Test Signal	Frequency (Hz)	Expected Reading (dB)	SLM Reading (dB)	Difference (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont.Ref	500	122.0	122.0	0.0	-	-		0.20
Neg. Half	500	124.4	125.4	1.0	1.4	-1.4		0.20
Pos. Half	500	124.4	125.4	1.0	1.4	-1.4		0.20

Class 1 Sound Level Meter Settings:

1) *Peak C Sound Level Only*
2) *Number of Cycles: 2*

Testing Officer: ______________________

Firezewed Antachew

Approved Signatory: ______________________ *fa72129*

David Jenkins/Yan Wu

Overload Indication @ 4000 Hz

A Weighting Response.							
Test Signal	Frequency (Hz)	SLM Reading at Overload (dB)	Difference Between Half Cycles (dB)	Class 1 Tolerance (dB)		Out Of Tolerance	Expanded Uncert. (±dB)
Cont Ref	4000	**137.7**					
Neg.	4000	137.6	-	-	-	-	0.20
Pos.	4000	137.6	0.0	1.8	-1.8		0.20

Class 1 Sound Level Meter Settings:

1) *LAFmax*
2) *Number of Cycles: 1999*

End of test

Environmental Conditions:

Barometric Pressure at time of testing:	*1007 mb*
Temperature at time of testing:	*27.5°C*
Relative Humidity at time of testing:	*41%*

Testing Officer: ______________________

Firezewell Antachew

Approved Signatory: ______________________ **fa72129**

David Jenkins/Yan Wu

Calibration Report on:

DUO

Class 1 Sound Level Meter

Model: *01dB-Cube*

Serial Number : *10824*

Accredited Laboratory Number: 676

Accredited for compliance with ISO/IEC 17025

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NATA

TESTING OFFICER: ______________________

NATA SIGNATORY: ______________________

Report number:fa74166
Date: 24/07/2018

DOCUMENT CONTROL

NATA Report Number: 74166-cal-01

Calibration Report on:

DUO

***Model:** 74166*

Class 1 Precision Integrating Sound Level Meter

***Serial Number:** 10824*

***Submission Date:** 24 Jul 2018*

File: fa74166 ***Report Code: 86***

Prepared For:	***Prepared by:***
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Author: .... ***Date*** 24/7/18

F.Antachew

Reviewed by: .... ***Date*** 25/7/18

David Jenkins/Yan Wu

Revision History:

Issue No.	***Date Issued***	***Reason/Comments***
1	*24-Jul-18*	*Original*

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1	*1*	*AECOM*	
2	*1*	*Vipac Melb. Library*	-

Key Words: *Calibration, Class 1 Sound Level Meter*

FILTER CALIBRATION REPORT

Device compliance:
1/1 octave-band filter, class 1, IEC 1260:1995.
1/3 octave-band filter has not passed calibration for any class; class 1 limits are listed.

1. SCOPE OF CALIBRATION

1.1. Insertion Loss.
- in accordance with AS/NZS 4476:1997 and IEC 1260

1.2. Attenuation in the Pass Band.
- in accordance with AS/NZS 4476:1997 and IEC 1260

1.3. Attenuation outside the Pass Band.
- in accordance with AS/NZS 4476:1997 and IEC 1260

The results presented in this report were obtained through the implementation of test procedures outlined in Vipac's instruction "SLM Filter Procedure for Resweep, Procedure No.P39-037-Rev 2".

TESTING OFFICER: ______________________

NATA SIGNATORY: ______________________

2. TEST APPARATUS

2.1. Signal Source:	HP 3314A Function Generator Serial Number: 2505A04840
2.2. RMS Voltmeter:	Solartron 7151 Computing Multimeter Serial Number: 200556
2.3. Frequency Meter:	Racal-Dana 1991 Universal Counter Serial Number: 4893

The signal source is connected to the direct input of the filter set.
The applied level and frequency are measured at this point.

3. ENVIRONMENTAL CONDITIONS

Barometric Pressure at time of testing:	*1005*
Temperature at time of testing:	*20.5*
Relative Humidity at time of testing:	*42*

4.1 1/1 OCTAVE FILTER SET

(filter class 1 limits displayed)

4.1.1 31.25 Hz Centre Frequency. (V0 = 9.348E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
2	0.9059	119.73	43.2	76.53	76.5	70.00 ≤ A	
3.9	0.8995	119.67	51.3	68.37	68.4	61.00 ≤ A	
7.81	0.911	119.78	63.5	56.28	56.3	42.00 ≤ A	
15.61	0.9136	119.8	94.2	25.6	25.6	17.50 ≤ A	
22.11	0.916	119.82	116.5	3.32	3.3	2.00 ≤ A ≤ 5.00	
24.11	0.9163	119.83	119.5	0.33	0.3	-0.30 ≤ A ≤ 1.30	
26.31	0.9165	119.83	119.8	0.03	0	-0.30 ≤ A ≤ 0.60	
28.71	0.9167	119.83	120	-0.17	-0.2	-0.30 ≤ A ≤ 0.40	
31.24	0.9348	120	120	0	0		
34.11	0.9173	119.84	120	-0.16	-0.2	-0.30 ≤ A ≤ 0.40	
37.21	0.9174	119.84	120	-0.16	-0.2	-0.30 ≤ A ≤ 0.60	
40.52	0.9175	119.84	119.8	0.04	0	-0.30 ≤ A ≤ 1.30	
44.22	0.9178	119.84	117.2	2.64	2.6	2.00 ≤ A ≤ 5.00	
62.53	0.9183	119.85	85.2	34.65	34.6	17.50 ≤ A	
125.04	0.9195	119.86	33.4	86.46	86.5	42.00 ≤ A	
249.97	0.9188	119.85	30.2	89.65	89.7	61.00 ≤ A	
499.93	0.9193	119.86	26.2	93.66	93.7	70.00 ≤ A	

4.1.2 62.5 Hz Centre Frequency. (V0 = 8.935E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
3.91	0.8956	120.02	43.2	76.82	76.8	70.00 ≤ A	
7.81	0.908	120.14	51.2	68.94	68.9	61.00 ≤ A	
15.61	0.9143	120.2	65	55.2	55.2	42.00 ≤ A	
31.31	0.9163	120.22	95.5	24.72	24.7	17.50 ≤ A	
44.22	0.9168	120.22	117	3.22	3.2	2.00 ≤ A ≤ 5.00	
48.22	0.9169	120.22	119.6	0.62	0.6	-0.30 ≤ A ≤ 1.30	
52.62	0.917	120.23	120.2	0.03	0	-0.30 ≤ A ≤ 0.60	
57.32	0.9172	120.23	120.2	0.03	0	-0.30 ≤ A ≤ 0.40	
62.59	0.9356	120.4	120.4	0	0		
68.22	0.9175	120.23	120.2	0.03	0	-0.30 ≤ A ≤ 0.40	
74.33	0.9176	120.23	120.2	0.03	0	-0.30 ≤ A ≤ 0.60	
81.12	0.9176	120.23	120	0.23	0.2	-0.30 ≤ A ≤ 1.30	
88.42	0.9178	120.23	117.2	3.03	3	2.00 ≤ A ≤ 5.00	
125.02	0.9184	120.24	85.4	34.84	34.8	17.50 ≤ A	
250.02	0.9177	120.23	39.7	80.53	80.5	42.00 ≤ A	
500.01	0.9182	120.24	36.4	83.84	83.8	61.00 ≤ A	
999.85	0.919	120.24	34.5	85.74	85.7	70.00 ≤ A	

4.1.3 125 Hz Centre Frequency. (V0 = 8.842E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
7.81	0.9104	120.25	45.3	74.95	75	70.00 ≤ A	
15.61	0.9155	120.3	51.6	68.7	68.7	61.00 ≤ A	
31.31	0.9155	120.3	67.2	53.1	53.1	42.00 ≤ A	
62.52	0.9165	120.31	95.3	25.01	25	17.50 ≤ A	
88.42	0.9171	120.32	117.2	3.12	3.1	2.00 ≤ A ≤ 5.00	
96.42	0.9173	120.32	119.8	0.52	0.5	-0.30 ≤ A ≤ 1.30	
105.13	0.9175	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.60	
114.63	0.9176	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.40	
125.18	0.9365	120.5	120.5	0	0		
136.33	0.9179	120.33	120.3	0.03	0	-0.30 ≤ A ≤ 0.40	
148.73	0.918	120.33	120.3	0.03	0	-0.30 ≤ A ≤ 0.60	
162.13	0.9182	120.33	120.1	0.23	0.2	-0.30 ≤ A ≤ 1.30	
176.81	0.9185	120.33	117.5	2.83	2.8	2.00 ≤ A ≤ 5.00	
250.07	0.9171	120.32	85.5	34.82	34.8	17.50 ≤ A	
500.12	0.9176	120.32	34.2	86.12	86.1	42.00 ≤ A	
1000.04	0.9182	120.33	32.8	87.53	87.5	61.00 ≤ A	
1981.52	0.9161	120.31	32.1	88.21	88.2	70.00 ≤ A	

4.1.4 250 Hz Centre Frequency. (V0 = 8.836E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
15.62	0.9141	120.29	43.5	76.79	76.8	70.00 ≤ A	
31.31	0.9154	120.31	51.2	69.11	69.1	61.00 ≤ A	
62.52	0.9163	120.32	67.3	53.02	53	42.00 ≤ A	
125.04	0.9176	120.33	95.4	24.93	24.9	17.50 ≤ A	
176.84	0.9183	120.33	117.2	3.13	3.1	2.00 ≤ A ≤ 5.00	
192.82	0.9185	120.34	119.9	0.44	0.4	-0.30 ≤ A ≤ 1.30	
209.97	0.9168	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.60	
228.97	0.9169	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.40	
250.01	0.9359	120.5	120.5	0	0		
271.96	0.917	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.40	
296.95	0.917	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.60	
323.94	0.9171	120.32	120.1	0.22	0.2	-0.30 ≤ A ≤ 1.30	
352.95	0.9172	120.32	117.2	3.12	3.1	2.00 ≤ A ≤ 5.00	
499.94	0.9175	120.33	85.4	34.93	34.9	17.50 ≤ A	
999.69	0.9182	120.33	33.6	86.73	86.7	42.00 ≤ A	
1980.89	0.916	120.31	33.7	86.61	86.6	61.00 ≤ A	
3972.8	0.915	120.3	33.1	87.2	87.2	70.00 ≤ A	

4.1.5 500 Hz Centre Frequency. (V0 = 8.838E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
31.31	0.9151	120.3	44.2	76.1	76.1	70.00 ≤ A	
62.53	0.916	120.31	50.4	69.91	69.9	61.00 ≤ A	
125.05	0.9171	120.32	67.3	53.02	53	42.00 ≤ A	
250.02	0.9164	120.31	95.4	24.91	24.9	17.50 ≤ A	
353.01	0.9167	120.32	117.2	3.12	3.1	2.00 ≤ A ≤ 5.00	
385	0.9168	120.32	120.1	0.22	0.2	-0.30 ≤ A ≤ 1.30	
420.04	0.9169	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.60	
458.04	0.9169	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.40	
500.03	0.9362	120.5	120.5	0	0		
545.02	0.917	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.40	
594.01	0.9171	120.32	120.3	0.02	0	-0.30 ≤ A ≤ 0.60	
648	0.9172	120.32	120.1	0.22	0.2	-0.30 ≤ A ≤ 1.30	
706.99	0.9173	120.32	117.3	3.02	3	2.00 ≤ A ≤ 5.00	
999.91	0.9176	120.33	85.4	34.93	34.9	17.50 ≤ A	
1980.48	0.9155	120.31	32.9	87.41	87.4	42.00 ≤ A	
3972.12	0.9145	120.3	32.8	87.5	87.5	61.00 ≤ A	
7978.09	0.9129	120.28	30.5	89.78	89.8	70.00 ≤ A	

4.1.6 1000 Hz Centre Frequency. (V0 = 9.050E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
62.53	0.9157	120.1	42.5	77.6	77.6	70.00 ≤ A	
125.05	0.9169	120.11	50.6	69.51	69.5	61.00 ≤ A	
249.99	0.9163	120.11	67.3	52.81	52.8	42.00 ≤ A	
499.96	0.9168	120.11	95.4	24.71	24.7	17.50 ≤ A	
706.91	0.9171	120.12	117.2	2.92	2.9	2.00 ≤ A ≤ 5.00	
770.91	0.9173	120.12	119.8	0.32	0.3	-0.30 ≤ A ≤ 1.30	
839.83	0.9172	120.12	120.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.60	
916.82	0.9173	120.12	120.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
999.97	0.9368	120.3	120.3	0	0		
1089.84	0.9175	120.12	120.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
1188.85	0.9176	120.12	120.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.60	
1295.85	0.9178	120.12	119.9	0.22	0.2	-0.30 ≤ A ≤ 1.30	
1413.88	0.9179	120.12	117.2	2.92	2.9	2.00 ≤ A ≤ 5.00	
1981.44	0.9154	120.1	85.4	34.7	34.7	17.50 ≤ A	
3974.1	0.9144	120.09	34.2	85.89	85.9	42.00 ≤ A	
7982.26	0.9126	120.07	33.4	86.67	86.7	61.00 ≤ A	
16121.32	0.9088	120.04	32.1	87.94	87.9	70.00 ≤ A	

4.1.7 2000 Hz Centre Frequency. (V0 = 9.454E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
125.05	0.9166	119.73	42.5	77.23	77.2	70.00 ≤ A	
250.09	0.9161	119.73	50	69.73	69.7	61.00 ≤ A	
500.14	0.9166	119.73	65.3	54.43	54.4	42.00 ≤ A	
1000.16	0.9172	119.74	95.4	24.34	24.3	17.50 ≤ A	
1414.37	0.9176	119.74	117	2.74	2.7	2.00 ≤ A ≤ 5.00	
1542.48	0.9177	119.74	119.6	0.14	0.1	-0.30 ≤ A ≤ 1.30	
1681.59	0.9178	119.74	119.8	-0.06	-0.1	-0.30 ≤ A ≤ 0.60	
1834.59	0.918	119.74	119.8	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
1981.7	0.9346	119.9	119.9	0	0		
2160.26	0.915	119.72	119.8	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
2348.08	0.9149	119.71	119.6	0.11	0.1	-0.30 ≤ A ≤ 0.60	
2566.98	0.9148	119.71	119.5	0.21	0.2	-0.30 ≤ A ≤ 1.30	
2795.79	0.9146	119.71	117.2	2.51	2.5	2.00 ≤ A ≤ 5.00	
3972.27	0.9142	119.71	85.4	34.31	34.3	17.50 ≤ A	
7978.75	0.9124	119.69	35.9	83.79	83.8	42.00 ≤ A	
16115.04	0.9086	119.65	34.9	84.75	84.8	61.00 ≤ A	
32011.16	0.9176	119.74	30.4	89.34	89.3	70.00 ≤ A	

4.1.8 4000 Hz Centre Frequency. (V0 = 9.774E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
250.08	0.916	119.44	44.1	75.34	75.3	70.00 ≤ A	
500.14	0.9163	119.44	49.5	69.94	69.9	61.00 ≤ A	
1000.12	0.9169	119.45	66.4	53.05	53	42.00 ≤ A	
1980.37	0.9148	119.43	94.5	24.93	24.9	17.50 ≤ A	
2795.79	0.9144	119.42	115.9	3.52	3.5	2.00 ≤ A ≤ 5.00	
3054.69	0.9143	119.42	119.2	0.22	0.2	-0.30 ≤ A ≤ 1.30	
3333.57	0.9141	119.42	119.4	0.02	0	-0.30 ≤ A ≤ 0.60	
3632.58	0.914	119.42	119.5	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
3974.89	0.9334	119.6	119.6	0	0		
4331.25	0.9138	119.42	119.5	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
4720.74	0.9135	119.41	119.4	0.01	0	-0.30 ≤ A ≤ 0.60	
5150.51	0.9134	119.41	119.2	0.21	0.2	-0.30 ≤ A ≤ 1.30	
5620.68	0.9132	119.41	116.5	2.91	2.9	2.00 ≤ A ≤ 5.00	
7978.57	0.912	119.4	81.6	37.8	37.8	17.50 ≤ A	
16115.02	0.9083	119.36	37.9	81.46	81.5	42.00 ≤ A	
32010.6	0.9173	119.45	38.9	80.55	80.5	61.00 ≤ A	
64004.1	0.9197	119.47	42.5	76.97	77	70.00 ≤ A	

4.1.9 8000 Hz Centre Frequency. (V0 = 1.426E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
500.12	0.9163	116.16	42.5	73.66	73.7	70.00 ≤ A	
1000.06	0.9169	116.16	48.2	67.96	68	61.00 ≤ A	
1981.32	0.9148	116.14	65.4	50.74	50.7	42.00 ≤ A	
3973.94	0.9138	116.13	93.4	22.73	22.7	17.50 ≤ A	
5623.22	0.9131	116.13	114	2.13	2.1	2.00 ≤ A ≤ 5.00	
6134.08	0.9127	116.12	116	0.12	0.1	-0.30 ≤ A ≤ 1.30	
6695.92	0.9126	116.12	116.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.60	
7308.78	0.9123	116.12	116.2	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
7984.86	0.9315	116.3	116.3	0	0		
8708.01	0.9116	116.11	116.2	-0.09	-0.1	-0.30 ≤ A ≤ 0.40	
9505.93	0.9112	116.11	116.2	-0.09	-0.1	-0.30 ≤ A ≤ 0.60	
10376.51	0.9109	116.11	116.2	-0.09	-0.1	-0.30 ≤ A ≤ 1.30	
11330.15	0.9104	116.1	114.1	2	2	2.00 ≤ A ≤ 5.00	
16121.92	0.9082	116.08	85.4	30.68	30.7	17.50 ≤ A	
32009.37	0.9173	116.17	45.6	70.57	70.6	42.00 ≤ A	
64001.72	0.9195	116.19	45.2	70.99	71	61.00 ≤ A	
127994.77	0.9211	116.2	43.2	73	73	70.00 ≤ A	

4.1.10 16000 Hz Centre Frequency. (V0 = 8.454E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
1000.06	0.909	120.63	42.5	78.13	78.1	70.00 ≤ A	
1981.33	0.9069	120.61	54.3	66.31	66.3	61.00 ≤ A	
3973.91	0.9058	120.6	72.2	48.4	48.4	42.00 ≤ A	
7982.26	0.904	120.58	95.4	25.18	25.2	17.50 ≤ A	
11330.13	0.9025	120.57	116.5	4.07	4.1	2.00 ≤ A ≤ 5.00	
12367.38	0.9021	120.56	120.1	0.46	0.5	-0.30 ≤ A ≤ 1.30	
13509.58	0.9015	120.56	120.7	-0.14	-0.1	-0.30 ≤ A ≤ 0.60	
14757.82	0.9009	120.55	120.7	-0.15	-0.1	-0.30 ≤ A ≤ 0.40	
16134.97	0.9269	120.8	120.8	0	0		
17605.45	0.8996	120.54	120.7	-0.16	-0.2	-0.30 ≤ A ≤ 0.40	
19237.49	0.899	120.53	120.6	-0.07	-0.1	-0.30 ≤ A ≤ 0.60	
20710.29	0.9088	120.63	120.2	0.43	0.4	-0.30 ≤ A ≤ 1.30	
22610.23	0.9088	120.63	117.2	3.43	3.4	2.00 ≤ A ≤ 5.00	
32008.44	0.9092	120.63	64.3	56.33	56.3	17.50 ≤ A	
64001.31	0.9115	120.65	54.1	66.55	66.6	42.00 ≤ A	
127990.02	0.9131	120.67	56.4	64.27	64.3	61.00 ≤ A	
256003.75	0.9061	120.6	42.2	78.4	78.4	70.00 ≤ A	

TESTING OFFICER: ____________________

NATA SIGNATORY: ____________________

4.2 1/3 OCTAVE FILTER SET

(filter class 1 limits displayed)

4.2.1 19.686 Hz Centre Frequency. (V0 = 1.008E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
3.6	0.9608	119.58	40.3	79.28	79.3	70.00 ≤ A	
6.41	0.8775	118.8	53.4	65.4	65.4	61.00 ≤ A	
10.41	0.9084	119.1	64.3	54.8	54.8	42.00 ≤ A	
15.21	0.9121	119.13	90.3	28.83	28.8	17.50 ≤ A	
17.51	0.9131	119.14	116.1	3.04	3	2.00 ≤ A ≤ 5.00	
18.11	0.913	119.14	119.1	0.04	0	-0.30 ≤ A ≤ 1.30	
18.61	0.913	119.14	119.1	0.04	0	-0.30 ≤ A ≤ 0.60	
19.21	0.9133	119.14	119.2	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
19.71	0.9299	119.3	119.3	0	0		
20.21	0.9125	119.14	119.2	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
20.81	0.9128	119.14	119.2	-0.06	-0.1	-0.30 ≤ A ≤ 0.60	
21.41	0.9127	119.14	119	0.14	0.1	-0.30 ≤ A ≤ 1.30	
22.11	0.9128	119.14	116.2	2.94	2.9	2.00 ≤ A ≤ 5.00	
25.51	0.9129	119.14	90.3	28.84	28.8	17.50 ≤ A	
37.12	0.9137	119.15	55.3	63.85	63.8	42.00 ≤ A	
60.44	0.9145	119.15	26.3	92.85	92.9	61.00 ≤ A	
107.06	0.9154	119.16	17.2	101.96	102	70.00 ≤ A	

4.2.2 24.803 Hz Centre Frequency. (V0 = 9.623E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
4.61	0.8654	119.08	42.3	76.78	76.8	70.00 ≤ A	
8.11	0.8959	119.38	58.6	60.78	60.8	61.00 ≤ A	*
13.11	0.9043	119.46	62.5	56.96	57	42.00 ≤ A	
19.11	0.9058	119.47	90.5	28.97	29	17.50 ≤ A	
22.1	0.9051	119.47	115.9	3.57	3.6	2.00 ≤ A ≤ 5.00	
22.8	0.9049	119.47	119.3	0.17	0.2	-0.30 ≤ A ≤ 1.30	
23.5	0.9053	119.47	119.5	-0.03	0	-0.30 ≤ A ≤ 0.60	
24.2	0.9052	119.47	119.6	-0.13	-0.1	-0.30 ≤ A ≤ 0.40	
24.8	0.9296	119.7	119.7	0	0		
25.5	0.9052	119.47	119.6	-0.13	-0.1	-0.30 ≤ A ≤ 0.40	
26.2	0.9056	119.47	119.6	-0.13	-0.1	-0.30 ≤ A ≤ 0.60	
27	0.9056	119.47	119.2	0.27	0.3	-0.30 ≤ A ≤ 1.30	
27.8	0.9057	119.47	116.4	3.07	3.1	2.00 ≤ A ≤ 5.00	
32.1	0.9059	119.48	89.3	30.18	30.2	17.50 ≤ A	
46.81	0.9064	119.48	52.3	67.18	67.2	42.00 ≤ A	
76.11	0.907	119.49	26.5	92.99	93	61.00 ≤ A	
134.8	0.9081	119.5	24.5	95	95	70.00 ≤ A	

4.2.3 31.25 Hz Centre Frequency. (V0 = 9.409E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
5.81	0.9148	119.76	36.8	82.96	83	70.00 ≤ A	
10.21	0.9077	119.69	58.6	61.09	61.1	61.00 ≤ A	
16.61	0.9139	119.75	61.5	58.25	58.2	42.00 ≤ A	
24.1	0.913	119.74	90.6	29.14	29.1	17.50 ≤ A	
27.8	0.9136	119.74	115.9	3.84	3.8	2.00 ≤ A ≤ 5.00	
28.7	0.9135	119.74	119.3	0.44	0.4	-0.30 ≤ A ≤ 1.30	
29.6	0.9136	119.74	119.8	-0.06	-0.1	-0.30 ≤ A ≤ 0.60	
30.4	0.9137	119.75	119.8	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
31.2	0.9301	119.9	119.9	0	0		
32.1	0.9137	119.74	119.8	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
33	0.9137	119.75	119.8	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
34	0.9138	119.75	119.4	0.35	0.3	-0.30 ≤ A ≤ 1.30	
35.1	0.9139	119.75	115.9	3.85	3.8	2.00 ≤ A ≤ 5.00	
40.5	0.9141	119.75	88.3	31.45	31.4	17.50 ≤ A	
59.01	0.9145	119.75	48.5	71.25	71.3	42.00 ≤ A	
95.91	0.9152	119.76	24.9	94.86	94.9	61.00 ≤ A	
169.79	0.9163	119.77	28.9	90.87	90.9	70.00 ≤ A	

4.2.4 39.373 Hz Centre Frequency. (V0 = 9.093E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
7.21	0.8952	119.86	43.2	76.66	76.7	70.00 ≤ A	
12.81	0.912	120.03	59.1	60.93	60.9	61.00 ≤ A	*
20.91	0.9128	120.03	61.9	58.13	58.1	42.00 ≤ A	
30.41	0.9137	120.04	92.1	27.94	27.9	17.50 ≤ A	
35.12	0.914	120.04	116.5	3.54	3.5	2.00 ≤ A ≤ 5.00	
36.22	0.914	120.04	119.8	0.24	0.2	-0.30 ≤ A ≤ 1.30	
37.32	0.914	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.60	
38.32	0.9141	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.40	
39.3	0.9305	120.2	120.2	0	0		
40.42	0.9142	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.40	
41.62	0.9142	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.60	
42.82	0.9142	120.05	119.6	0.45	0.4	-0.30 ≤ A ≤ 1.30	
44.23	0.9143	120.05	115.9	4.15	4.1	2.00 ≤ A ≤ 5.00	
51.03	0.9145	120.05	87.4	32.65	32.6	17.50 ≤ A	
74.34	0.915	120.05	39.9	80.15	80.2	42.00 ≤ A	
120.96	0.9157	120.06	25.6	94.46	94.5	61.00 ≤ A	
214.08	0.9151	120.06	23.5	96.56	96.6	70.00 ≤ A	

TESTING OFFICER: ______________________

NATA SIGNATORY: ______________________

4.2.5 49.606 Hz Centre Frequency. (V0 = 9.094E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
9.11	0.9049	119.96	43.5	76.46	76.5	70.00 ≤ A	
16.22	0.912	120.02	58.9	61.12	61.1	61.00 ≤ A	
26.31	0.9134	120.04	60.6	59.44	59.4	42.00 ≤ A	
38.32	0.9141	120.04	91.6	28.44	28.4	17.50 ≤ A	
44.23	0.9143	120.05	116.8	3.25	3.2	2.00 ≤ A ≤ 5.00	
45.63	0.9143	120.05	119.7	0.35	0.3	-0.30 ≤ A ≤ 1.30	
47.03	0.9144	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
48.33	0.9144	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
49.61	0.9306	120.2	120.2	0	0		
50.93	0.9146	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
52.43	0.9145	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
54.03	0.9145	120.05	119.6	0.45	0.4	-0.30 ≤ A ≤ 1.30	
55.73	0.9147	120.05	89.6	30.45	30.4	2.00 ≤ A ≤ 5.00	*
64.34	0.9148	120.05	89.6	30.45	30.5	17.50 ≤ A	
93.65	0.9154	120.06	52.6	67.46	67.5	42.00 ≤ A	
152.37	0.9163	120.07	37.1	82.97	83	61.00 ≤ A	
268.97	0.9153	120.06	34.5	85.56	85.6	70.00 ≤ A	

4.2.6 62.5 Hz Centre Frequency. (V0 = 8.993E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
11.51	0.9085	120.09	42.2	77.89	77.9	70.00 ≤ A	
20.41	0.9128	120.13	63.2	56.93	56.9	61.00 ≤ A	*
33.11	0.9139	120.14	60.5	59.64	59.6	42.00 ≤ A	
48.23	0.9145	120.15	91.5	28.65	28.6	17.50 ≤ A	
55.73	0.9147	120.15	116.8	3.35	3.3	2.00 ≤ A ≤ 5.00	
57.53	0.9147	120.15	119.8	0.35	0.3	-0.30 ≤ A ≤ 1.30	
59.23	0.9148	120.15	120.1	0.05	0	-0.30 ≤ A ≤ 0.60	
60.93	0.9147	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
62.52	0.9309	120.3	120.3	0	0		
64.24	0.9148	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
66.04	0.9148	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
68.04	0.9149	120.15	119.8	0.35	0.3	-0.30 ≤ A ≤ 1.30	
70.24	0.9149	120.15	116.2	3.95	3.9	2.00 ≤ A ≤ 5.00	
81.04	0.9151	120.15	88.7	31.45	31.5	17.50 ≤ A	
117.96	0.9159	120.16	48.6	71.56	71.6	42.00 ≤ A	
191.85	0.9168	120.17	25.6	94.57	94.6	61.00 ≤ A	
338.93	0.9154	120.15	23.6	96.55	96.6	70.00 ≤ A	

4.2.7 78.745 Hz Centre Frequency. (V0 = 8.996E-7 Vrms)

Frequency (Hz)	*Volts In (Vrms)*	*Level In (dB)*	*Level Out (dB)*	*Abs. Atten. (dB)*	*A = Rel. Atten. (dB)*	*Limits (dB)*	*Outside tolerance*
14.51	0.9109	120.11	42.3	77.81	77.8	70.00 ≤ A	
25.71	0.9134	120.13	63.5	56.63	56.6	61.00 ≤ A	*
41.72	0.9142	120.14	61.5	58.64	58.6	42.00 ≤ A	
60.83	0.9148	120.15	92.5	27.65	27.6	17.50 ≤ A	
70.24	0.9151	120.15	117.2	2.95	2.9	2.00 ≤ A ≤ 5.00	
72.44	0.9151	120.15	120	0.15	0.1	-0.30 ≤ A ≤ 1.30	
74.64	0.915	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
76.74	0.9151	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
78.72	0.9312	120.3	120.3	0	0		
80.94	0.9152	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
83.14	0.9152	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
85.74	0.9152	120.15	119.8	0.35	0.3	-0.30 ≤ A ≤ 1.30	
88.44	0.9153	120.15	116.3	3.85	3.9	2.00 ≤ A ≤ 5.00	
102.05	0.9155	120.15	87.4	32.75	32.8	17.50 ≤ A	
148.66	0.9162	120.16	40.3	79.86	79.9	42.00 ≤ A	
241.07	0.9153	120.15	28.4	91.75	91.8	61.00 ≤ A	
428.12	0.9157	120.15	26.5	93.65	93.7	70.00 ≤ A	

4.2.8 99.213 Hz Centre Frequency. (V0 = 8.898E-7 Vrms)

Frequency (Hz)	*Volts In (Vrms)*	*Level In (dB)*	*Level Out (dB)*	*Abs. Atten. (dB)*	*A = Rel. Atten. (dB)*	*Limits (dB)*	*Outside tolerance*
18.31	0.9131	120.22	42.3	77.92	77.9	70.00 ≤ A	
32.31	0.9139	120.23	63.5	56.73	56.7	61.00 ≤ A	*
52.63	0.9145	120.24	59.9	60.34	60.3	42.00 ≤ A	
76.64	0.915	120.24	91.6	28.64	28.6	17.50 ≤ A	
88.44	0.9152	120.24	117	3.24	3.2	2.00 ≤ A ≤ 5.00	
91.24	0.9154	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
94.04	0.9154	120.25	120.2	0.05	0	-0.30 ≤ A ≤ 0.60	
96.64	0.9155	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
99.22	0.9318	120.4	120.4	0	0		
101.95	0.9156	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
104.85	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
107.95	0.9156	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
111.45	0.9157	120.25	116.5	3.75	3.7	2.00 ≤ A ≤ 5.00	
128.56	0.9159	120.25	89.6	30.65	30.7	17.50 ≤ A	
187.25	0.9168	120.26	52.3	67.96	68	42.00 ≤ A	
304.07	0.9153	120.25	32.6	87.65	87.6	61.00 ≤ A	
539.11	0.9157	120.25	24.3	95.95	95.9	70.00 ≤ A	

4.2.9 125 Hz Centre Frequency. (V0 = 8.902E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
23.01	0.9133	120.22	41.2	79.02	79	70.00 ≤ A	
40.72	0.9142	120.23	64.2	56.03	56	61.00 ≤ A	*
66.24	0.9149	120.24	60.2	60.04	60	42.00 ≤ A	
96.55	0.9154	120.24	91.8	28.44	28.4	17.50 ≤ A	
111.46	0.9157	120.25	116.8	3.45	3.4	2.00 ≤ A ≤ 5.00	
114.96	0.9158	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
118.46	0.9158	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
121.76	0.9158	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
125.03	0.9321	120.4	120.4	0	0		
128.36	0.9159	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
132.06	0.916	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
136.06	0.916	120.25	119.8	0.45	0.4	-0.30 ≤ A ≤ 1.30	
140.37	0.916	120.25	116.5	3.75	3.7	2.00 ≤ A ≤ 5.00	
162.07	0.9163	120.25	88.6	31.65	31.7	17.50 ≤ A	
234.95	0.9151	120.24	49.2	71.04	71	42.00 ≤ A	
382.9	0.9154	120.24	27.5	92.74	92.7	61.00 ≤ A	
678.78	0.9159	120.25	23.5	96.75	96.7	70.00 ≤ A	

4.2.10 157.49 Hz Centre Frequency. (V0 = 8.906E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
29.01	0.9137	120.22	41.3	78.92	78.9	70.00 ≤ A	
51.33	0.9145	120.23	63.5	56.73	56.7	61.00 ≤ A	*
83.54	0.9153	120.24	61.5	58.74	58.7	42.00 ≤ A	
121.66	0.9158	120.24	92.5	27.74	27.7	17.50 ≤ A	
140.37	0.9161	120.25	117.1	3.15	3.1	2.00 ≤ A ≤ 5.00	
144.87	0.9162	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 1.30	
149.17	0.9163	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
153.47	0.9163	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
157.43	0.9325	120.4	120.4	0	0		
161.77	0.9163	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
166.37	0.9165	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
171.37	0.9166	120.25	119.8	0.45	0.5	-0.30 ≤ A ≤ 1.30	
176.86	0.9166	120.25	116.5	3.75	3.8	2.00 ≤ A ≤ 5.00	
204.05	0.9151	120.24	87.6	32.64	32.6	17.50 ≤ A	
297.07	0.9154	120.24	40.6	79.64	79.6	42.00 ≤ A	
483.11	0.9157	120.24	32.5	87.74	87.7	61.00 ≤ A	
855	0.9161	120.25	29.5	90.75	90.7	70.00 ≤ A	

4.2.11 198.43 Hz Centre Frequency. (V0 = 8.809E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
36.52	0.914	120.32	40.3	80.02	80	70.00 ≤ A	
64.64	0.9148	120.33	64.3	56.03	56	61.00 ≤ A	*
105.26	0.9156	120.34	59.6	60.74	60.7	42.00 ≤ A	
153.27	0.9163	120.34	91.6	28.74	28.7	17.50 ≤ A	
176.88	0.9167	120.35	117.1	3.25	3.2	2.00 ≤ A ≤ 5.00	
182.47	0.9167	120.35	119.9	0.45	0.4	-0.30 ≤ A ≤ 1.30	
187.97	0.9168	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.60	
193.34	0.9168	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.40	
198.42	0.9331	120.5	120.5	0	0		
203.03	0.9151	120.33	120.3	0.03	0	-0.30 ≤ A ≤ 0.40	
209.03	0.9151	120.33	120.3	0.03	0	-0.30 ≤ A ≤ 0.60	
215.04	0.9151	120.33	120	0.33	0.3	-0.30 ≤ A ≤ 1.30	
222.04	0.9151	120.33	117.2	3.13	3.1	2.00 ≤ A ≤ 5.00	
257.07	0.9153	120.33	90.2	30.13	30.1	17.50 ≤ A	
374.07	0.9154	120.33	52.6	67.73	67.7	42.00 ≤ A	
609.1	0.9158	120.34	27.6	92.74	92.7	61.00 ≤ A	
1078.05	0.9163	120.34	26.5	93.84	93.8	70.00 ≤ A	

4.2.12 250 Hz Centre Frequency. (V0 = 8.895E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
46.03	0.9144	120.24	40.2	80.04	80	70.00 ≤ A	
81.44	0.9151	120.25	63.5	56.75	56.7	61.00 ≤ A	*
132.56	0.916	120.26	60.2	60.06	60.1	42.00 ≤ A	
193.05	0.9168	120.26	91.6	28.66	28.7	17.50 ≤ A	
222.03	0.9151	120.25	116.3	3.95	3.9	2.00 ≤ A ≤ 5.00	
229.04	0.9151	120.25	119.8	0.45	0.4	-0.30 ≤ A ≤ 1.30	
236.03	0.9151	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
243.05	0.9152	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
250	0.9315	120.4	120.4	0	0		
256.04	0.9152	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
264.04	0.9153	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
271.05	0.9153	120.25	120	0.25	0.2	-0.30 ≤ A ≤ 1.30	
280.05	0.9153	120.25	116.9	3.35	3.3	2.00 ≤ A ≤ 5.00	
323.06	0.9154	120.25	89.3	30.95	30.9	17.50 ≤ A	
471.1	0.9157	120.25	48.6	71.65	71.7	42.00 ≤ A	
767.05	0.916	120.25	33.4	86.85	86.9	61.00 ≤ A	
1358.07	0.9166	120.26	32.5	87.76	87.8	70.00 ≤ A	

4.2.13 314.98 Hz Centre Frequency. (V0 = 8.794E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
58.03	0.9148	120.34	37.4	82.94	82.9	70.00 ≤ A	
102.64	0.9156	120.35	63.5	56.85	56.9	61.00 ≤ A	*
166.95	0.9164	120.36	61.5	58.86	58.9	42.00 ≤ A	
243.12	0.9152	120.35	92.5	27.85	27.8	17.50 ≤ A	
280.13	0.9154	120.35	116.8	3.55	3.5	2.00 ≤ A ≤ 5.00	
289.13	0.9154	120.35	119.9	0.45	0.4	-0.30 ≤ A ≤ 1.30	
298.14	0.9154	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.60	
306.14	0.9154	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.40	
313.97	0.9315	120.5	120.5	0	0		
323.15	0.9154	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.40	
332.15	0.9154	120.35	120.3	0.05	0	-0.30 ≤ A ≤ 0.60	
342.16	0.9154	120.35	120	0.35	0.3	-0.30 ≤ A ≤ 1.30	
353.2	0.9155	120.35	116.8	3.55	3.5	2.00 ≤ A ≤ 5.00	
408.26	0.9156	120.35	87.5	32.85	32.9	17.50 ≤ A	
594.32	0.9159	120.35	40.5	79.85	79.9	42.00 ≤ A	
966.38	0.9163	120.36	28.3	92.06	92.1	61.00 ≤ A	
1712.03	0.917	120.36	26.5	93.86	93.9	70.00 ≤ A	

4.2.14 396.85 Hz Centre Frequency. (V0 = 8.897E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
73.03	0.9151	120.24	36.5	83.74	83.7	70.00 ≤ A	
129.34	0.916	120.25	63.7	56.55	56.6	61.00 ≤ A	*
209.99	0.9151	120.24	59.6	60.64	60.6	42.00 ≤ A	
305.97	0.9154	120.25	91.6	28.65	28.6	17.50 ≤ A	
352.97	0.9155	120.25	116.8	3.45	3.4	2.00 ≤ A ≤ 5.00	
363.96	0.9156	120.25	119.8	0.45	0.4	-0.30 ≤ A ≤ 1.30	
374.96	0.9156	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
385.95	0.9156	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
395.94	0.9316	120.4	120.4	0	0		
406.99	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
419	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
430.99	0.9157	120.25	120	0.25	0.3	-0.30 ≤ A ≤ 1.30	
444.99	0.9157	120.25	116.9	3.35	3.4	2.00 ≤ A ≤ 5.00	
513.96	0.9157	120.25	90	30.25	30.3	17.50 ≤ A	
747.88	0.9161	120.25	52.3	67.95	68	42.00 ≤ A	
1217.73	0.9166	120.26	28.6	91.66	91.7	61.00 ≤ A	
2129.8	0.9142	120.24	26.3	93.94	93.9	70.00 ≤ A	

4.2.15 500 Hz Centre Frequency. (V0 = 8.899E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
92.03	0.9154	120.24	35.3	84.94	84.9	70.00 ≤ A	
162.94	0.9165	120.26	64.1	56.16	56.2	61.00 ≤ A	*
264.97	0.9153	120.24	60.2	60.04	60	42.00 ≤ A	
384.93	0.9155	120.25	91.3	28.95	28.9	17.50 ≤ A	
444.95	0.9157	120.25	116.6	3.65	3.6	2.00 ≤ A ≤ 5.00	
458.96	0.9157	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
472.95	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
486.94	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
499.94	0.9319	120.4	120.4	0	0		
512.94	0.9158	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
527.93	0.9157	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
542.93	0.9158	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
560.93	0.9158	120.25	116.6	3.65	3.6	2.00 ≤ A ≤ 5.00	
646.89	0.916	120.25	89	31.25	31.3	17.50 ≤ A	
942.73	0.9162	120.25	48.2	72.05	72.1	42.00 ≤ A	
1533.76	0.9168	120.26	29.4	90.86	90.9	61.00 ≤ A	
2686.85	0.9138	120.23	26.4	93.83	93.8	70.00 ≤ A	

4.2.16 629.96 Hz Centre Frequency. (V0 = 8.901E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
115.94	0.9157	120.25	34.1	86.15	86.1	70.00 ≤ A	
204.98	0.9151	120.24	63.5	56.74	56.7	61.00 ≤ A	*
332.95	0.9154	120.24	61.3	58.94	58.9	42.00 ≤ A	
485.92	0.9157	120.25	92.4	27.85	27.8	17.50 ≤ A	
560.9	0.9158	120.25	116.9	3.35	3.3	2.00 ≤ A ≤ 5.00	
578.89	0.9159	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
595.87	0.9159	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
612.87	0.9159	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
628.87	0.9321	120.4	120.4	0	0		
645.85	0.9159	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
664.85	0.9159	120.25	120.3	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
684.84	0.916	120.25	119.9	0.35	0.3	-0.30 ≤ A ≤ 1.30	
706.83	0.9161	120.25	116.5	3.75	3.7	2.00 ≤ A ≤ 5.00	
815.73	0.9161	120.25	87.4	32.85	32.9	17.50 ≤ A	
1187.69	0.9165	120.25	40.2	80.05	80.1	42.00 ≤ A	
1932.82	0.9171	120.26	29.4	90.86	90.9	61.00 ≤ A	
3394	0.9133	120.22	26.4	93.82	93.8	70.00 ≤ A	

4.2.17 793.7 Hz Centre Frequency. (V0 = 8.903E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
146.04	0.9163	120.25	34.6	85.65	85.7	70.00 ≤ A	
257.96	0.9153	120.24	63.4	56.84	56.8	61.00 ≤ A	*
419.93	0.9155	120.24	59.8	60.44	60.4	42.00 ≤ A	
611.84	0.9159	120.25	91.5	28.75	28.7	17.50 ≤ A	
706.8	0.916	120.25	116.8	3.45	3.4	2.00 ≤ A ≤ 5.00	
728.79	0.916	120.25	119.8	0.45	0.4	-0.30 ≤ A ≤ 1.30	
750.79	0.916	120.25	120.2	0.05	0	-0.30 ≤ A ≤ 0.60	
772.78	0.9161	120.25	120.2	0.05	0	-0.30 ≤ A ≤ 0.40	
792.79	0.9322	120.4	120.4	0	0		
813.69	0.9162	120.25	120.2	0.05	0	-0.30 ≤ A ≤ 0.40	
837.69	0.9162	120.25	120.2	0.05	0	-0.30 ≤ A ≤ 0.60	
862.68	0.9162	120.25	119.8	0.45	0.4	-0.30 ≤ A ≤ 1.30	
889.67	0.9163	120.25	116.9	3.35	3.4	2.00 ≤ A ≤ 5.00	
1027.65	0.9163	120.25	89.9	30.35	30.4	17.50 ≤ A	
1496.63	0.9167	120.25	52.4	67.85	67.9	42.00 ≤ A	
2408.16	0.9138	120.23	29.8	90.43	90.4	61.00 ≤ A	
4282.16	0.9129	120.22	28.6	91.62	91.6	70.00 ≤ A	

4.2.18 1000 Hz Centre Frequency. (V0 = 9.008E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
184.03	0.9168	120.15	34.3	85.85	85.9	70.00 ≤ A	
324.94	0.9154	120.14	63.4	56.74	56.7	61.00 ≤ A	*
529.89	0.9159	120.14	60	60.14	60.1	42.00 ≤ A	
770.78	0.9162	120.15	91.6	28.55	28.5	17.50 ≤ A	
889.66	0.9163	120.15	116.6	3.55	3.5	2.00 ≤ A ≤ 5.00	
918.66	0.9163	120.15	119.8	0.35	0.3	-0.30 ≤ A ≤ 1.30	
946.64	0.9162	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
972.64	0.9163	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
999.68	0.9324	120.3	120.3	0	0		
1025.65	0.9163	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
1054.64	0.9163	120.15	120.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
1086.64	0.9164	120.15	119.9	0.25	0.2	-0.30 ≤ A ≤ 1.30	
1121.64	0.9165	120.15	116.6	3.55	3.6	2.00 ≤ A ≤ 5.00	
1294.62	0.9166	120.15	88.6	31.55	31.6	17.50 ≤ A	
1885.68	0.9171	120.16	48.3	71.86	71.9	42.00 ≤ A	
3035.19	0.9135	120.12	29.6	90.52	90.5	61.00 ≤ A	
5401.62	0.9125	120.11	28.6	91.51	91.5	70.00 ≤ A	

4.2.19 1259.9 Hz Centre Frequency. (V0 = 9.115E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
231.09	0.9153	120.04	33.5	86.54	86.5	70.00 ≤ A	
410.15	0.9157	120.04	63.5	56.54	56.5	61.00 ≤ A	*
667.14	0.916	120.04	61.2	58.84	58.8	42.00 ≤ A	
972.11	0.9164	120.05	92.3	27.75	27.7	17.50 ≤ A	
1122.18	0.9166	120.05	116.9	3.15	3.1	2.00 ≤ A ≤ 5.00	
1158.21	0.9165	120.05	119.9	0.15	0.1	-0.30 ≤ A ≤ 1.30	
1193.22	0.9166	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.60	
1227.23	0.9166	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
1258.64	0.9328	120.2	120.2	0	0		
1293.26	0.9166	120.05	120.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
1330.29	0.9167	120.05	120	0.05	0	-0.30 ≤ A ≤ 0.60	
1370.32	0.9166	120.05	119.7	0.35	0.3	-0.30 ≤ A ≤ 1.30	
1414.38	0.9167	120.05	116.3	3.75	3.7	2.00 ≤ A ≤ 5.00	
1632.52	0.9169	120.05	87.2	32.85	32.9	17.50 ≤ A	
2348.45	0.914	120.02	41.6	78.42	78.4	42.00 ≤ A	
3832.67	0.9132	120.02	31.3	88.72	88.7	61.00 ≤ A	
6814.88	0.9119	120	28.6	91.4	91.4	70.00 ≤ A	

4.2.20 1587.4 Hz Centre Frequency. (V0 = 9.222E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
292.09	0.9154	119.94	33.3	86.64	86.6	70.00 ≤ A	
517.14	0.9158	119.94	63.5	56.44	56.4	61.00 ≤ A	*
841.08	0.9162	119.94	59.2	60.74	60.7	42.00 ≤ A	
1225.19	0.9166	119.95	91.5	28.45	28.4	17.50 ≤ A	
1414.32	0.9168	119.95	116.6	3.35	3.3	2.00 ≤ A ≤ 5.00	
1459.36	0.9168	119.95	119.6	0.35	0.3	-0.30 ≤ A ≤ 1.30	
1503.39	0.9169	119.95	119.9	0.05	0	-0.30 ≤ A ≤ 0.60	
1546.42	0.9169	119.95	120	-0.05	0	-0.30 ≤ A ≤ 0.40	
1586.73	0.9329	120.1	120.1	0	0		
1629.48	0.9169	119.95	120	-0.05	0	-0.30 ≤ A ≤ 0.40	
1676.51	0.917	119.95	119.9	0.05	0.1	-0.30 ≤ A ≤ 0.60	
1726.52	0.917	119.95	119.6	0.35	0.4	-0.30 ≤ A ≤ 1.30	
1781.49	0.9171	119.95	116.6	3.35	3.4	2.00 ≤ A ≤ 5.00	
2030.27	0.9142	119.92	91.2	28.72	28.7	17.50 ≤ A	
2965.54	0.9137	119.92	52.4	67.52	67.5	42.00 ≤ A	
4841.42	0.9129	119.91	30.6	89.31	89.3	61.00 ≤ A	
8605.16	0.9111	119.89	29.6	90.29	90.3	70.00 ≤ A	

4.2.21 2000 Hz Centre Frequency. (V0 = 9.411E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
368.08	0.9156	119.76	34.2	85.56	85.6	70.00 ≤ A	
651.12	0.916	119.77	63.4	56.37	56.4	61.00 ≤ A	*
1059.1	0.9165	119.77	59.6	60.17	60.2	42.00 ≤ A	
1543.36	0.9169	119.77	91.5	28.27	28.3	17.50 ≤ A	
1781.53	0.9171	119.78	116.5	3.28	3.3	2.00 ≤ A ≤ 5.00	
1838.48	0.9172	119.78	119.6	0.18	0.2	-0.30 ≤ A ≤ 1.30	
1894.49	0.9172	119.78	119.8	-0.02	0	-0.30 ≤ A ≤ 0.60	
1947.45	0.9172	119.78	119.8	-0.02	0	-0.30 ≤ A ≤ 0.40	
1980.48	0.9303	119.9	119.9	0	0		
2030.16	0.9142	119.75	119.8	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
2089.87	0.9142	119.75	119.8	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
2149.46	0.9142	119.75	119.6	0.15	0.1	-0.30 ≤ A ≤ 1.30	
2219.02	0.9141	119.75	117.4	2.35	2.3	2.00 ≤ A ≤ 5.00	
2567.28	0.9139	119.75	89.4	30.35	30.3	17.50 ≤ A	
3742.77	0.9133	119.74	48.3	71.44	71.4	42.00 ≤ A	
6102.37	0.9123	119.73	31.3	88.43	88.4	61.00 ≤ A	
10871.24	0.9099	119.71	31.2	88.51	88.5	70.00 ≤ A	

4.2.22 2519.8 Hz Centre Frequency. (V0 = 9.625E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
463.09	0.9157	119.57	34.2	85.37	85.4	70.00 ≤ A	
819.97	0.9161	119.57	63.3	56.27	56.3	61.00 ≤ A	*
1335.07	0.9166	119.58	60.9	58.68	58.7	42.00 ≤ A	
1944.33	0.9172	119.58	92	27.58	27.6	17.50 ≤ A	
2218.78	0.9141	119.55	115	4.55	4.6	2.00 ≤ A ≤ 5.00	
2288.53	0.9141	119.55	119.5	0.05	0.1	-0.30 ≤ A ≤ 1.30	
2358.12	0.914	119.55	119.5	0.05	0.1	-0.30 ≤ A ≤ 0.60	
2427.75	0.9139	119.55	119.6	-0.05	0	-0.30 ≤ A ≤ 0.40	
2487.5	0.9299	119.7	119.7	0	0		
2557.12	0.9138	119.55	119.6	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
2636.65	0.9138	119.55	119.6	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
2716.31	0.9138	119.55	119.5	0.05	0	-0.30 ≤ A ≤ 1.30	
2796.01	0.9138	119.55	117.3	2.25	2.2	2.00 ≤ A ≤ 5.00	
3234.21	0.9135	119.55	88.2	31.35	31.3	17.50 ≤ A	
4721.29	0.9128	119.54	41	78.54	78.5	42.00 ≤ A	
7708.93	0.9115	119.53	32.6	86.93	86.9	61.00 ≤ A	
13752.63	0.9086	119.5	31.2	88.3	88.3	70.00 ≤ A	

4.2.23 3174.8 Hz Centre Frequency. (V0 = 9.732E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
584.04	0.908	119.4	35.2	84.2	84.2	70.00 ≤ A	
1033.96	0.9085	119.4	63.3	56.1	56.1	61.00 ≤ A	*
1682.17	0.909	119.41	58.9	60.51	60.5	42.00 ≤ A	
2427.55	0.9061	119.38	89.6	29.78	29.8	17.50 ≤ A	
2795.7	0.9058	119.38	115.4	3.98	4	2.00 ≤ A ≤ 5.00	
2885.36	0.9058	119.38	119.3	0.08	0.1	-0.30 ≤ A ≤ 1.30	
2974.94	0.9058	119.38	119.5	-0.12	-0.1	-0.30 ≤ A ≤ 0.60	
3064.61	0.9058	119.38	119.5	-0.12	-0.1	-0.30 ≤ A ≤ 0.40	
3144.41	0.9294	119.6	119.6	0	0		
3223.94	0.9057	119.38	119.5	-0.12	-0.1	-0.30 ≤ A ≤ 0.40	
3323.59	0.9056	119.37	119.5	-0.13	-0.1	-0.30 ≤ A ≤ 0.60	
3423.3	0.9056	119.37	119.2	0.17	0.2	-0.30 ≤ A ≤ 1.30	
3532.95	0.9055	119.37	117.2	2.17	2.2	2.00 ≤ A ≤ 5.00	
4081.97	0.9054	119.37	90.2	29.17	29.2	17.50 ≤ A	
5961.53	0.9045	119.36	51.3	68.06	68.1	42.00 ≤ A	
9735.36	0.9027	119.35	32.3	87.05	87	61.00 ≤ A	
17406.97	0.899	119.31	31.3	88.01	88	70.00 ≤ A	

4.2.24 4000 Hz Centre Frequency. (V0 = 9.728E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
735.97	0.9083	119.4	35.2	84.2	84.2	70.00 ≤ A	
1302.89	0.9089	119.41	63.2	56.21	56.2	61.00 ≤ A	*
2089.45	0.9064	119.39	58.3	61.09	61.1	42.00 ≤ A	
3054.39	0.9057	119.38	89.5	29.88	29.9	17.50 ≤ A	
3532.57	0.9055	119.38	115.4	3.98	4	2.00 ≤ A ≤ 5.00	
3642.24	0.9054	119.38	119.2	0.18	0.2	-0.30 ≤ A ≤ 1.30	
3751.97	0.9055	119.38	119.3	0.08	0.1	-0.30 ≤ A ≤ 0.60	
3861.72	0.9054	119.38	119.3	0.08	0.1	-0.30 ≤ A ≤ 0.40	
3972.19	0.929	119.6	119.6	0	0		
4071.6	0.9052	119.37	119.3	0.07	0.1	-0.30 ≤ A ≤ 0.40	
4191.32	0.9052	119.37	119.3	0.07	0.1	-0.30 ≤ A ≤ 0.60	
4321.09	0.9052	119.37	119.2	0.17	0.2	-0.30 ≤ A ≤ 1.30	
4450.92	0.9051	119.37	116.5	2.87	2.9	2.00 ≤ A ≤ 5.00	
5150.47	0.9048	119.37	88.5	30.87	30.9	17.50 ≤ A	
7516.74	0.9037	119.36	45.5	73.86	73.9	42.00 ≤ A	
12302.28	0.9014	119.34	33.3	86.04	86	61.00 ≤ A	
21718.48	0.9083	119.4	32.3	87.1	87.1	70.00 ≤ A	

4.2.25 5039.7 Hz Centre Frequency. (V0 = 9.950E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
927.31	0.9085	119.21	34.3	84.91	84.9	70.00 ≤ A	
1641.85	0.909	119.21	63.3	55.91	55.9	61.00 ≤ A	*
2646.18	0.906	119.19	59.2	59.99	60	42.00 ≤ A	
3851.53	0.9054	119.18	90.2	28.98	29	17.50 ≤ A	
4450.64	0.9051	119.18	115.2	3.98	4	2.00 ≤ A ≤ 5.00	
4600.43	0.905	119.18	117.9	1.28	1.3	-0.30 ≤ A ≤ 1.30	
4740.24	0.905	119.18	119.05	0.13	0.1	-0.30 ≤ A ≤ 0.60	
4870.19	0.9049	119.18	119.3	-0.17	-0.2	-0.30 ≤ A ≤ 0.40	
5000.75	0.9286	119.4	119.4	0	0		
5140.06	0.9048	119.17	119.3	-0.13	-0.1	-0.30 ≤ A ≤ 0.40	
5290.07	0.9047	119.17	119.19	-0.2	0	-0.30 ≤ A ≤ 0.60	
5450.15	0.9046	119.17	118	1.17	1.2	-0.30 ≤ A ≤ 1.30	
5620.31	0.9045	119.17	115.9	3.27	3.3	2.00 ≤ A ≤ 5.00	
6491.94	0.9042	119.17	85.3	33.87	33.9	17.50 ≤ A	
9491.59	0.9028	119.16	38.5	80.66	80.7	42.00 ≤ A	
15562.78	0.8999	119.13	34.3	84.83	84.8	61.00 ≤ A	
27305.27	0.9086	119.21	24.6	94.61	94.6	70.00 ≤ A	

4.2.26 6349.6 Hz Centre Frequency. (V0 = 1.168E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
1168.08	0.9162	117.89	34.4	83.49	83.5	70.00 ≤ A	
2043.92	0.9139	117.87	65.3	52.57	52.6	61.00 ≤ A	*
3340.11	0.9133	117.86	58	59.86	59.9	42.00 ≤ A	
4880.2	0.9126	117.85	90.2	27.65	27.7	17.50 ≤ A	
5631.72	0.9123	117.85	114.9	2.95	3	2.00 ≤ A ≤ 5.00	
5810.42	0.9128	117.86	117.6	0.26	0.3	-0.30 ≤ A ≤ 1.30	
5990.88	0.9128	117.86	118	-0.14	-0.1	-0.30 ≤ A ≤ 0.60	
6161.45	0.9127	117.85	118	-0.15	-0.1	-0.30 ≤ A ≤ 0.40	
6311.77	0.9281	118	118	0	0		
6492.85	0.9126	117.85	117.9	-0.05	0	-0.30 ≤ A ≤ 0.40	
6683.69	0.9124	117.85	117.9	-0.05	0	-0.30 ≤ A ≤ 0.60	
6884.65	0.9123	117.85	117.5	0.35	0.4	-0.30 ≤ A ≤ 1.30	
7097.75	0.9138	117.87	114.9	2.97	3	2.00 ≤ A ≤ 5.00	
8203.59	0.9133	117.86	85.5	32.36	32.4	17.50 ≤ A	
12010.74	0.9115	117.84	50.6	67.24	67.2	42.00 ≤ A	
19721.44	0.9081	117.81	33.2	84.61	84.6	61.00 ≤ A	
34496.7	0.9189	117.91	35.2	82.71	82.7	70.00 ≤ A	

4.2.27 8000 Hz Centre Frequency. (V0 = 1.436E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
1472.46	0.9163	116.1	34.2	81.9	81.9	70.00 ≤ A	
2577.28	0.9135	116.07	63.4	52.67	52.7	61.00 ≤ A	*
4202.19	0.9126	116.06	58.2	57.86	57.9	42.00 ≤ A	
6142.18	0.9119	116.05	88.2	27.85	27.9	17.50 ≤ A	
7095.44	0.9114	116.05	112.9	3.15	3.1	2.00 ≤ A ≤ 5.00	
7326.49	0.9114	116.05	115.9	0.15	0.1	-0.30 ≤ A ≤ 1.30	
7547.7	0.9113	116.05	116	0.05	0	-0.30 ≤ A ≤ 0.60	
7769.06	0.9111	116.05	116.1	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
7978.84	0.9273	116.2	116.2	0	0		
8191.21	0.911	116.05	116	0.05	0	-0.30 ≤ A ≤ 0.40	
8422.89	0.9109	116.05	116	0.05	0	-0.30 ≤ A ≤ 0.60	
8685.06	0.9107	116.04	115.8	0.24	0.2	-0.30 ≤ A ≤ 1.30	
8957.36	0.9107	116.04	113.5	2.54	2.5	2.00 ≤ A ≤ 5.00	
10363.02	0.9099	116.04	84.5	31.54	31.5	17.50 ≤ A	
15184.11	0.9076	116.01	48.2	67.81	67.8	42.00 ≤ A	
24517.45	0.916	116.09	32.2	83.89	83.9	61.00 ≤ A	
43418.38	0.917	116.1	31.5	84.6	84.6	70.00 ≤ A	

4.2.28 10079 Hz Centre Frequency. (V0 = 1.418E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
1854.01	0.9166	116.21	36.4	79.81	79.8	70.00 ≤ A	
3254.75	0.9129	116.17	63.5	52.67	52.7	61.00 ≤ A	*
5311.93	0.912	116.17	59.4	56.77	56.8	42.00 ≤ A	
7750.17	0.9109	116.16	86.2	29.96	30	17.50 ≤ A	
8959.07	0.9103	116.15	113.2	2.95	2.9	2.00 ≤ A ≤ 5.00	
9251.9	0.9102	116.15	115.8	0.35	0.3	-0.30 ≤ A ≤ 1.30	
9534.77	0.9101	116.15	116.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
9807.85	0.9101	116.15	116.2	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
10068.82	0.9262	116.3	116.3	0	0		
10344.6	0.9098	116.14	116.2	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
10648.62	0.9095	116.14	116.2	-0.06	-0.1	-0.30 ≤ A ≤ 0.60	
10973.15	0.9095	116.14	116.2	-0.06	-0.1	-0.30 ≤ A ≤ 1.30	
11328.47	0.9092	116.14	113	3.14	3.1	2.00 ≤ A ≤ 5.00	
13099.57	0.9085	116.13	86.1	30.03	30	17.50 ≤ A	
19226.45	0.9056	116.11	40.6	75.51	75.5	42.00 ≤ A	
30906.38	0.9161	116.2	37.4	78.8	78.8	61.00 ≤ A	
54698.47	0.9177	116.22	35.1	81.12	81.1	70.00 ≤ A	

4.2.29 12699 Hz Centre Frequency. (V0 = 1.038E-6 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
2309.45	0.9132	118.89	35.4	83.49	83.5	70.00 ≤ A	
4103.77	0.9123	118.88	64.5	54.38	54.4	61.00 ≤ A	*
6696.29	0.9112	118.87	59.6	59.27	59.3	42.00 ≤ A	
9800.25	0.9096	118.86	89.2	29.66	29.7	17.50 ≤ A	
11331.71	0.9089	118.85	114.8	4.05	4	2.00 ≤ A ≤ 5.00	
11697.54	0.9088	118.85	118.6	0.25	0.2	-0.30 ≤ A ≤ 1.30	
12053.5	0.9087	118.85	119	-0.15	-0.2	-0.30 ≤ A ≤ 0.60	
12399.71	0.9086	118.85	118.9	-0.05	-0.1	-0.30 ≤ A ≤ 0.40	
12730.24	0.9248	119	119	0	0		
13082.96	0.9082	118.84	119	-0.16	-0.2	-0.30 ≤ A ≤ 0.40	
13460.69	0.908	118.84	119	-0.16	-0.2	-0.30 ≤ A ≤ 0.60	
13879.64	0.9077	118.84	118.6	0.24	0.2	-0.30 ≤ A ≤ 1.30	
14329.93	0.9076	118.84	114.9	3.94	3.9	2.00 ≤ A ≤ 5.00	
16585.46	0.9067	118.83	83.5	35.33	35.3	17.50 ≤ A	
23910.43	0.9157	118.91	39.6	79.31	79.3	42.00 ≤ A	
38904.56	0.9163	118.92	53.4	65.52	65.5	61.00 ≤ A	
68998.09	0.9188	118.94	32.5	86.44	86.4	70.00 ≤ A	

4.2.30 16000 Hz Centre Frequency. (V0 = 8.419E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
2915.62	0.9126	120.7	34.5	86.2	86.2	70.00 ≤ A	
5181.34	0.9116	120.69	64.2	56.49	56.5	61.00 ≤ A	*
8453.83	0.9101	120.68	62.2	58.48	58.5	42.00 ≤ A	
12375.45	0.9083	120.66	94.1	26.56	26.6	17.50 ≤ A	
14325.85	0.9073	120.65	117.3	3.35	3.3	2.00 ≤ A ≤ 5.00	
14786.74	0.907	120.65	120.3	0.35	0.3	-0.30 ≤ A ≤ 1.30	
15248.07	0.9069	120.65	120.7	-0.05	-0.1	-0.30 ≤ A ≤ 0.60	
15689.5	0.9067	120.64	120.7	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
16119.08	0.9231	120.8	120.8	0	0		
16553	0.9064	120.64	120.7	-0.06	-0.1	-0.30 ≤ A ≤ 0.40	
17035.16	0.9061	120.64	120.7	-0.06	-0.1	-0.30 ≤ A ≤ 0.60	
17560.9	0.9059	120.64	120.5	0.14	0.1	-0.30 ≤ A ≤ 1.30	
18128.62	0.9056	120.63	116	4.63	4.6	2.00 ≤ A ≤ 5.00	
20713.63	0.9152	120.73	80.4	40.33	40.3	17.50 ≤ A	
30113.32	0.9157	120.73	48.5	72.23	72.2	42.00 ≤ A	
49112.24	0.9169	120.74	48.2	72.54	72.5	61.00 ≤ A	
86901.04	0.9193	120.76	34.5	86.26	86.3	70.00 ≤ A	

4.2.31 20159 Hz Centre Frequency. (V0 = 7.843E-7 Vrms)

Frequency (Hz)	Volts In (Vrms)	Level In (dB)	Level Out (dB)	Abs. Atten. (dB)	A = Rel. Atten. (dB)	Limits (dB)	Outside tolerance
3673.67	0.92	121.39	42.5	78.89	78.9	70.00 ≤ A	
6534.7	0.9187	121.37	64.2	57.17	57.2	61.00 ≤ A	*
10690.72	0.9166	121.35	70	51.35	51.4	42.00 ≤ A	
15662	0.9143	121.33	100.2	21.13	21.1	17.50 ≤ A	
18134.92	0.9131	121.32	118	3.32	3.3	2.00 ≤ A ≤ 5.00	
18734	0.9129	121.32	120.9	0.42	0.4	-0.30 ≤ A ≤ 1.30	
19314.07	0.9127	121.32	121.4	-0.08	-0.1	-0.30 ≤ A ≤ 0.60	
19868.18	0.9126	121.32	121.4	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
20108.58	0.9321	121.5	121.5	0	0		
20602.76	0.9231	121.42	121.5	-0.08	-0.1	-0.30 ≤ A ≤ 0.40	
21203.3	0.9231	121.42	121.5	-0.08	-0.1	-0.30 ≤ A ≤ 0.60	
21903.6	0.9231	121.42	121.2	0.22	0.2	-0.30 ≤ A ≤ 1.30	
22602.63	0.9231	121.42	118.1	3.32	3.3	2.00 ≤ A ≤ 5.00	
26102.04	0.9234	121.42	46.6	74.82	74.8	17.50 ≤ A	
37993.62	0.924	121.42	56.5	64.92	64.9	42.00 ≤ A	
61782.64	0.9258	121.44	52.1	69.34	69.3	61.00 ≤ A	
109462.48	0.9276	121.46	34.5	86.96	87	70.00 ≤ A	

5. FILTER CALIBRATION

Results are presented in tabular form below.
Insertion Loss is given by the absolute attenuation at the centre frequency.
The reference level (in dB) for each filter is given by 'Level In' at the centre frequency, and is measured with the filter switched out of circuit.
The reference voltage V0 is stated for each filter, and is calculated from the following:

$$L = 20 \times \mathrm{Log}\,(V / V0)$$

Where L is the reference level in dB, and V is the voltage applied in Vrms.

All values except the reference level in 'Level In' are calculated from the applied voltage using V0 as the reference.
All values in 'Level Out' are taken from the measurement amplifier.
The limits for attenuation are given in AS/NZS 4476:1997, Table 1, and IEC 1260, Table 1.

6. MEASUREMENT UNCERTAINTY

The estimated uncertainty of value quoted, at 95% confidence level, with a coverage factor of 2, is +/- 0.15dB.

TESTING OFFICER: ______________________

NATA SIGNATORY: ______________________

Documentation Métrologique
Metrological documentation

DUO 12601

Date d'émission : *Date of issue :* **06/09/2018**

Référence Document : NOT1536
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TABLE OF CONTENT

Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60706

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation :
Designation :

Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :

01dB

Type :
Type :

DUO

N° de serie :
Serial number :

12601

N° d'identification :
Identification number

Date d'émission :
Date of issue :

06/09/2018

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60706

LA REPRODUCTION DE CE CONSTAT N'EST AUTORISEE QUE SOUS LA FORME DE FAC-SIMILE PHOTOGRAPHIQUE INTEGRAL

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED OTHER THAN IN FULL BY PHOTOGRAPHIC PROCESS

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12601		331756

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.6 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**97,81 kPa**
Température : *Temperature*	**23,3 °C**
Taux d'humidité relative : *Relative humidity*	**52,6 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :
Conformity decision has been taken with the tolerance descriptions in the following standards:

IEC 61260
IEC 61672-1 classe 1
ANSI S1.11 class 1
ANSI S1.4 class

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.

CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60706

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation :
Designation :

Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :

01dB

Type :
Type :

DUO

N° de serie :
Serial number :

12601

N° d'identification :
Identification number

Date d'émission :
Date of issue :

06/09/2018

Ce certificat comprend 10 Pages
This certificate includes *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60706

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12601		331756

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.6 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**97,81 kPa**
Température : *Temperature*	**23,3 °C**
Taux d'humidité relative : *Relative humidity*	**52,6 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :
INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :
RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-0,8	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	*-0,5*	*-0,6*	*-0,6*	0,45
250 Hz	-0,5	-0,4	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	-0,1	-0,1	-0,2	0,29
4000 Hz	-0,7	-0,3	-0,1	-0,5	0,39
8000 Hz	-1,0	-1,8	-1,4	-1,4	0,61
16000 Hz	-0,6	-2,6	-6,6	-6,3	0,61
A	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,9	-27,0	-26,9	0,45
125 Hz	*-16,9*	*-16,7*	*-16,8*	*-16,8*	0,45
250 Hz	-9,2	-9,1	-9,3	-9,3	0,29
500 Hz	-3,7	-3,7	-3,9	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,2	1,1	1,1	1,0	0,29
4000 Hz	0,2	0,6	0,8	0,5	0,39
8000 Hz	-2,6	-3,4	-3,0	-3,0	0,61
16000 Hz	-12,6	-14,5	-18,5	-18,3	0,61
B	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-10,1	-10,0	-10,1	-10,1	0,45
125 Hz	*-4,9*	-4,8	-4,9	-4,8	0,45
250 Hz	-1,9	-1,8	-2,0	-2,0	0,29
500 Hz	-0,7	-0,7	-0,9	-0,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,2	-0,2	-0,3	0,29
4000 Hz	-1,5	-1,1	-0,9	-1,2	0,39
8000 Hz	-4,4	-5,2	-4,8	-4,8	0,61
16000 Hz	-14,4	-16,4	-20,4	-20,1	0,61
C	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,5	-1,6	-1,5	0,45
125 Hz	*-0,8*	*-0,7*	*-0,8*	*-0,8*	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,2	-0,3	-0,2	-0,4	0,29
4000 Hz	-1,6	-1,2	-1,0	-1,3	0,39
8000 Hz	-4,5	-5,3	-4,9	-4,9	0,61
16000 Hz	-14,5	-16,5	-20,5	-20,2	0,61

Linéarité
Linearity

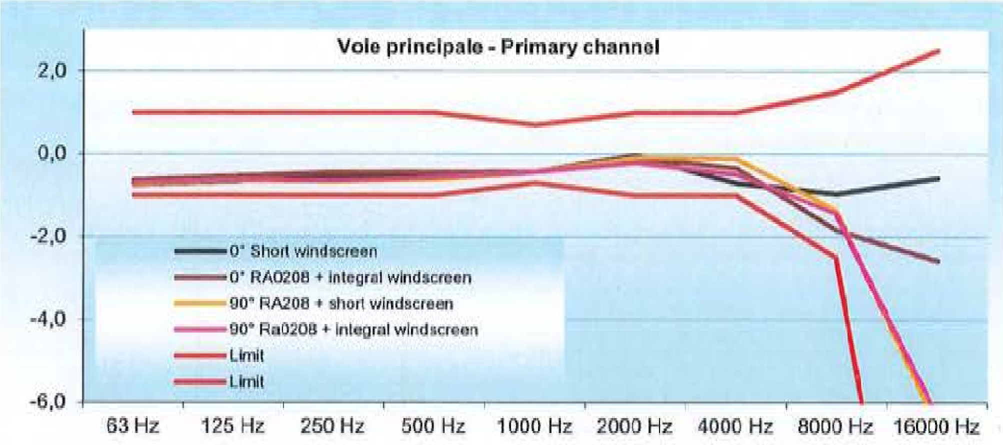
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,0	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,9	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,1	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

Réponse acoustique
Acoustic response



OPTION DMK 01 (1/3)

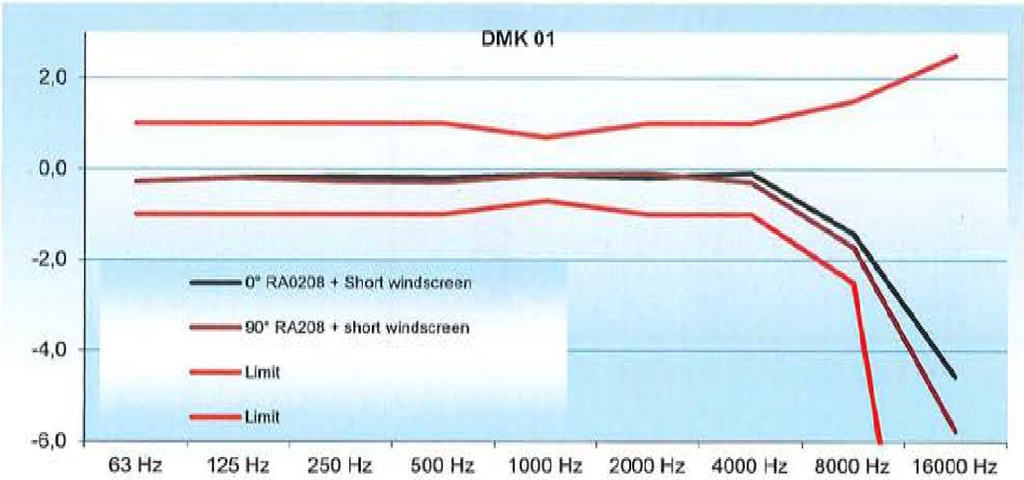
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	34,9	0,2
Leq 40 dBZ / 8000 Hz	40,0	39,9	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,8	0,2
Leq 130 dBA / 8000 Hz	130,0	129,8	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,1	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,1	-0,3	0,39
8000 Hz	-1,4	-1,7	0,61
16000 Hz	-4,6	-5,8	0,61
A	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-26,5	-26,5	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,8	-8,9	0,29
500 Hz	-3,4	-3,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,0	1,1	0,29
4000 Hz	0,8	0,6	0,39
8000 Hz	-3,0	-3,3	0,61
16000 Hz	-16,5	-17,7	0,61
B	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,4	-4,4	0,45
250 Hz	-1,5	-1,6	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,3	-0,2	0,29
4000 Hz	-0,8	-1,1	0,39
8000 Hz	-4,8	-5,1	0,61
16000 Hz	-18,4	-19,6	0,61
C	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,4	-0,3	0,29
4000 Hz	-1,0	-1,2	0,39
8000 Hz	-4,9	-5,2	0,61
16000 Hz	-18,5	-19,7	0,61

Fin du certificat d'étalonnage   End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60706

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12601**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date* **06/09/2018**	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY* Bertrand LEROY

01dB

Documentation Métrologique
Metrological documentation

DUO 12602

Date d'émission :
Date of issue : **06/09/2018**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

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A simplified joint stock company with a capital of 4,331,298 EUR - SIRET 409 869 708 00019 - Lyon Trade Register 409 869 708 - European VAT number FR 82 409 869 708
01dB - METRAVIB - ONEPROD - Brands of ACOEM

TABLE DES MATIERES
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Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60711

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**
N° de serie : *Serial number :*	**12602**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**06/09/2018**

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60711

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12602		331790

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:
- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:
- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**6 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**97,79 kPa**
Température : *Temperature*	**23,4 °C**
Taux d'humidité relative : *Relative humidity*	**56,2 %HR**

Moyens de mesure utilises pour la verification :
Instruments used for verification:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

Resultats :
Results:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :
Conformity decision has been taken with the tolerance descriptions in the following standards:

IEC 61260
IEC 61672-1 classe 1
ANSI S1.11 class 1
ANSI S1.4 class

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification End of verification certificate

Chapitre 2.

CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60711

DELIVRE PAR :
ISSUED BY

ACOEM
Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : **Sonomètre Intégrateur-Moyenneur**
Designation : ***Integrating-Averaging Sound Level Meter***

Constructeur : **01dB**
Manufacturer :

Type : **DUO**
Type :

N° de serie : **12602**
Serial number :

N° d'identification :
Identification number

Date d'émission : **06/09/2018**
Date of issue :

Ce certificat comprend 10 Pages
This certificate includes *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60711

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12602		331790

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibretion [French format]*	**6 - 9 - 2018**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**97,79 kPa**
Température : *Temperature*	**23,4 °C**
Taux d'humidité relative : *Relative humidity*	**56,2 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :
INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :
RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-0,7	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	-0,5	-0,6	-0,6	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	-0,1	-0,1	-0,2	0,29
4000 Hz	-0,7	-0,3	-0,1	-0,4	0,39
8000 Hz	-0,9	-1,8	-1,3	-1,4	0,61
16000 Hz	-0,3	-2,3	-6,3	-6,1	0,61
A	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,9	-27,0	-26,9	0,45
125 Hz	-16,9	-16,7	-16,8	-16,8	0,45
250 Hz	-9,2	-9,1	-9,4	-9,3	0,29
500 Hz	-3,7	-3,7	-3,9	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,2	1,2	1,2	1,0	0,29
4000 Hz	0,3	0,7	0,9	0,5	0,39
8000 Hz	-2,5	-3,4	-2,9	-3,0	0,61
16000 Hz	-12,3	-14,3	-18,3	-18,1	0,61
B	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-10,1	-10,0	-10,1	-10,1	0,45
125 Hz	-4,9	-4,8	-4,9	-4,8	0,45
250 Hz	-1,9	-1,8	-2,0	-2,0	0,29
500 Hz	-0,8	-0,7	-0,9	-0,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,2	-0,2	-0,3	0,29
4000 Hz	-1,4	-1,0	-0,8	-1,2	0,39
8000 Hz	-4,3	-5,2	-4,7	-4,8	0,61
16000 Hz	-14,1	-16,1	-20,1	-19,8	0,61
C	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,4	-1,5	-1,5	0,45
125 Hz	-0,8	-0,7	-0,8	-0,8	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,2	-0,2	-0,2	-0,4	0,29
4000 Hz	-1,5	-1,1	-0,9	-1,3	0,39
8000 Hz	-4,4	-5,3	-4,8	-4,9	0,61
16000 Hz	-14,2	-16,2	-20,2	-20,0	0,61

Linéarité

Linearity

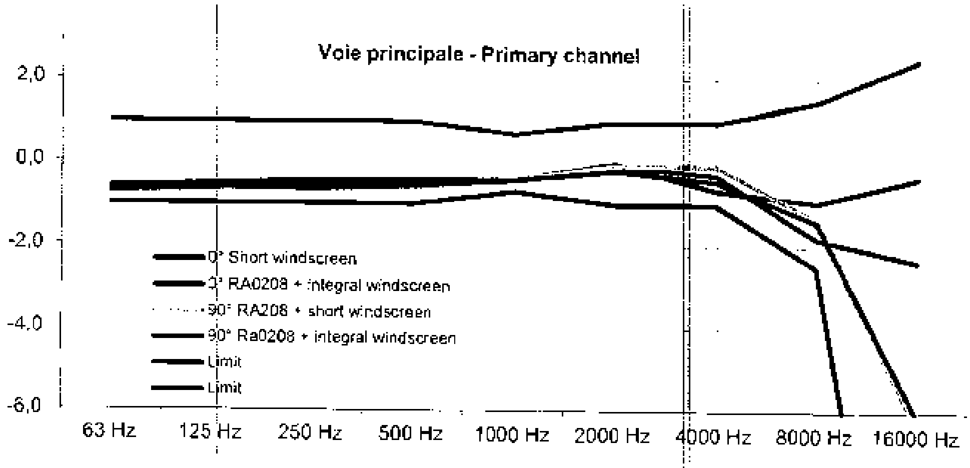
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,1	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,1	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,1	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,1	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	109,9	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,1	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



Option DMK 01 (1/3)

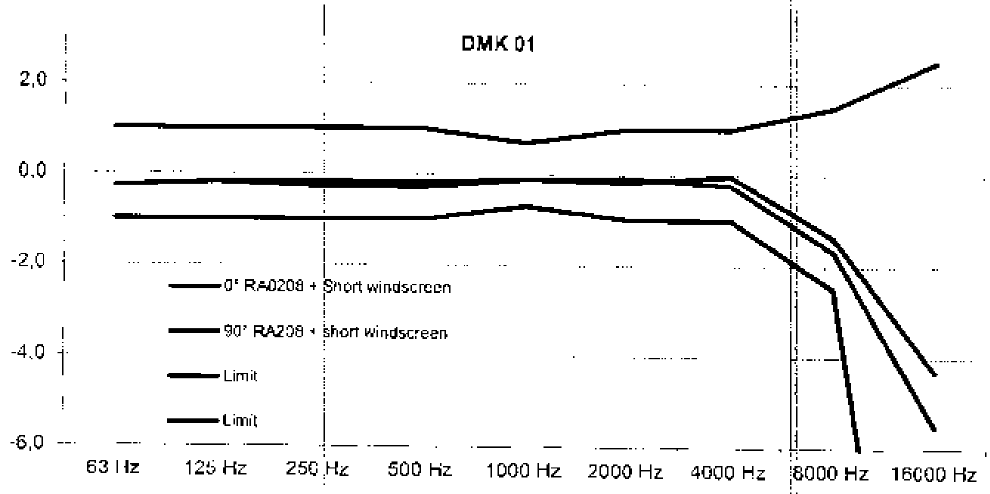
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	109,9	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	39,9	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,7	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Z	Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01) 0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	0,0	-0,2	0,39
8000 Hz	-1,4	-1,7	0,61
16000 Hz	-4,3	-5,5	0,61
A	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-26,5	-26,5	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,4	-3,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,0	1,1	0,29
4000 Hz	0,9	0,7	0,39
8000 Hz	-3,0	-3,3	0,61
16000 Hz	-16,3	-17,5	0,61
B	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,4	-4,4	0,45
250 Hz	-1,5	-1,6	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,3	-0,2	0,29
4000 Hz	-0,5	-1,0	0,39
8000 Hz	-4,8	-5,1	0,61
16000 Hz	-18,1	-19,3	0,61
C	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,4	-0,3	0,29
4000 Hz	-0,9	-1,1	0,39
8000 Hz	-4,9	-5,2	0,61
16000 Hz	-18,2	-19,4	0,61

Fin du certificat d'étalonnage   End of calibration certificate

Chapitre 3.

CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60711

Nous, fabricant
We, manufacturer

Acoem
200, Chemin des Ormeaux
F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation :
Designation:
Sonomètre Intégrateur Moyenneur
Integrating-Averaging Sound level meter

Référence :
Reference:
DUO

Numéro de série :
Serial Number:
12602

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date
Date

06/09/2018

LE REFERENT METROLOGIE ACOUSTIQUE
PAR DELEGATION
THE REFERENT ACOUSTIC METROLOGY

Bertrand LEROY

01dB

Documentation Métrologique
Metrological documentation

DUO 12604

Date d'émission :
Date of issue : **07/09/2018**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

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Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60715

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation :
Designation :

Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :

01dB

Type :
Type :

DUO

N° de serie :
Serial number :

12604

N° d'identification :
Identification number

Date d'émission :
Date of issue :

07/09/2018

Ce constat comprend 5 pages
This certificate includes pages

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60715

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12604		331759

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,17 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**59,4 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :	IEC 61260 IEC 61672-1 classe	1
Conformity decision has been taken with the tolerance descriptions in the following standards:	ANSI S1.11 class ANSI S1.4 class	1

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60715

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**
N° de serie : *Serial number :*	**12604**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**07/09/2018**

Ce certificat comprend 10 Pages
This certificate includes *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60715

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12604		331759

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**

Pression atmosphérique : *Static pressure*	**98,17 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**59,4 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :
INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :
RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-0,7	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	*-0,5*	*-0,6*	*-0,6*	0,45
250 Hz	-0,5	-0,4	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	0,0	0,0	-0,2	0,29
4000 Hz	-0,5	-0,2	0,1	-0,3	0,39
8000 Hz	-0,7	-1,5	-1,1	-1,1	0,61
16000 Hz	-1,0	-3,0	-7,0	-6,7	0,61
A	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,9	-27,0	-27,0	0,45
125 Hz	*-16,9*	*-16,8*	*-16,9*	*-16,8*	0,45
250 Hz	-9,2	-9,1	-9,4	-9,3	0,29
500 Hz	-3,8	-3,7	-3,9	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,2	1,1	1,2	1,0	0,29
4000 Hz	0,4	0,8	1,0	0,6	0,39
8000 Hz	-2,3	-3,2	-2,7	-2,8	0,61
16000 Hz	-13,0	-15,0	-18,9	-18,7	0,61
B	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-10,2	-10,0	-10,1	-10,1	0,45
125 Hz	*-4,9*	-4,8	-4,9	-4,9	0,45
250 Hz	-1,9	-1,8	-2,1	-2,0	0,29
500 Hz	-0,8	-0,7	-0,9	-0,9	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,1	-0,1	-0,2	0,29
4000 Hz	-1,3	-0,9	-0,7	-1,1	0,39
8000 Hz	-4,1	-5,0	-4,5	-4,6	0,61
16000 Hz	-14,8	-16,8	-20,8	-20,6	0,61
C	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,5	-1,6	-1,5	0,45
125 Hz	*-0,8*	*-0,7*	*-0,8*	*-0,8*	0,45
250 Hz	-0,5	-0,4	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,2	-0,2	-0,3	0,29
4000 Hz	-1,4	-1,0	-0,8	-1,2	0,39
8000 Hz	-4,2	-5,1	-4,6	-4,7	0,61
16000 Hz	-14,9	-16,9	-20,9	-20,7	0,61

Linéarité
Linearity

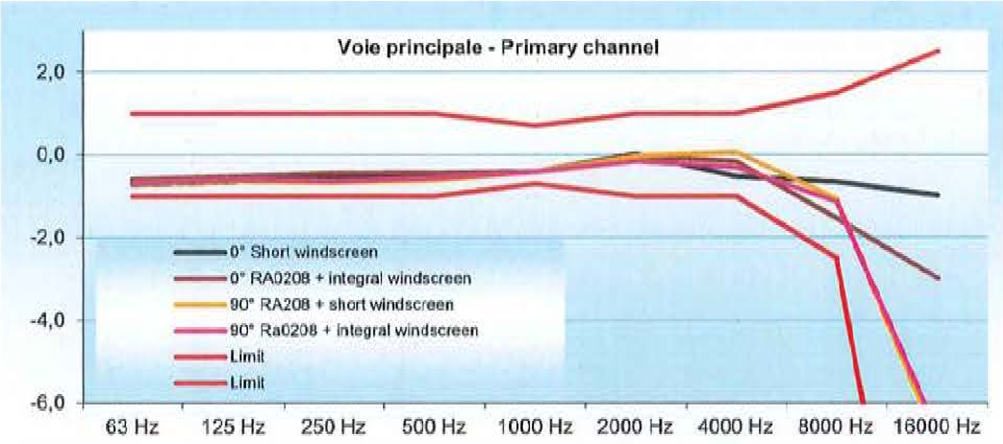
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,1	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,1	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,9	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,9	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	109,9	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	109,9	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



OPTION DMK 01 (1/3)

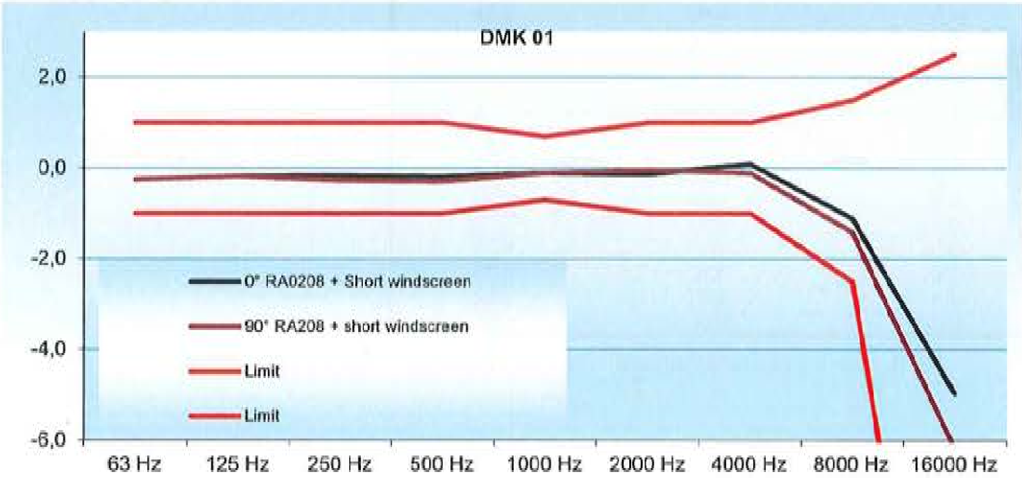
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	109,9	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	109,9	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	39,9	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,8	0,2
Leq 130 dBA / 8000 Hz	130,0	129,8	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,1	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,1	0,0	0,29
4000 Hz	0,1	-0,1	0,39
8000 Hz	-1,1	-1,4	0,61
16000 Hz	-5,0	-6,2	0,61
A	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-26,5	-26,5	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,5	-3,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,0	1,1	0,29
4000 Hz	1,0	0,8	0,39
8000 Hz	-2,8	-3,1	0,61
16000 Hz	-16,9	-18,1	0,61
B	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,5	-4,5	0,45
250 Hz	-1,6	-1,7	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,7	-0,9	0,39
8000 Hz	-4,6	-4,9	0,61
16000 Hz	-18,8	-20,0	0,61
C	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,3	-0,3	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,3	-0,2	0,29
4000 Hz	-0,8	-1,0	0,39
8000 Hz	-4,7	-5,0	0,61
16000 Hz	-18,9	-20,1	0,61

Fin du certificat d'étalonnage End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60715

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12604**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date* **07/09/2018**	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY* Bertrand LEROY

01dB

Documentation Métrologique
Metrological documentation

DUO 12605

Date d'émission : *Date of issue :* **07/09/2018**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

www.acoemgroup.com
support@acoemgroup.com

01dB-Metravib SAS - Head Office: 200 chemin des Ormeaux - F-69578 Limonest Cedex - France // Phone: +33 4 72 52 48 00 - Fax : +33 4 72 52 47 47 // www.acoemgroup.com

A simplified joint stock company with a capital of 7,331,298 EUR - SIRET: 409 869 708 00019 - Lyon Trade Register: 409 869 708 - European VAT number: FR 82 409 869 708

01dB - METRAVIB - ONEPROD Brands of ACOEM

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Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60716

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**
N° de serie : *Serial number :*	**12605**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**07/09/2018**

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60716

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12605		331777

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,17 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**59,5 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :	IEC 61260 IEC 61672-1 classe	1
Conformity decision has been taken with the tolerance descriptions in the following standards:	ANSI S1.11 class ANSI S1.4 class	1

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60716

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**

N° de serie : *Serial number :*	**12605**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**07/09/2018**

Ce certificat comprend 10 Pages
This certificate includes 10 *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60716

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.

THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12605		331777

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :
- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:
- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	.7 - 9 - 2018 .
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**

Pression atmosphérique : *Static pressure*	**98,17 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**59,5 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :
INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :
RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-0,8	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	*-0,5*	*-0,6*	-0,6	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,1	0,0	0,0	-0,1	0,29
4000 Hz	-0,3	0,1	0,3	-0,1	0,39
8000 Hz	-0,4	-1,2	-0,8	-0,8	0,61
16000 Hz	-0,6	-2,6	-6,6	-6,3	0,61
A	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-27,1	-26,9	-27,0	-27,0	0,45
125 Hz	*-16,9*	*-16,8*	*-16,9*	*-16,9*	0,45
250 Hz	-9,3	-9,2	-9,4	-9,3	0,29
500 Hz	-3,8	-3,7	-3,9	-3,9	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,3	1,2	1,2	1,1	0,29
4000 Hz	0,6	1,0	1,2	0,8	0,39
8000 Hz	-2,0	-2,9	-2,4	-2,5	0,61
16000 Hz	-12,5	-14,5	-18,5	-18,3	0,61
B	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-10,2	-10,1	-10,2	-10,1	0,45
125 Hz	*-4,9*	-4,8	-4,9	-4,9	0,45
250 Hz	-2,0	-1,9	-2,1	-2,1	0,29
500 Hz	-0,8	-0,8	-0,9	-0,9	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	0,0	0,0	-0,2	0,29
4000 Hz	-1,1	-0,7	-0,5	-0,9	0,39
8000 Hz	-3,8	-4,7	-4,2	-4,3	0,61
16000 Hz	-14,4	-16,4	-20,4	-20,2	0,61
C	*0° Short windscreen*	*0° RA0208 + integral windscreen*	*90° RA208 + short windscreen*	*90° Ra0208 + integral windscreen*	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,5	-1,6	-1,6	0,45
125 Hz	*-0,9*	*-0,8*	*-0,9*	*-0,8*	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,2	-0,2	-0,3	0,29
4000 Hz	-1,2	-0,8	-0,6	-1,0	0,39
8000 Hz	-3,9	-4,8	-4,3	-4,4	0,61
16000 Hz	-14,5	-16,5	-20,5	-20,3	0,61

Linéarité
Linearity

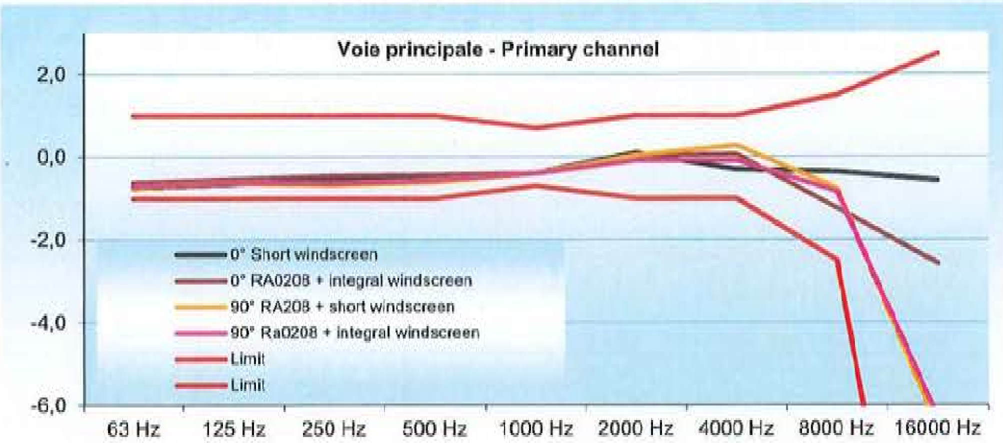
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,1	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,1	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,1	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,7	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,8	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	29,9	0,2
Leq 26 dBA / 8000 Hz	26,0	26,0	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	109,9	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



OPTION DMK 01 (1/3)

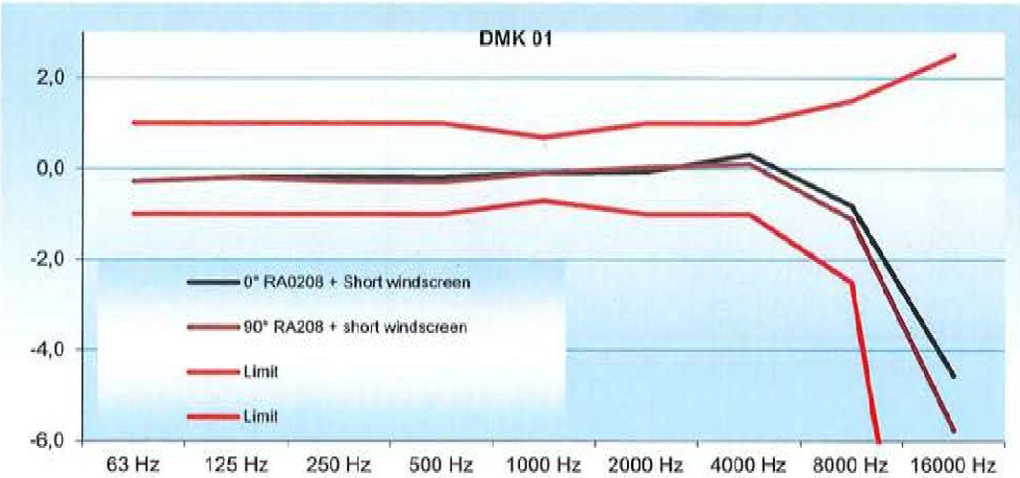
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	34,9	0,2
Leq 40 dBZ / 8000 Hz	40,0	39,9	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,7	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,1	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,1	0,0	0,29
4000 Hz	0,3	0,1	0,39
8000 Hz	-0,8	-1,1	0,61
16000 Hz	-4,6	-5,8	0,61
A	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-26,6	-26,6	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,5	-3,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,1	1,2	0,29
4000 Hz	1,2	1,0	0,39
8000 Hz	-2,5	-2,8	0,61
16000 Hz	-16,5	-17,7	0,61
B	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,5	-4,5	0,45
250 Hz	-1,6	-1,7	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	0,0	0,29
4000 Hz	-0,5	-0,7	0,39
8000 Hz	-4,3	-4,6	0,61
16000 Hz	-18,4	-19,6	0,61
C	0° RA0208 + Short windscreen	90° RA208 + short windscreen	Incertitude uncertainty
63 Hz	-1,2	-1,2	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,3	-0,2	0,29
4000 Hz	-0,6	-0,8	0,39
8000 Hz	-4,4	-4,7	0,61
16000 Hz	-18,5	-19,7	0,61

Fin du certificat d'étalonnage End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60716

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12605**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date* **07/09/2018**	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY* Bertrand LEROY

Documentation Métrologique
Metrological documentation

DUO 12606

Date d'émission : **07/09/2018**
Date of issue :

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

www.acoemgroup.com
support@acoemgroup.com

01dB-Metravib SAS - Head Office: 200 chemin des Ormeaux - F-69578 Limonest Cedex - France // Phone: +33 4 72 52 48 00 - Fax : +33 4 72 52 47 47 // www.acoemgroup.com

A simplified joint stock company with a capital of 7,331,208 EUR - SIRET: 409 869 708 00019 - Lyon Trade Register: 409 869 708 - European VAT number: FR 82 409 869 708

01dB - METRAVIB - ONEPROD Brands of ACOEM

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CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60718

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation : *Designation :* **Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***

Constructeur : *Manufacturer :* **01dB**

Type : *Type :* **DUO**

N° de serie : *Serial number :* **12606**

N° d'identification : *Identification number*

Date d'émission : *Date of issue :* **07/09/2018**

Ce constat comprend *This certificate includes* 5 pages *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60718

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12606		331836

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:
- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:
- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,2 kPa**
Température : *Temperature*	**23,6 °C**
Taux d'humidité relative : *Relative humidity*	**61,9 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :

INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :

RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :
Conformity decision has been taken with the tolerance descriptions in the following standards:

IEC 61260
IEC 61672-1 classe 1
ANSI S1.11 class
ANSI S1.4 class 1

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60718

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**

N° de serie : *Serial number :*	**12606**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**07/09/2018**

Ce certificat comprend 10 Pages
This certificate includes 10 Pages

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60718

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12606		331836

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**

Pression atmosphérique : *Static pressure*	**98,2 kPa**
Température : *Temperature*	**23,6 °C**
Taux d'humidité relative : *Relative humidity*	**61,9 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :

INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :

RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-0,7	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	-0,5	-0,6	-0,6	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,1	0,0	0,0	-0,1	0,29
4000 Hz	-0,3	0,0	0,3	-0,1	0,39
8000 Hz	-0,5	-1,4	-0,9	-1,0	0,61
16000 Hz	-1,2	-3,2	-7,2	-7,0	0,61
A	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,8	-26,9	-26,9	0,45
125 Hz	-16,9	-16,7	-16,9	-16,8	0,45
250 Hz	-9,3	-9,2	-9,4	-9,3	0,29
500 Hz	-3,7	-3,7	-3,9	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,3	1,3	1,3	1,1	0,29
4000 Hz	0,6	1,0	1,2	0,9	0,39
8000 Hz	-2,1	-3,0	-2,5	-2,6	0,61
16000 Hz	-13,2	-15,2	-19,2	-18,9	0,61
B	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-10,1	-10,0	-10,1	-10,1	0,45
125 Hz	-4,9	-4,8	-4,9	-4,8	0,45
250 Hz	-1,9	-1,8	-2,0	-2,0	0,29
500 Hz	-0,7	-0,7	-0,9	-0,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	-0,1	0,0	-0,2	0,29
4000 Hz	-1,1	-0,7	-0,5	-0,9	0,39
8000 Hz	-3,9	-4,8	-4,3	-4,4	0,61
16000 Hz	-15,0	-17,0	-21,0	-20,7	0,61
C	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,4	-1,6	-1,5	0,45
125 Hz	-0,8	-0,7	-0,8	-0,8	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,1	-0,1	-0,3	0,29
4000 Hz	-1,2	-0,8	-0,6	-1,0	0,39
8000 Hz	-4,0	-4,9	-4,4	-4,5	0,61
16000 Hz	-15,1	-17,1	-21,1	-20,8	0,61

Linéarité

Linearity

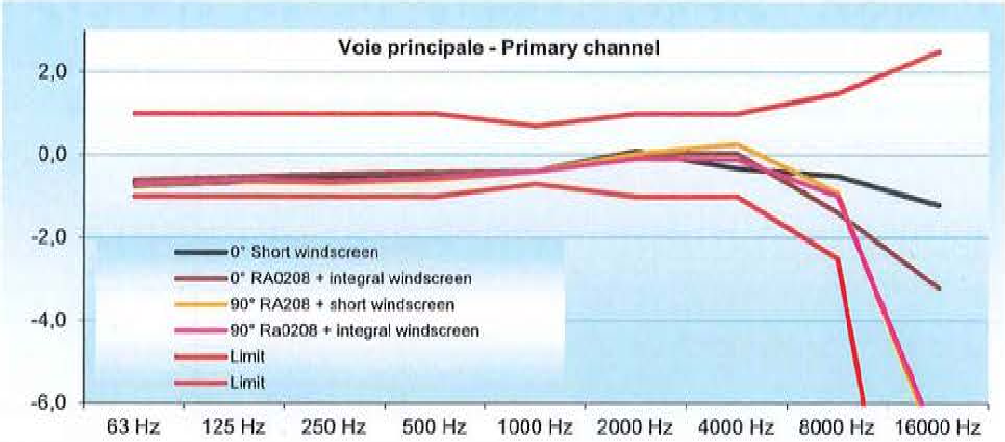
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,1	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,1	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,9	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,1	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	109,9	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



OPTION DMK 01 (1/3)

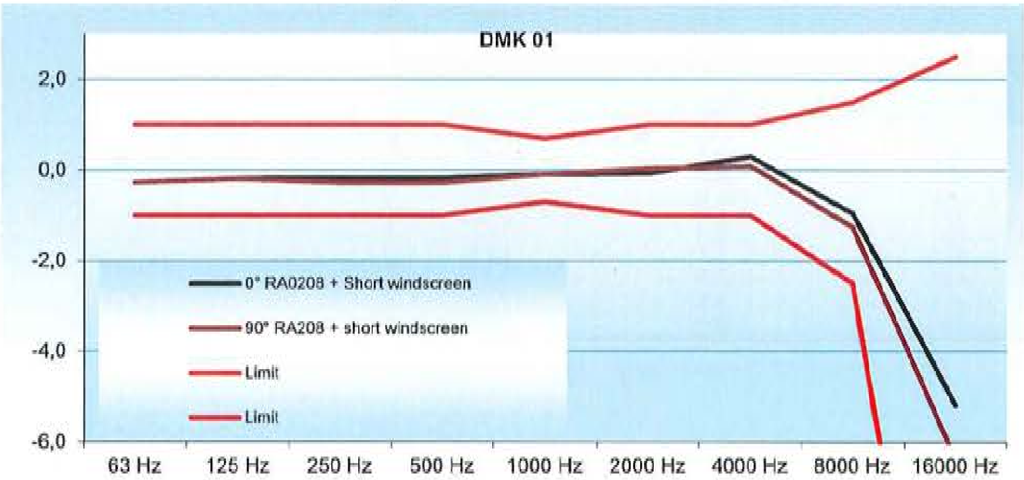
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,0	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,1	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,7	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,1	0,2
Leq 26 dBA / 8000 Hz	26,0	26,2	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,1	0,0	0,29
4000 Hz	0,3	0,1	0,39
8000 Hz	-1,0	-1,3	0,61
16000 Hz	-5,2	-6,4	0,61
A	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-26,5	-26,5	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,4	-3,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,1	1,3	0,29
4000 Hz	1,2	1,1	0,39
8000 Hz	-2,6	-2,9	0,61
16000 Hz	-17,2	-18,4	0,61
B	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-9,6	-9,6	0,45
125 Hz	-4,4	-4,4	0,45
250 Hz	-1,5	-1,6	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,5	-0,7	0,39
8000 Hz	-4,4	-4,7	0,61
16000 Hz	-19,0	-20,2	0,61
C	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,6	-0,8	0,39
8000 Hz	-4,5	-4,8	0,61
16000 Hz	-19,1	-20,3	0,61

Fin du certificat d'étalonnage   End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60718

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12606**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date* **07/09/2018**	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY* Bertrand LEROY

Documentation Métrologique
Metrological documentation

DUO 12608

Date d'émission : **07/09/2018**
Date of issue :

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

www.acoemgroup.com
support@acoemgroup.com

TABLE DES MATIERES
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Chapitre 1.
Constat de verification
Verification certificate

CV-DTE-L-18-PVE-60720

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation :
Designation :

Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :

01dB

Type :
Type :

DUO

N° de serie :
Serial number :

12608

N° d'identification :
Identification number

Date d'émission :
Date of issue :

07/09/2018

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60720

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12608		331780

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,2 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**61,9 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes : *Conformity decision has been taken with the tolerance descriptions in the following standards:*	IEC 61260 IEC 61672-1 classe ANSI S1.11 class ANSI S1.4 class	1 1

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60720

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : **Sonomètre Intégrateur-Moyenneur**
Designation : ***Integrating-Averaging Sound Level Meter***

Constructeur : **01dB**
Manufacturer :

Type : **DUO**
Type :

N° de serie : **12608**
Serial number :

N° d'identification :
Identification number

Date d'émission : **07/09/2018**
Date of issue :

Ce certificat comprend 10 Pages
This certificate includes *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60720

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12608		331780

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.7 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,2 kPa**
Température : *Temperature*	**23,5 °C**
Taux d'humidité relative : *Relative humidity*	**61,9 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :

INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur de fonction / Waveform generator	Helwet-Packard	HP 33120 A	US36028745	APM 1163
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605202	APM 5541
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :

RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-0,7	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	-0,5	-0,6	-0,6	0,45
250 Hz	-0,5	-0,4	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	0,0	0,0	-0,1	0,29
4000 Hz	-0,5	-0,1	0,1	-0,3	0,39
8000 Hz	-0,7	-1,5	-1,1	-1,1	0,61
16000 Hz	-0,5	-2,5	-6,5	-6,3	0,61
A	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,9	-27,0	-27,0	0,45
125 Hz	-16,9	-16,8	-16,9	-16,8	0,45
250 Hz	-9,2	-9,1	-9,4	-9,3	0,29
500 Hz	-3,7	-3,7	-3,9	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,2	1,1	1,2	1,0	0,29
4000 Hz	0,4	0,8	1,0	0,6	0,39
8000 Hz	-2,3	-3,2	-2,7	-2,8	0,61
16000 Hz	-12,5	-14,5	-18,5	-18,2	0,61
B	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-10,2	-10,0	-10,1	-10,1	0,45
125 Hz	-4,9	-4,8	-4,9	-4,9	0,45
250 Hz	-1,9	-1,8	-2,1	-2,0	0,29
500 Hz	-0,8	-0,7	-0,9	-0,9	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,1	-0,1	-0,2	0,29
4000 Hz	-1,3	-0,9	-0,7	-1,1	0,39
8000 Hz	-4,1	-5,0	-4,5	-4,6	0,61
16000 Hz	-14,3	-16,3	-20,3	-20,1	0,61
C	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,5	-1,6	-1,6	0,45
125 Hz	-0,8	-0,7	-0,8	-0,8	0,45
250 Hz	-0,5	-0,4	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	-0,1	-0,2	-0,2	-0,3	0,29
4000 Hz	-1,4	-1,0	-0,8	-1,2	0,39
8000 Hz	-4,2	-5,1	-4,6	-4,7	0,61
16000 Hz	-14,4	-16,4	-20,4	-20,2	0,61

Linéarité
Linearity

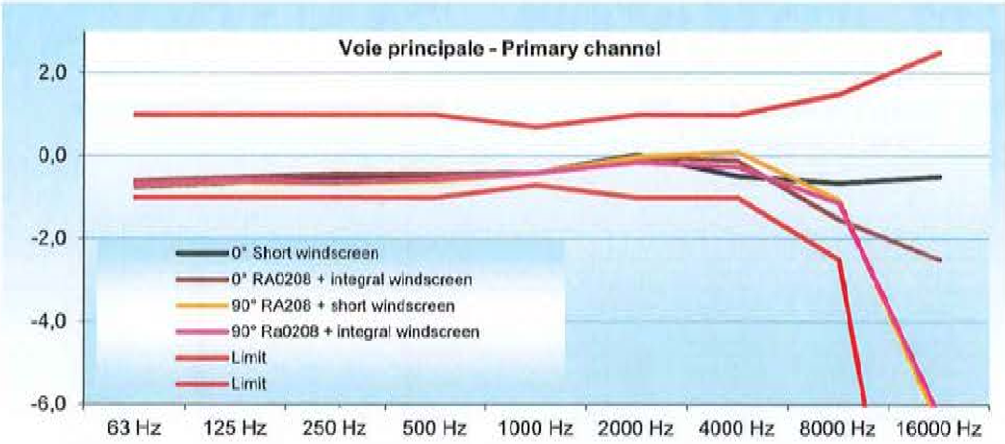
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,1	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,1	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,8	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	29,9	0,2
Leq 26 dBA / 8000 Hz	26,0	26,0	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	109,9	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



Option DMK 01 (1/3)

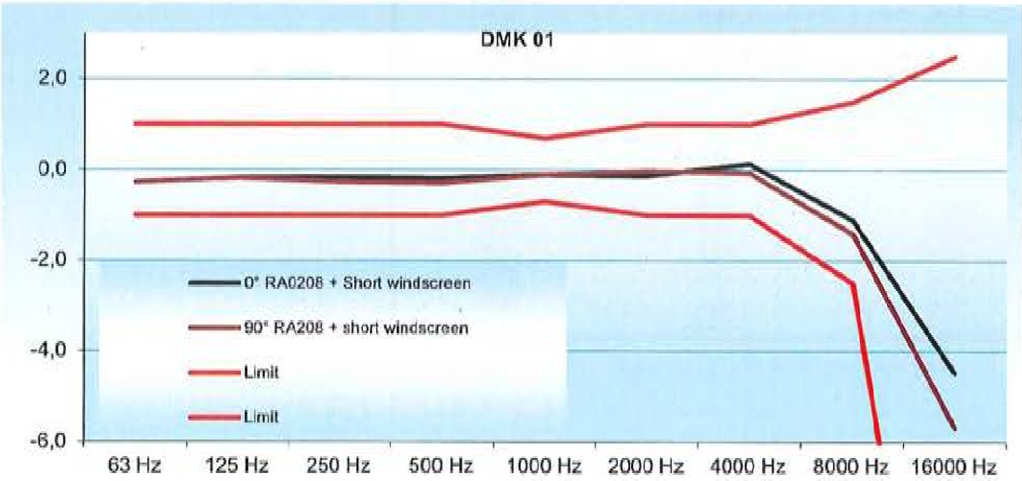
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	34,9	0,2
Leq 40 dBZ / 8000 Hz	40,0	39,9	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,7	0,2
Leq 110 dBA / 8000 Hz	110,0	109,8	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,1	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,1	0,0	0,29
4000 Hz	0,1	-0,1	0,39
8000 Hz	-1,1	-1,4	0,61
16000 Hz	-4,5	-5,7	0,61
A	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-26,6	-26,6	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,4	-3,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,0	1,1	0,29
4000 Hz	1,0	0,8	0,39
8000 Hz	-2,7	-3,0	0,61
16000 Hz	-16,5	-17,7	0,61
B	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,5	-4,5	0,45
250 Hz	-1,6	-1,7	0,29
500 Hz	-0,5	-0,6	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,7	-0,9	0,39
8000 Hz	-4,6	-4,9	0,61
16000 Hz	-18,3	-19,5	0,61
C	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,3	-0,2	0,29
4000 Hz	-0,8	-1,0	0,39
8000 Hz	-4,7	-5,0	0,61
16000 Hz	-18,4	-19,6	0,61

Fin du certificat d'étalonnage End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60720

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12608**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date* 07/09/2018	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY* Bertrand LEROY

Documentation Métrologique
Metrological documentation

DUO 12609

Date d'émission : *Date of issue :* **10/09/2018**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

www.acoemgroup.com
support@acoemgroup.com

01dB-Metravib SAS - Head Office: 200 chemin des Ormeaux - F-69578 Limonest Cedex - France // Phone: +33 4 72 52 48 00 - Fax : +33 4 72 52 47 47 // www.acoemgroup.com

A simplified joint stock company with a capital of 7,331,208 EUR - SIRET: 409 869 708 00019 - Lyon Trade Register: 409 869 708 - European VAT number: FR 82 409 869 708

01dB - METRAVIB - ONEPROD Brands of ACOEM

TABLE DES MATIERES
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Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-18-PVE-60725

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation :
Designation :
Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :
01dB

Type :
Type :
DUO

N° de serie :
Serial number :
12609

N° d'identification :
Identification number

Date d'émission :
Date of issue :
10/09/2018

Ce constat comprend 5 pages
This certificate includes 5 pages

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60725

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12609		331806

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.10 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,87 kPa**
Température : *Temperature*	**23,8 °C**
Taux d'humidité relative : *Relative humidity*	**51,8 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :
Conformity decision has been taken with the tolerance descriptions in the following standards:

IEC 61260
IEC 61672-1 classe 1
ANSI S1.11 class 1
ANSI S1.4 class

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-18-PVE-60725

DELIVRE PAR :
ISSUED BY

ACOEM

Service Métrologie
200 Chemin des Ormeaux

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**DUO**
N° de serie : *Serial number :*	**12609**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**10/09/2018**

Ce certificat comprend 10 Pages
This certificate includes 10 Pages

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB
François MAGAND

DTE-L-18-PVE-60725

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB		GRAS
Type : *Type*	DUO	Interne - Internal	40CD
Numéro de série : *Serial number*	12609		331806

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration [French format]*	**.10 - 9 - 2018 .**
Nom de l'opérateur : *Operator Name*	**Quentin Dufournet**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**98,87 kPa**
Température : *Temperature*	**23,8 °C**
Taux d'humidité relative : *Relative humidity*	**51,8 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :

INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36036418	APM 5399
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société ACOEM. Les étalons de référence de la société ACOEM sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the ACOEM reference standards. ACOEM reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :

RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

Pondération fréquentielle (voie interne) - Frequency weighting (primary channel)					
Z	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-0,8	-0,6	-0,7	-0,7	0,45
125 Hz	-0,7	-0,5	-0,6	-0,6	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,5	-0,4	-0,6	-0,6	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,1	0,1	0,1	0,0	0,29
4000 Hz	-0,2	0,2	0,4	0,0	0,39
8000 Hz	-0,4	-1,3	-0,8	-0,9	0,61
16000 Hz	-1,3	-3,3	-7,3	-7,1	0,61
A	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-27,0	-26,8	-27,0	-26,9	0,45
125 Hz	-16,9	-16,7	-16,8	-16,8	0,45
250 Hz	-9,2	-9,1	-9,4	-9,3	0,29
500 Hz	-3,7	-3,7	-3,8	-3,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	1,4	1,3	1,3	1,2	0,29
4000 Hz	0,8	1,1	1,3	1,0	0,39
8000 Hz	-2,0	-2,8	-2,4	-2,4	0,61
16000 Hz	-13,3	-15,3	-19,3	-19,1	0,61
B	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-10,1	-10,0	-10,1	-10,1	0,45
125 Hz	-4,9	-4,8	-4,9	-4,8	0,45
250 Hz	-1,9	-1,8	-2,0	-2,0	0,29
500 Hz	-0,7	-0,7	-0,9	-0,8	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	0,0	0,0	-0,1	0,29
4000 Hz	-1,0	-0,6	-0,4	-0,7	0,39
8000 Hz	-3,8	-4,6	-4,2	-4,2	0,61
16000 Hz	-15,1	-17,1	-21,1	-20,9	0,61
C	0° Short windscreen	0° RA0208 + integral windscreen	90° RA208 + short windscreen	90° Ra0208 + integral windscreen	Incertitude uncertainty (dB)
63 Hz	-1,6	-1,5	-1,6	-1,5	0,45
125 Hz	-0,8	-0,7	-0,8	-0,8	0,45
250 Hz	-0,6	-0,5	-0,7	-0,6	0,29
500 Hz	-0,4	-0,4	-0,6	-0,5	0,29
1000 Hz	-0,4	-0,4	-0,4	-0,4	0,29
2000 Hz	0,0	-0,1	-0,1	-0,2	0,29
4000 Hz	-1,1	-0,7	-0,5	-0,8	0,39
8000 Hz	-3,9	-4,8	-4,3	-4,4	0,61
16000 Hz	-15,2	-17,2	-21,2	-21,0	0,61

Linéarité
Linearity

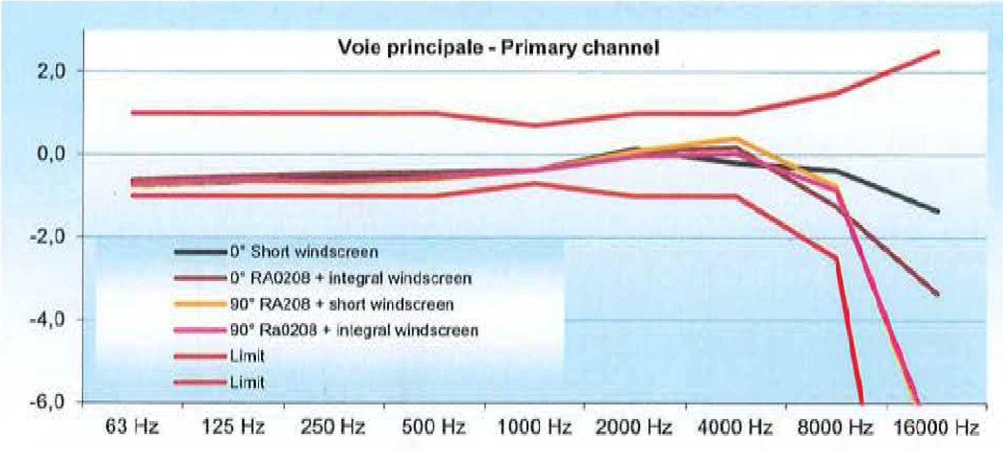
Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,0	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,8	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,8	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,7	0,2
Leq 110 dBA / 8000 Hz	110,0	109,8	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,0	0,2
Leq 30 dBA / 8000 Hz	30,0	30,0	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	109,9	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Réponse acoustique
Acoustic response



OPTION DMK 01 (1/3)

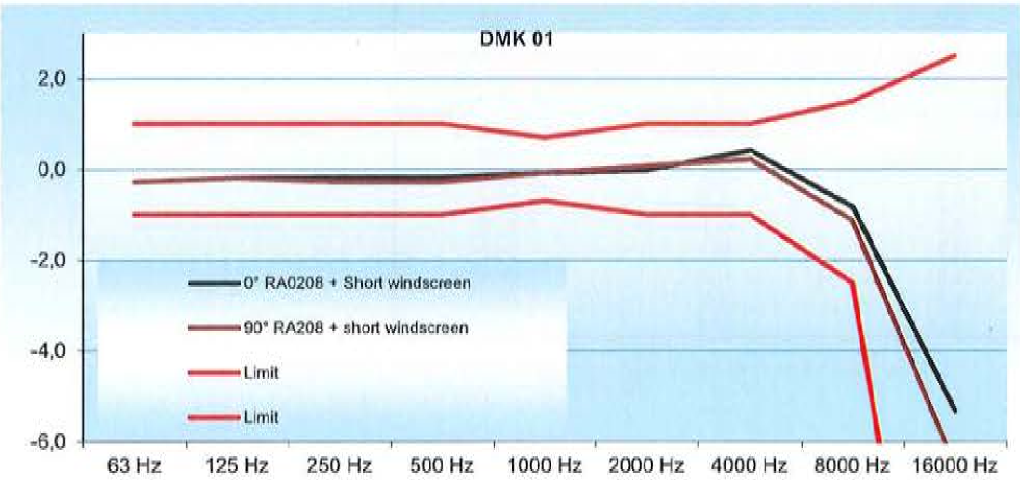
Les données liées au DMK01 sont issues de la réponse en fréquence du microphone associé à l'influence typique du DMK01.
The DMK01's results describes the association of the microphone acoustical response with the tipical DMK01 influence.

Filtre par bande d'octave (DMK 01) *Octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	110,0	0,4

Filtre tiers d'octave (DMK 01) *Third octave filter (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	110,0	0,6

OPTION DMK 01 (2/3)

Linéatité (avec DMK01) *Linearity (with DMK01)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,2
Leq 40 dBZ / 8000 Hz	40,0	40,0	0,2
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,2
Leq 60 dBZ / 8000 Hz	60,0	60,0	0,2
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,2
Leq 80 dBZ / 8000 Hz	80,0	80,0	0,2
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,2
Leq 100 dBZ / 8000 Hz	100,0	100,0	0,2
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,2
Leq 120 dBZ / 8000 Hz	120,0	119,8	0,2
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,2
Leq 134 dBZ / 8000 Hz	134,0	133,7	0,2
Leq 134 dBA / 8000 Hz	134,0	133,7	0,2
Leq 130 dBA / 8000 Hz	130,0	129,7	0,2
Leq 120 dBA / 8000 Hz	120,0	119,8	0,2
Leq 110 dBA / 8000 Hz	110,0	109,9	0,2
Leq 100 dBA / 8000 Hz	100,0	100,0	0,2
Leq 90 dBA / 8000 Hz	90,0	90,0	0,2
Leq 80 dBA / 8000 Hz	80,0	80,0	0,2
Leq 70 dBA / 8000 Hz	70,0	70,0	0,2
Leq 60 dBA / 8000 Hz	60,0	60,0	0,2
Leq 50 dBA / 8000 Hz	50,0	50,0	0,2
Leq 40 dBA / 8000 Hz	40,0	40,1	0,2
Leq 30 dBA / 8000 Hz	30,0	30,1	0,2
Leq 26 dBA / 8000 Hz	26,0	26,1	0,2



OPTION DMK 01 (3/3)

Pondération fréquentielle (avec DMK01) Frequency weighting (with DMK01)			
Z	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-0,3	-0,3	0,45
125 Hz	-0,2	-0,2	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	0,0	0,1	0,29
4000 Hz	0,4	0,2	0,39
8000 Hz	-0,8	-1,1	0,61
16000 Hz	-5,3	-6,5	0,61
A	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-26,5	-26,5	0,45
125 Hz	-16,4	-16,4	0,45
250 Hz	-8,9	-9,0	0,29
500 Hz	-3,4	-3,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	1,2	1,3	0,29
4000 Hz	1,4	1,2	0,39
8000 Hz	-2,4	-2,7	0,61
16000 Hz	-17,3	-18,5	0,61
B	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-9,7	-9,7	0,45
125 Hz	-4,4	-4,4	0,45
250 Hz	-1,5	-1,6	0,29
500 Hz	-0,5	-0,5	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,1	0,0	0,29
4000 Hz	-0,3	-0,5	0,39
8000 Hz	-4,2	-4,5	0,61
16000 Hz	-19,1	-20,3	0,61
C	*0° RA0208 + Short windscreen*	*90° RA208 + short windscreen*	Incertitude uncertainty
63 Hz	-1,1	-1,1	0,45
125 Hz	-0,4	-0,4	0,45
250 Hz	-0,2	-0,3	0,29
500 Hz	-0,2	-0,3	0,29
1000 Hz	-0,1	-0,1	0,29
2000 Hz	-0,2	-0,1	0,29
4000 Hz	-0,5	-0,7	0,39
8000 Hz	-4,3	-4,6	0,61
16000 Hz	-19,2	-20,4	0,61

Fin du certificat d'étalonnage End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-18-PVE-60725

Nous, fabricant *We, manufacturer*	**Acoem** 200, Chemin des Ormeaux F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation : *Designation:*	**Sonomètre Intégrateur Moyenneur** ***Integrating-Averaging Sound level meter***
Référence : *Reference:*	**DUO**
Numéro de série : *Serial Number:*	**12609**

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date *Date*	LE REFERENT METROLOGIE ACOUSTIQUE PAR DELEGATION *THE REFERENT ACOUSTIC METROLOGY*
10/09/2018	Bertrand LEROY

Documentation Métrologique
Metrological documentation

CUBE 11100

Date d'émission :
Date of issue : **08/03/2017**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

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01dB-Metravib SAS - Head Office: 200 chemin des Ormeaux - F-69578 Limonest Cedex - France // Phone: +33 4 72 52 48 00 - Fax : +33 4 72 52 47 47 // www.acoemgroup.com

A simplified joint stock company with a capital of 7,331,298 EUR - SIRET: 409 869 708 00019 - Lyon Trade Register: 409 869 708 - European VAT number: FR 62 409 869 708

01dB - METRAVIB - ONEPROD Brands of ACOEM

TABLE DES MATIERES
TABLE OF CONTENT

Chapitre 1.
Constat de verification
Verification certificate

CV-DTE-L-17-PVE-47522

DELIVRE PAR :
ISSUED BY :

ACOEM
Service Métrologie

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**CUBE**
N° de serie : *Serial number :*	**11100**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**08/03/2017**

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB

DTE-L-17-PVE-47522

François MAGAND

Ce document ne peut pas etre utilise en lieu et place d'un certificat d'etalonnage. Ce document est realise suivant les recommandations du fascicule de documentation X 07-011.

This document can't be used as calibration certificate. It is compliant with the X 07-011 standard recommendations.

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :
INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36045991	APM 1162
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société Acoem. Les étalons de référence de la société Acoem sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the Acoem reference standards. Acoem reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :
RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :	IEC 61260 IEC 61672-1 classe	1
Conformity decision has been taken with the tolerance descriptions in the following standards:	ANSI S1.11 class ANSI S1.4 class	1

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-17-PVE-47522

DELIVRE PAR :
ISSUED BY :

ACOEM

Service Métrologie

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation :
Designation :

Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :

01dB

Type :
Type :

CUBE

N° de serie :
Serial number :

11100

N° d'identification :
Identification number

Date d'émission :
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08/03/2017

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LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB

DTE-L-17-PVE-47522

François MAGAND

CE CERTIFICAT EST CONFORME AU FASCICULE DE DOCUMENTATION FD X 07-012.
THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :

INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36045991	APM 1162
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

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All the measuring instruments are calibrated using the Acoem reference standards. Acoem reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :

RESULTS:

Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Linéarité

Linearity

Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,1	0,23
Leq 45 dBZ / 8000 Hz	45,0	45,0	0,23
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,20
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,20
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,20
Leq 110 dBZ / 8000 Hz	110,0	109,8	0,20
Leq 130 dBZ / 8000 Hz	130,0	129,6	0,20
Leq 134 dBZ / 8000 Hz	134,0	133,6	0,20
Leq 134 dBA / 8000 Hz	134,0	133,6	0,20
Leq 130 dBA / 8000 Hz	130,0	129,6	0,20
Leq 110 dBA / 8000 Hz	110,0	109,7	0,20
Leq 90 dBA / 8000 Hz	90,0	90,0	0,20
Leq 70 dBA / 8000 Hz	70,0	70,0	0,20
Leq 50 dBA / 8000 Hz	50,0	50,0	0,20
Leq 30 dBA / 8000 Hz	30,0	30,1	0,20
Leq 26 dBA / 8000 Hz	26,0	26,1	0,20

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-17-PVE-47522

Nous, fabricant
We, manufacturer

Acoem
200, Chemin des Ormeaux
F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation :
Designation:
Sonomètre Intégrateur Moyenneur
Integrating-Averaging Sound level meter

Référence :
Reference:
CUBE

Numéro de série :
Serial Number:
11100

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date
Date
08/03/2017

LE REFERENT METROLOGIE ACOUSTIQUE
PAR DELEGATION
THE REFERENT ACOUSTIC METROLOGY
Bertrand LEROY

Calibration Chart
½" Prepolarized Free-Field Microphone
Type 40CD

Microphone Type 40CD: **Serial No. 260788**

Calibration Date:	19. Oct 2016
Operator:	Pec

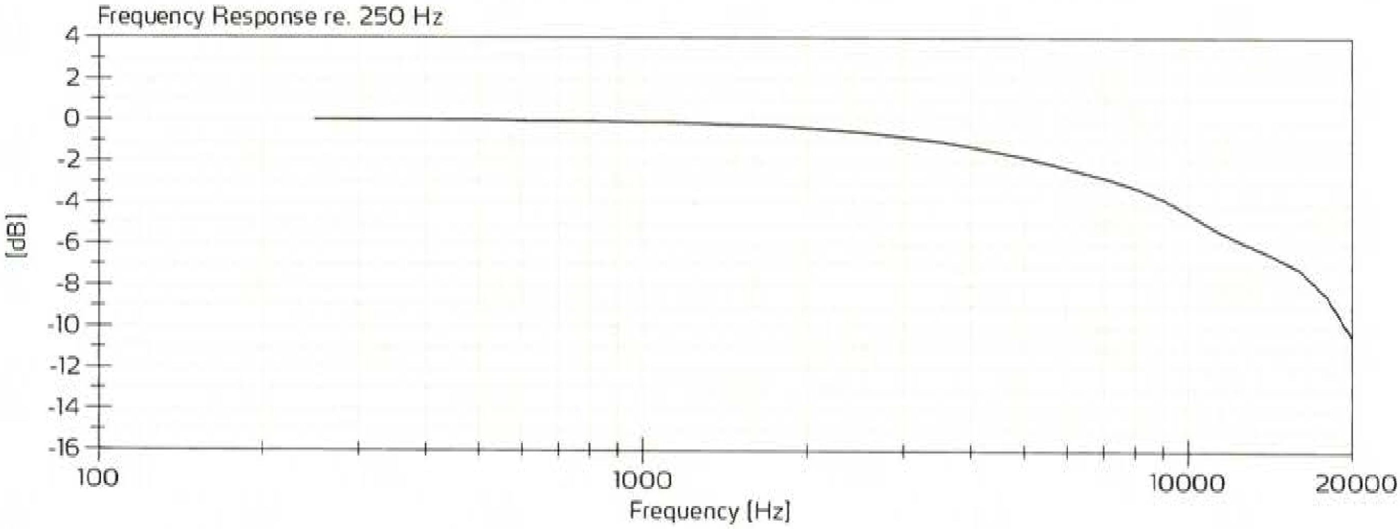
Enviromental Calibration Conditions:

Temperature:	23 °C
Relative humidity:	44 %
Barometric pressure:	1009 hPa

Open Circuit Sensitivity

The calibration is performed by comparison with a Reference Microphone Cartridge Type 40AG and is traceable to the National Physical Laboratory, UK.
The stated sensitivity for the microphone cartridge is the open circuit sensitivity. When used with a typical preamplifier, like the G.R.A.S. Type 26AH, the sensitivity will be 0.2 dB lower.

Test Frequency [Hz]	Measured Level [mV/Pa]	Measured Level [dB re. 1V/Pa]	Uncertainty [dB]
250	48.73	-26.24	±0.08



Frequency response

The graph shows the pressure frequency response of the microphone.
The response is recorded by elecrostatic actuator and is measured relative to 250 Hz.
(See back for free-field correction to fullfill IEC 61672)

½" Prepolarized Free-Field Microphone
Type 40CD

Serial No. 260788

Documentation Métrologique
Metrological documentation

CUBE 11096

Date d'émission :
Date of issue : **08/03/2017**

Référence Document : NOT1536
Nom : Documentation métrologique - *Metrological documentation* FRGB

www.acoemgroup.com
support@acoemgroup.com

01dB-Metravib SAS - Head Office: 200 chemin des Ormeaux - F-69578 Limonest Cedex - France // Phone: +33 4 72 52 48 00 - Fax : +33 4 72 52 47 47 // www.acoemgroup.com

TABLE DES MATIERES
TABLE OF CONTENT

Chapitre 1.
CONSTAT DE VERIFICATION
VERIFICATION CERTIFICATE

CV-DTE-L-17-PVE-47513

DELIVRE PAR :
ISSUED BY :

ACOEM
Service Métrologie

69760 LIMONEST
France

INSTRUMENT VERIFIE
INSTRUMENT CHECKED

Désignation :
Designation :
Sonomètre Intégrateur-Moyenneur
Integrating-Averaging Sound Level Meter

Constructeur :
Manufacturer :
01dB

Type :
Type :
CUBE

N° de serie :
Serial number :
11096

N° d'identification :
Identification number

Date d'émission :
Date of issue :
08/03/2017

Ce constat comprend 5 pages
This certificate includes *pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB

DTE-L-17-PVE-47513

François MAGAND

CE DOCUMENT NE PEUT PAS ETRE UTILISE EN LIEU ET PLACE D'UN CERTIFICAT D'ETALONNAGE. CE DOCUMENT EST REALISE SUIVANT LES RECOMMANDATIONS DU FASCICULE DE DOCUMENTATION X 07-011.

THIS DOCUMENT CAN'T BE USED AS CALIBRATION CERTIFICATE. IT IS COMPLIANT WITH THE X 07-011 STANDARD RECOMMENDATIONS.

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB	01dB	GRAS
Type : *Type*	CUBE	PRE22	40CD
Numéro de série : *Serial number*	11096	1610392	260780

PROGRAMME DE VERIFICATION :
VERIFICATION PROGRAM:

Ce sonomètre a été vérifié sur les caractéristiques suivantes:

- Réponse en fréquence du sonomètre
- Linéarité
- Pondérations fréquentielles A-B-C-Z
- Bruit de fond
- Filtre 1/1 et 1/3 octave

This sound level meter has been verified on its following characteristics:

- *Frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z Weighting*
- *Background noise*
- *1/1 and 1/3 Octave filter*

METHODE DE VERIFICATION :
VERIFICATION METHOD:

L'appareil est vérifié dans une salle climatisée. Les caractéristiques sont vérifiées étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is controlled in an air conditioned room. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS DE VERIFICATION :
VERIFICATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration* (french format)	. 8 - 3 - 2017 .
Nom de l'opérateur : *Operator Name*	**Stéphane Trève**
Instruction d'étalonnage : *Calibration instruction*	**P118-NOT-01**
Pression atmosphérique : *Static pressure*	**99,26 kPa**
Température : *Temperature*	**24,7 °C**
Taux d'humidité relative : *Relative humidity*	**31,2 %HR**

MOYENS DE MESURE UTILISES POUR LA VERIFICATION :

INSTRUMENTS USED FOR VERIFICATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
Générateur BF / Waveform generator	Helwet-Packard	33120A	US36045991	APM 1162
Calibreur acoustique / Calibrator	01dB-Metravib	CAL21	50441936	APM 1398
Boite à décades / Decade box	01dB-Metravib	OUT1694	1605204	APM 5543

Tous les moyens de mesure utilisés sont raccordés aux étalons de référence de la société Acoem. Les étalons de référence de la société Acoem sont raccordés aux étalons nationaux par un étalonnage COFRAC. La liste de ces étalons est disponible sur simple demande auprès du responsable métrologique du laboratoire.

All the measuring instruments are calibrated using the Acoem reference standards. Acoem reference standards are calibrated with COFRAC certificate of calibration. The reference standard list is available on simple request to the head of the Metrology Lab.

RESULTATS :

RESULTS:

Le jugement de conformité de chaque test est établi suivant les tolérances données dans les normes suivantes :	IEC 61260 IEC 61672-1 classe	 1
Conformity decision has been taken with the tolerance descriptions in the following standards:	ANSI S1.11 class ANSI S1.4 class	1

Linéarité
Linearity

Description *Description*	Résultat *Result*
Linéarité *Linearity*	Conforme *Compliant*

Pondérations fréquentielles A-B-C-Z
A-B-C-Z Weightings

Description *Description*	Résultat *Result*
Pondération fréquentielle *Frequency weighting*	Conforme *Compliant*

Bruit de fond
Background noise

Description *Description*	Résultat *Result*
Bruit de fond *Noise level*	Conforme *Compliant*

Filtre d'octave
1/1 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/1 octave *1/1 Octave filter central frequency attenuation*	Conforme *Compliant*

Filtre de 1/3 d'octave
1/3 Octave filter

Description *Description*	Résultat *Result*
Fréquence centrale filtre 1/3 octave *1/3 Octave filter central frequency attenuation*	Conforme *Compliant*

Fin du constat de vérification   End of verification certificate

Chapitre 2.
CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE

CE-DTE-L-17-PVE-47513

DELIVRE PAR :
ISSUED BY :

ACOEM

Service Métrologie

69760 LIMONEST
France

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : *Designation :*	**Sonomètre Intégrateur-Moyenneur** ***Integrating-Averaging Sound Level Meter***
Constructeur : *Manufacturer :*	**01dB**
Type : *Type :*	**CUBE**
N° de serie : *Serial number :*	**11096**
N° d'identification : *Identification number*	
Date d'émission : *Date of issue :*	**08/03/2017**

Ce certificat comprend 6 Pages
This certificate includes *Pages*

LE RESPONSABLE METROLOGIQUE
DU LABORATOIRE
HEAD OF THE METROLOGY LAB

DTE-L-17-PVE-47513

François MAGAND

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THIS CERTIFICATE IS COMPLIANT WITH THE FD X 07-012 STANDARD DOCUMENTATION

IDENTIFICATION :
IDENTIFICATION:

	Sonomètre *Sound level meter*	Préamplificateur *Preamplifier*	Microphone *Microphone*
Constructeur : *Manufacturer*	01dB	01dB	GRAS
Type : *Type*	CUBE	PRE22	40CD
Numéro de série : *Serial number*	11096	1610392	260780

PROGRAMME D'ETALONNAGE :
CALIBRATION PROGRAM:

Ce Sonomètre a été étalonné sur les caractéristiques suivantes :

- Réponse en fréquence du sonomètre en champ libre
- Linéarité
- Pondérations fréquentielles A-B-C-Z

The Sound level meter has been calibrated on the following characteristics:

- *Free field frequency response of the sound level meter*
- *Linearity*
- *A-B-C-Z frequency weightings*

METHODE D'ETALONNAGE :
CALIBRATION METHOD:

L'appareil est étalonné dans une salle climatisée. Les caractéristiques sont étalonnées avec un multimètre et un générateur étalonnés en amplitude et en fréquence. Des corrections constructeurs sont appliquées pour prendre en compte les effets des accessoires et du boîtier selon la norme IEC 61672-3

The instrument is calibrated in an air conditioned room.. The other characteristics are verified with multimeter and generator calibrated in amplitude and in frequency. Some manufacturer's corrections have been applied to account the acoustical effect from the case of the sound level meter and his accessories (IEC 61672-3).

CONDITIONS D'ETALONNAGE :
CALIBRATION CONDITIONS:

Date de l'étalonnage : *Date of Calibration* (french format)	. 8 - 3 - 2017 .
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Pression atmosphérique : *Static pressure*	**99,26 kPa**
Température : *Temperature*	**24,7 °C**
Taux d'humidité relative : *Relative humidity*	**31,2 %HR**

MOYENS DE MESURES UTILISES POUR L'ETALONNAGE :

INSTRUMENTS USED FOR CALIBRATION:

Désignation	Constructeur	Type	N° de série	N° d'identification
Designation	Manufacturer	Type	Serial number	Identification number
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All the measuring instruments are calibrated using the Acoem reference standards. Acoem reference standards are calibrated to national standard with COFRAC certificate of calibration. The reference standards list is available on simple request to the head of the Metrology lab.

RESULTATS :

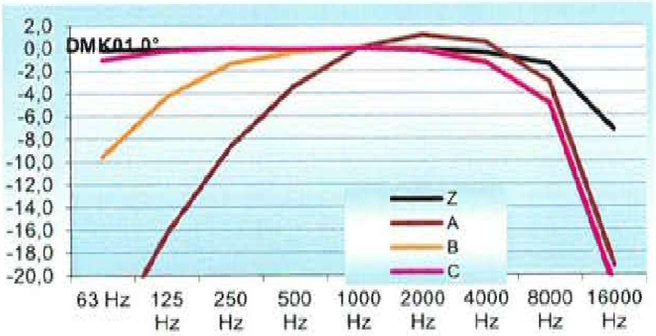
RESULTS:

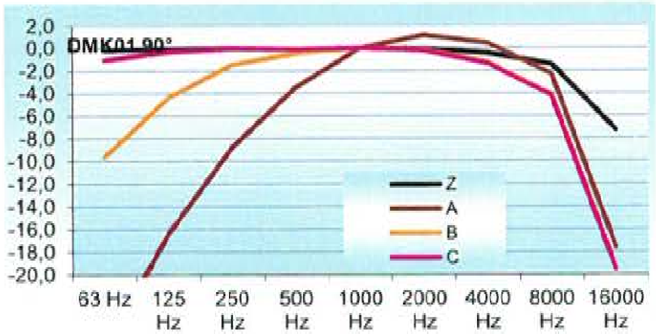
Les incertitudes élargies mentionnées sont celles correspondant à deux incertitudes types (k=2). Les incertitudes types sont calculées en tenant compte des différentes composantes d'incertitudes, étalons de référence, moyens d'étalonnage, conditions d'environnement, contribution de l'instrument étalonné, répétabilité ...

Mentioned expanded uncertainties correspond to two standard uncertainty types (k=2). Standard uncertainties are calculated including different uncertainty components, reference standards, instruments used, environmental conditions, calibrated instrument contribution, repeatability...

Pondération fréquentielle
Frequency Weighting

DMK 0°: Pondération fréquentielle ; Frequency weighting					
Fréquence Frequency (Hz)	Z	A	B	C	Incertitude uncertainty (dB)
63 Hz	-0,2	-26,4	-9,6	-1,0	0,45
125 Hz	-0,1	-16,3	-4,3	-0,3	0,45
250 Hz	0,0	-8,7	-1,4	0,0	0,29
500 Hz	-0,2	-3,4	-0,4	-0,1	0,29
1000 Hz	0,0	0,0	0,0	0,0	0,29
2000 Hz	-0,1	1,1	-0,2	-0,3	0,29
4000 Hz	-0,5	0,5	-1,2	-1,3	0,39
8000 Hz	-1,5	-3,0	-4,8	-5,0	0,61
16000 Hz	-7,3	-19,2	-21,0	-21,1	0,61
DMK 90°: Pondération fréquentielle ; Frequency weighting					
Fréquence Frequency (Hz)	Z	A	B	C	Incertitude uncertainty (dB)
63 Hz	-0,2	-26,5	-9,6	-1,1	0,45
125 Hz	-0,1	-16,4	-4,4	-0,3	0,45
250 Hz	-0,1	-8,8	-1,5	-0,1	0,29
500 Hz	-0,2	-3,5	-0,5	-0,2	0,29
1000 Hz	0,0	0,0	0,0	0,0	0,29
2000 Hz	-0,1	1,1	-0,2	-0,2	0,29
4000 Hz	-0,5	0,4	-1,3	-1,4	0,39
8000 Hz	-0,7	-2,3	-4,1	-4,2	0,61
16000 Hz	-5,7	-17,6	-19,4	-19,6	0,61





Linéarité
Linearity

Linéatité (voie principale) *Linearity (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 35 dBZ / 8000 Hz	35,0	35,0	0,23
Leq 45 dBZ / 8000 Hz	45,0	45,0	0,23
Leq 50 dBZ / 8000 Hz	50,0	50,0	0,20
Leq 70 dBZ / 8000 Hz	70,0	70,0	0,20
Leq 90 dBZ / 8000 Hz	90,0	90,0	0,20
Leq 110 dBZ / 8000 Hz	110,0	109,9	0,20
Leq 130 dBZ / 8000 Hz	130,0	129,7	0,20
Leq 134 dBZ / 8000 Hz	134,0	133,7	0,20
Leq 134 dBA / 8000 Hz	134,0	133,7	0,20
Leq 130 dBA / 8000 Hz	130,0	129,7	0,20
Leq 110 dBA / 8000 Hz	110,0	109,9	0,20
Leq 90 dBA / 8000 Hz	90,0	90,0	0,20
Leq 70 dBA / 8000 Hz	70,0	70,0	0,20
Leq 50 dBA / 8000 Hz	50,0	50,0	0,20
Leq 30 dBA / 8000 Hz	30,0	30,1	0,20
Leq 26 dBA / 8000 Hz	26,0	26,2	0,20

Filtre
Filter

Filtre par bande d'octave (Voie principale) *Octave filter (primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/1 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/1 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/1 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/1 Octave / 8000 Hz	110,0	109,9	0,4

Filtre tiers d'octave (Voie principale) *Third octave filter (Primary channel)*	Valeur nominale *Nominal value* (dB)	Valeur affichée *Displayed value* (dB)	Incertitudes *Uncertainty* (dB)
Leq 110 dB / 1/3 Octave / 25 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 31,5 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 40 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 50 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 63 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 80 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 100 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 125 Hz	110,0	109,9	0,5
Leq 110 dB / 1/3 Octave / 160 Hz	110,0	110,0	0,5
Leq 110 dB / 1/3 Octave / 200 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 250 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 315 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 400 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 500 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 630 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 800 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1000 Hz	110,0	110,0	0,3
Leq 110 dB / 1/3 Octave / 1250 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 1600 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 2500 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 3150 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 4000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 5000 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 6300 Hz	110,0	110,0	0,4
Leq 110 dB / 1/3 Octave / 8000 Hz	110,0	109,9	0,4
Leq 110 dB / 1/3 Octave / 10000 Hz	110,0	109,9	0,6

Fin du certificat d'étalonnage   End of calibration certificate

Chapitre 3.
CERTIFICAT DE CONFORMITE
CONFORMITY CERTIFICATE

CC-DTE-L-17-PVE-47513

Nous, fabricant
We, manufacturer

Acoem
200, Chemin des Ormeaux
F 69578 LIMONEST Cedex- FRANCE

déclarons sous notre seule responsabilité que le produit suivant :
declare under our own responsibility that the following equipment:

Désignation :
Designation:
Sonomètre Intégrateur Moyenneur
Integrating-Averaging Sound level meter

Référence :
Reference:
CUBE

Numéro de série :
Serial Number:
11096

est conforme aux dispositions des normes suivantes :
complies with the requirements of the following standards:

	Norme *Standard*	Classe *Class*	Edition du *Edition of*
Sonomètre :	IEC 60651	1	10-2000
Sound level meter :	IEC 60804	1	10-2000
	IEC 61672-1	1	09-2013
	IEC 61260	1	07-1995-2011
	ANSI S1.11	1	2004
	ANSI S1.4	1	1983-1985

et répond en tout point, après vérification et essais, aux exigences spécifiées, aux normes et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.

After testing and verification, this device satisfies all specified requirements and applicable standards and regulations apart from exceptions, reservations, or exemptions listed in this conformance certificate.

Date
Date

08/03/2017

LE REFERENT METROLOGIE ACOUSTIQUE
PAR DELEGATION
THE REFERENT ACOUSTIC METROLOGY

Bertrand LEROY

Calibration Chart
½" Prepolarized Free-Field Microphone
Type 40CD

Microphone Type 40CD: **Serial No. 260780**

Calibration Date: 19. Oct 2016
Operator: Pec

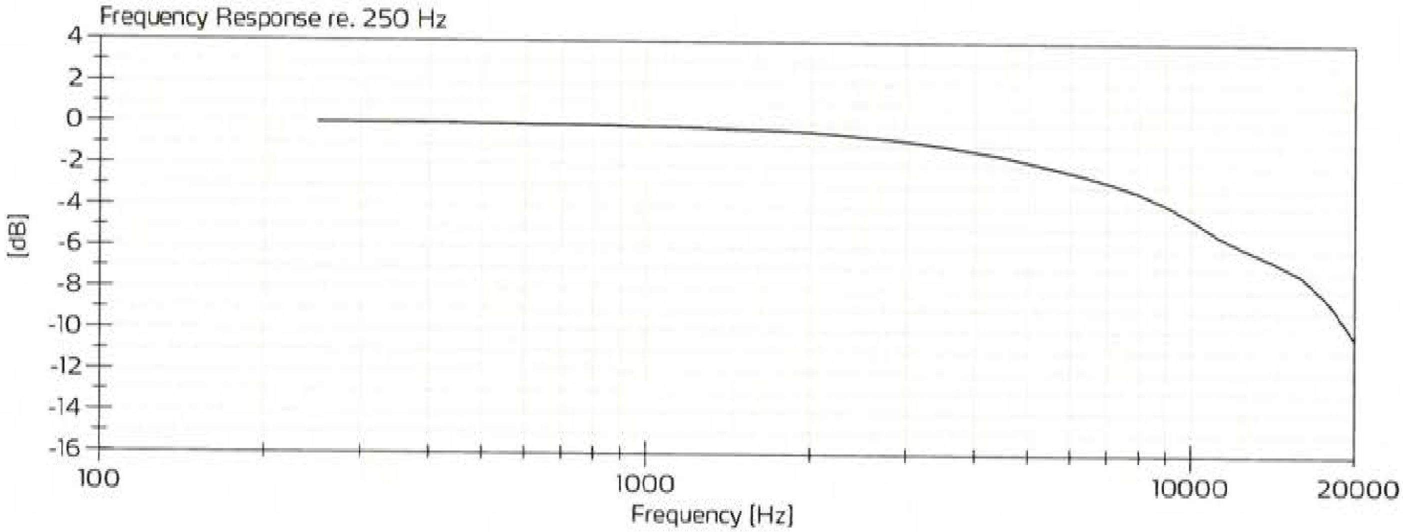
Enviromental Calibration Conditions:
Temperature: 23 °C
Relative humidity: 44 %
Barometric pressure: 1009 hPa

Open Circuit Sensitivity

The calibration is performed by comparison with a Reference Microphone Cartridge Type 40AG and is traceable to the National Physical Laboratory, UK.

The stated sensitivity for the microphone cartridge is the open circuit sensitivity. When used with a typical preamplifier, like the G.R.A.S. Type 26AH, the sensitivity will be 0.2 dB lower.

Test Frequency [Hz]	Measured Level [mV/Pa]	Measured Level [dB re. 1V/Pa]	Uncertainty [dB]
250	54.69	-25.24	±0.08



Frequency response

The graph shows the pressure frequency response of the microphone.

The response is recorded by elecrostatic actuator and is measured relative to 250 Hz.

(See back for free-field correction to fullfill IEC 61672)

½" Prepolarized Free-Field Microphone
Type 40CD

Serial No. 260780

Calibration Chart
½" Prepolarized Free-Field Microphone
Type 40CD

Frequency	Free Field Correction with rain protection grid (dB)		Free Field Correction when used with RA0208 (dB)	
(Hz)	0° incidence	90° incidence	0° incidence	90° incidence
1000	-0.1	0	0.1	0
1060	-0.1	0	0.1	0
1120	-0.1	0.1	0	0
1180	-0.1	0.1	-0.1	0.1
1250	-0.2	0.2	-0.1	0.1
1320	-0.2	0.2	-0.2	0.2
1400	-0.2	0.2	-0.2	0.3
1500	-0.2	0.2	-0.3	0.2
1600	-0.3	0.2	-0.3	0.1
1700	-0.3	0.2	-0.4	0.1
1800	-0.3	0.3	-0.4	0.2
1900	-0.3	0.4	-0.4	0.4
2000	-0.3	0.5	-0.5	0.5
2120	-0.3	0.6	-0.5	0.6
2240	-0.3	0.6	-0.5	0.6
2360	-0.3	0.5	-0.5	0.6
2500	-0.4	0.5	-0.5	0.5
2650	-0.4	0.5	-0.5	0.5
2800	-0.4	0.5	-0.5	0.4
3000	-0.4	0.5	-0.5	0.4
3150	-0.4	0.5	-0.5	0.5
3350	-0.4	0.6	-0.5	0.5
3550	-0.4	0.7	-0.6	0.6
3750	-0.4	0.9	-0.6	0.6
4000	-0.4	1	-0.7	0.7
4250	-0.5	1.1	-0.8	0.7
4500	-0.5	1.3	-1	0.8
4750	-0.6	1.5	-1.1	0.8
5000	-0.6	1.7	-1.3	0.9
5300	-0.7	1.9	-1.6	0.9
5600	-0.8	2.1	-1.9	0.9
6000	-0.9	2.2	-2.3	0.9
6300	-1.1	2.4	-2.7	0.8
6700	-1.2	2.4	-3.1	0.6
7100	-1.4	2.4	-3.6	0.3
7500	-1.7	2.3	-4	-0.1
8000	-1.9	2.3	-4.4	-0.6
8500	-2.2	2.3	-4.7	-1
9000	-2.5	2.3	-4.8	-1.2
9500	-2.7	2.4	-4.7	-1
10000	-2.9	2.7	-4.5	-0.5
10600	-3.1	2.9	-3.9	0.4
11200	-3.3	3	-3.1	1.7
11800	-3.4	3	-2.1	3
12500	-3.4	3	-0.6	3
13200	-3.2	3	0.9	3
14000	-2.9	3	2.4	3
15000	-2.4	3	3	3
16000	-1.6	3	3	3
17000	-0.6	3	3	3
18000	0.4	3	3	3
19000	1.4	3	3	3
20000	2.3	3	3	3

THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

Certificate Number: 2100

CERTIFICATE OF CALIBRATION

Certificate Number: **2100** **NATA Accreditation No: 15841**

Customer: Noise Measurement Services
18 Lade Street, Enoggera, QLD, 4051

Test object:	**Manufacturer:**	**Model:**	**Serial no:**	**ID:**
Sound level meter	Larson Davis	LD831	0001620	2100
Microphone:	PCB	377B02	LW137491	2100
Preamplifier	PCB	PRM831	012214	2100
Connecting Cable	None			

Environmental conditions:	**Pressure:**	**Temperature:**	**Relative humidity:**
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Conditions before measurement:	101.80 kPa	24.8 °C	56.9 %RH
Conditions after measurement:	101.63 kPa	25.0 °C	56.1 %RH

The measurements are performed according to the *IEC 61672 Sound level meters - Part 3: Periodic tests, DIN 45657 Sound Level Meters - Requirements for Special Applications* and *IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters.*

The expanded uncertainty of measurement is reported at approximately 95% confidence level with a coverage factor k, of 2.

Accredited for compliance with ISO/IEC 17025.

Date of calibration: 12/10/18
Technician: Jaie Wilde
Authorised Signatory:

Beau Weyers

Unit 3, 4 Tombo Street, Capalaba, QLD 4157
07 3245 1730
enquiries@calibretechnology.com.au

NATA
WORLD RECOGNISED ACCREDITATION
No. 15841

Certificate Number: 2100

Statement of Conformity.
The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. However, No general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conforms to the requirements of IEC 61672-1:2002, and because the periodic tests of IEC 61672-3 cover only a limited subset of the specifications in IEC 61672-1.

Uncertainty
For all tests, the expanded uncertainty of measurement is reported at approximately 95% confidence level with a coverage factor k, of 2. Except where noted otherwise, the results provided in this report are associated with the following expanded uncertainties:
Electrical tests: 0.09 dB
Toneburst: 0.09 dB
Acoustic tests:
0.13 dB for 31.5Hz <= f < 2kHz
0.14 dB for 2kHz <= f < 8kHz
0.16 dB for 8kHz <= f < 12.6kHz
0.10 dB for 1kHz
Bandpass filters:
0.1 dB for attenuation less than 4 dB
0.15 dB for attenuation less above 4 dB to 18 dB
0.25 for attenuation 18 dB to 80 dB

Traceability
The measured values are traceable to the following laboratories:
Sound Pressure Level: National Measurement Institute, Australia
Voltage: TRVMS, Australia
Frequency: TRVMS, Australia
Ambient Pressure: Thales, Australia
Temperature: Thales, Australia
Relative Humidity: Thales, Australia

Test Overview
The verification measurements have been performed using the calibration system Nor1504A with software type Nor1019.

The calibration has been undertaken in accordance with the procedures described in the Calibre Technology Acoustic Calibration Manual. For further details of the procedures, please contact the laboratory.

Tests undertaken in accordance with IEC 61672-3 include both acoustical and electrical tests. The acoustical tests undertaken include the acoustical part of the self-noise test and the acoustical verification of the frequency response. A special adapter with a suitable electrical characteristic is used.

All other tests undertaken are electrical tests. For these tests, signals are fed to the sound measuring device through an adapter that resembles the microphone signal.

Detailed measurement results are printed on the following pages.
Each of the verification test points has a Result indication (P, U, or N) that tells the obtained result of the actual test.
P = the result is Passed
U = due to the Uncertainty of the measurement it is not possible to state if the result is passed or not
N = the result is Not passed
All verification tests must have a Passed indication in order to fulfill the requirements in the standard.

Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.

Unit 3, 4 Tombo Street, Capalaba, QLD 4157
07 3245 1730
enquiries@calibretechnology.com.au

NATA
WORLD RECOGNISED ACCREDITATION
No. 15841

Certificate Number: 2100

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.2 #10	Passed
Self-generated noise - IEC 61672-3 Ed.2.0 #11	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.2.0 #13.3	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.2.0 #13.3	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 #13.3	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 #14	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.2.0 #16	Passed
Toneburst response - IEC 61672-3 Ed.2.0 #18	Passed
Peak C sound level - IEC 61672-3 Ed.2.0 #19	Passed
Overload indication - IEC 61672-3 Ed.2.0 #20	Passed
High level stability test - IEC 61672-3 Ed.2.0 #21	Passed
Long term stability test - IEC 61672-3 Ed.2.0 #15	Passed
DIN 45657 (2013): Statistical Distribution Test #5.2	Passed
Filter Test - IEC 61260 1/1octave: Linear operating range - IEC 61260, #11	Passed
Filter Test - IEC 61260 1/1octave: Relative attenuation - IEC 61260, #13	Passed
Filter Test - IEC 61260 1/1octave: Relative attenuation at midband frequency- IEC 61260, #10	Passed
Filter Test - IEC 61260 1/3octave: Linear operating range - IEC 61260, #11	Passed
Filter Test - IEC 61260 1/3octave: Relative attenuation - IEC 61260, #13	Passed
Filter Test - IEC 61260 1/3octave: Relative attenuation at midband frequency- IEC 61260, #10	Passed
Electrical signal tests of frequency weightings - IEC 61672-3 Ed.2.0 #13	Passed

THE CALIBRE TECHNOLOGY

ACOUSTIC & VIBRATION CALIBRATION CENTRE

Certificate Number: 2100

Results

Indication at the calibration check frequency - IEC61672-3 Ed.2 #10
Reference Calibrator: WSC2 - B&K4226_1k_114dB
Reference calibrator level: 114.07
Before calibration:
Environmental corrections: 0.00
Other corrections:
Notional level: 114.07
Calibrator level before adjustment: 114.4
After calibration:
Environmental corrections: 0.00
Other corrections:
Notional level: 114.07
Reference calibrator level after calibration: 114.0
Associated Calibrator: - -
Associated calibrator level: Not calibrated
Test Passed

Self-generated noise - IEC 61672-3 Ed.2.0 #11

Network	Level (dB)	Max (dB)	Uncert. (dB)	Result	Comment
A	18.6	19.0	0.09		Microphone installed
A	14.9	15.0	0.09	P	Equivalent capacity
C	16.2	22.0	0.09	P	Equivalent capacity
Z	22.2	25.0	0.09	P	Equivalent capacity

Test Passed
Note: Compliance with this test is not a requirement of IEC61672.3-2013, these results are provided for reference only.

Frequency weightings: A Network - IEC 61672-3 Ed.2.0 #13.3

Freq (Hz)	Ref. (dB)	Meas. (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
125.9	96.0	96.0	1.0	-1.0	0.09	0.0	P
251.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
501.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P
1995.3	96.0	96.0	1.0	-1.0	0.09	0.0	P
3981.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
7943.3	96.0	96.0	1.5	-2.5	0.09	0.0	P
15848.9	96.0	96.1	2.5	-16.0	0.09	0.1	P

Test Passed

Frequency weightings: C Network - IEC 61672-3 Ed.2.0 #13.3

Freq (Hz)	Ref. Level (dB)	Meas. Value (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
125.9	96.0	96.0	1.0	-1.0	0.09	0.0	P
251.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
501.2	96.0	96.0	1.0	-1.0	0.09	0.0	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P

1995.3	96.0	96.0	1.0	-1.0	0.09	0.0	P
3981.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
7943.3	96.0	96.0	1.5	-2.5	0.09	0.0	P
15848.9	96.0	96.0	2.5	-16.0	0.09	0.0	P

Test Passed

Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 #13.3

Freq	Ref. Level	Meas. Value	Tol.		Uncert.	Dev.	Result
(Hz)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
125.9	96.0	96.0	1.0	-1.0	0.09	0.0	P
251.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
501.2	96.0	96.0	1.0	-1.0	0.09	0.0	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P
1995.3	96.0	95.9	1.0	-1.0	0.09	-0.1	P
3981.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
7943.3	96.0	96.0	1.5	-2.5	0.09	0.0	P
15848.9	96.0	95.9	2.5	-16.0	0.09	-0.1	P

Test Passed

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 #14

Weightings		Ref.	Measured	Lim.		Uncert.	Dev.	Result
Time	Netw	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
Fast	A	114.0	114.0	0.1	-0.1	0.09	0.0	P
Fast	C	114.0	114.0	0.1	-0.1	0.09	0.0	P
Fast	Z	114.0	114.0	0.1	-0.1	0.09	0.0	P
Slow	A	114.0	114.0	0.1	-0.1	0.09	0.0	P
Leq	A	114.0	114.0	0.1	-0.1	0.09	0.0	P

Test Passed

Level linearity on the reference level range - IEC 61672-3 Ed.2.0 #16
Measurements are SPL measurements
Full scale setting: 140dB
Measured at 8 kHz

Ref.	Measured	Lim.		Uncert.	Dev.	Result
(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
114.0	114.0	0.8	-0.8	0.09	0.0	P
119.0	119.0	0.8	-0.8	0.09	0.0	P
124.0	124.0	0.8	-0.8	0.09	0.0	P
129.0	129.0	0.8	-0.8	0.09	0.0	P
134.0	134.0	0.8	-0.8	0.09	0.0	P
114.0	114.0	0.8	-0.8	0.09	0.0	P
109.0	109.0	0.8	-0.8	0.09	0.0	P
104.0	104.0	0.8	-0.8	0.09	0.0	P
99.0	99.0	0.8	-0.8	0.09	0.0	P
94.0	94.0	0.8	-0.8	0.09	0.0	P
89.0	89.0	0.8	-0.8	0.09	0.0	P
84.0	84.0	0.8	-0.8	0.09	0.0	P
79.0	79.0	0.8	-0.8	0.09	0.0	P
74.0	74.0	0.8	-0.8	0.09	0.0	P
69.0	69.0	0.8	-0.8	0.09	0.0	P
64.0	64.0	0.8	-0.8	0.09	0.0	P
59.0	59.0	0.8	-0.8	0.09	0.0	P
54.0	54.0	0.8	-0.8	0.09	0.0	P

Certificate Number: 2100

49.0	49.0	0.8	-0.8	0.09	0.0	P
44.0	44.0	0.8	-0.8	0.09	0.0	P
39.0	39.0	0.8	-0.8	0.09	0.0	P
34.0	34.1	0.8	-0.8	0.09	0.1	P
30.0	30.2	0.8	-0.8	0.09	0.2	P
29.0	29.3	0.8	-0.8	0.09	0.3	P
28.0	28.3	0.8	-0.8	0.09	0.3	P
27.0	27.3	0.8	-0.8	0.09	0.3	P
26.0	26.4	0.8	-0.8	0.09	0.4	P

Test Passed

Toneburst response - IEC 61672-3 Ed.2.0 #18

Burst type	Ref. (dB)	Measured (dB)	Lim. (dB)	Lim. (dB)	Uncert. (dB)	Dev. (dB)	Result
Fast 200 mSec	137.0	136.9	0.5	-0.5	0.09	-0.1	P
Fast 2.0 mSec	120.0	119.5	1.0	-1.5	0.09	-0.5	P
Fast 0.25 mSec	111.0	110.7	1.0	-3.0	0.09	-0.3	P
Slow 200 mSec	130.6	130.4	0.5	-0.5	0.09	-0.2	P
Slow 2.0 mSec	111.0	110.8	1.0	-3.0	0.09	-0.2	P
Leq 200 mSec	121.0	120.7	0.5	-0.5	0.09	-0.3	P
Leq 2.0 mSec	101.0	101.1	1.0	-1.5	0.09	0.1	P
Leq 0.25 mSec	92.0	92.0	1.0	-3.0	0.09	0.0	P

Test Passed

Peak C sound level - IEC 61672-3 Ed.2.0 #19

Pulse Type	Pulse Freq. (Hz)	Ref. RMS (dB)	Ref. Peak (dB)	Measured Value (dB)	Lim. (+/-dB)	Uncert. (dB)	Dev. (dB)	Result
1 cycle	8k	131.0	134.4	133.6	2.0	0.09	-0.8	P
Pos 1/2 cycle	500	134.0	136.4	136.2	1.0	0.09	-0.2	P
Neg 1/2 cycle	500	134.0	136.4	136.2	1.0	0.09	-0.2	P

Test Passed

Overload indication - IEC 61672-3 Ed.2.0 #20

	Deviation (dB)	Lim. (+/-dB)	Uncert. (dB)	Result
Level difference of positive and negative pulses:	0.1	1.5	0.09	P

Positive 1/2 cycle 4 kHz. Overload occurred at: 144.4
Negative 1/2 cycle 4 kHz. Overload occurred at: 144.5
Test Passed

High level stability test - IEC 61672-3 Ed.2.0 #21
Test signal: Sine wave at 1 kHz

Initial level (dB)	Final level (dB)	Diff. (dB)	Lim. value (dB)	Uncert. (dB)	Result
140.0	140.0	0.0	0.1	0.09	P

Test Passed

Certificate Number: 2100

Long term stability test - IEC 61672-3 Ed.2.0 #15

Test signal: Sine wave at 1 kHz

Time interval (mm:SS)	StartLevel (dB)	StopLevel (dB)	Difference (dB)	Tolerance (dB)	Result
26:31	114.0	114.0	0.0	0.1	P

Test Passed

DIN 45657 (2013): Statistical Distribution Test #5.2

Ln %	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
1%	140.4	140.7	0.5	0.3	P
5%	138.0	138.2	0.5	0.2	P
10%	135.0	135.2	0.5	0.2	P
50%	111.0	111.0	0.5	0.0	P
90%	87.0	86.8	0.5	-0.2	P
95%	84.0	83.8	0.5	-0.2	P
LeqA	129.8	129.8	0.5	0.0	P

Test Passed

Filter Test - IEC 61260 1/1octave: Linear operating range - IEC 61260, #11

Test 1/1 octave filter X=-5 fexact=31.623Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	135.0	-0.4	0.4	P
130.0	130.0	-0.4	0.4	P
125.0	124.9	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	115.0	-0.4	0.4	P
110.0	110.0	-0.4	0.4	P
105.0	105.0	-0.4	0.4	P
100.0	100.0	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	90.0	-0.4	0.4	P
85.0	85.0	-0.4	0.4	P
80.0	79.9	-0.4	0.4	P
75.0	74.9	-0.4	0.4	P
70.0	70.0	-0.4	0.4	P
65.0	65.1	-0.4	0.4	P
60.0	60.1	-0.4	0.4	P
55.0	55.0	-0.4	0.4	P
50.0	50.0	-0.4	0.4	P
45.0	45.0	-0.4	0.4	P
40.0	40.1	-0.4	0.4	P
35.0	35.2	-0.4	0.4	P

Test 1/1 octave filter X= 0 fexact=1000.000Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	135.0	-0.4	0.4	P
130.0	130.0	-0.4	0.4	P
125.0	125.0	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	115.0	-0.4	0.4	P
110.0	110.0	-0.4	0.4	P

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105.0	105.0	-0.4	0.4	P
100.0	100.0	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	90.0	-0.4	0.4	P
85.0	85.0	-0.4	0.4	P
80.0	80.0	-0.4	0.4	P
75.0	75.0	-0.4	0.4	P
70.0	70.0	-0.4	0.4	P
65.0	65.0	-0.4	0.4	P
60.0	60.0	-0.4	0.4	P
55.0	55.0	-0.4	0.4	P
50.0	50.0	-0.4	0.4	P
45.0	45.0	-0.4	0.4	P
40.0	40.1	-0.4	0.4	P
35.0	35.1	-0.4	0.4	P

Test 1/1 octave filter X= 4 fexact=15848.932Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	135.0	-0.4	0.4	P
130.0	130.0	-0.4	0.4	P
125.0	125.0	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	115.0	-0.4	0.4	P
110.0	110.0	-0.4	0.4	P
105.0	105.0	-0.4	0.4	P
100.0	100.0	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	90.0	-0.4	0.4	P
85.0	85.0	-0.4	0.4	P
80.0	80.0	-0.4	0.4	P
75.0	74.9	-0.4	0.4	P
70.0	69.9	-0.4	0.4	P
65.0	65.0	-0.4	0.4	P
60.0	60.0	-0.4	0.4	P
55.0	55.0	-0.4	0.4	P
50.0	49.9	-0.4	0.4	P
45.0	45.0	-0.4	0.4	P
40.0	40.0	-0.4	0.4	P
35.0	35.0	-0.4	0.4	P

Test Passed

Filter Test - IEC 61260 1/1octave: Relative attenuation - IEC 61260, #13

Test 1/1 octave filter X=-5 fexact=31.623Hz class 1

Nominal	Measured	LoLim	HiLim	Result
1.995	34.1	0.0	68.0	P
3.981	37.6	0.0	77.0	P
7.943	51.5	0.0	96.0	P
15.849	63.3	0.0	120.5	P
22.387	134.8	133.0	136.0	P
24.406	137.7	136.7	138.3	P
26.607	137.9	137.4	138.3	P
29.007	138.0	137.6	138.3	P
31.623	138.0	137.7	138.3	P
34.475	138.0	137.6	138.3	P
37.584	138.0	137.4	138.3	P
40.973	138.0	136.7	138.3	P
44.668	134.9	133.0	136.0	P
63.096	34.4	0.0	120.5	P

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125.893	30.4	0.0	96.0	P
251.189	31.3	0.0	77.0	P
501.187	32.2	0.0	68.0	P

Test 1/1 octave filter X= 0 fexact=1000.000Hz class 1

Nominal	Measured	LoLim	HiLim	Result
63.096	41.3	0.0	68.0	P
125.893	42.0	0.0	77.0	P
251.189	50.0	0.0	96.0	P
501.187	62.9	0.0	120.5	P
707.946	134.8	133.0	136.0	P
771.792	137.8	136.7	138.3	P
841.395	137.9	137.4	138.3	P
917.276	138.0	137.6	138.3	P
1000.00	138.0	137.7	138.3	P
1090.18	137.9	137.6	138.3	P
1188.50	137.9	137.4	138.3	P
1295.69	138.0	136.7	138.3	P
1412.54	134.8	133.0	136.0	P
1995.26	41.5	0.0	120.5	P
3981.07	41.3	0.0	96.0	P
7943.28	41.9	0.0	77.0	P
15848.9	44.7	0.0	68.0	P

Test 1/1 octave filter X= 4 fexact=15848.932Hz class 1

Nominal	Measured	LoLim	HiLim	Result
1000.00	57.5	0.0	68.0	P
1995.26	58.1	0.0	77.0	P
3981.07	58.4	0.0	96.0	P
7943.28	63.8	0.0	120.5	P
11220.2	134.9	133.0	136.0	P
12232.1	137.8	136.7	138.3	P
13335.2	138.0	137.4	138.3	P
14537.8	138.0	137.6	138.3	P
15848.9	138.0	137.7	138.3	P
17278.3	137.9	137.6	138.3	P
18836.5	137.8	137.4	138.3	P
20535.3	137.7	136.7	138.3	P
22387.2	134.2	133.0	136.0	P
31622.8	71.4	0.0	120.5	P
63095.7	49.2	0.0	96.0	P
125893	66.1	0.0	77.0	P
200000	66.1	0.0	68.0	P

Test Passed

Filter Test - IEC 61260 1/1octave: Relative attenuation at midband frequency- IEC 61260, #10

Nominal f[Hz]	Measured [dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
15.849	138.0	137.6	138.4	P
31.623	138.0	137.6	138.4	P
63.096	138.0	137.6	138.4	P
125.893	138.0	137.6	138.4	P
251.189	137.9	137.6	138.4	P
501.187	138.0	137.6	138.4	P
1000.00	138.0	137.6	138.4	P
1995.26	137.9	137.6	138.4	P
3981.07	137.9	137.6	138.4	P
7943.28	138.0	137.6	138.4	P
15848.9	138.0	137.6	138.4	P

Test Passed

Filter Test - IEC 61260 1/3octave: Linear operating range - IEC 61260, #11

Test 1/3 octave filter X=-15 fexact=31.623Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	135.0	-0.4	0.4	P
130.0	130.0	-0.4	0.4	P
125.0	125.0	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	115.0	-0.4	0.4	P
110.0	110.0	-0.4	0.4	P
105.0	105.0	-0.4	0.4	P
100.0	100.0	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	90.0	-0.4	0.4	P
85.0	85.0	-0.4	0.4	P
80.0	80.0	-0.4	0.4	P
75.0	74.9	-0.4	0.4	P
70.0	69.9	-0.4	0.4	P
65.0	65.0	-0.4	0.4	P
60.0	60.0	-0.4	0.4	P
55.0	54.9	-0.4	0.4	P
50.0	50.0	-0.4	0.4	P
45.0	44.9	-0.4	0.4	P
40.0	40.1	-0.4	0.4	P
35.0	35.2	-0.4	0.4	P

Test 1/3 octave filter X= 0 fexact=1000.000Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	135.0	-0.4	0.4	P
130.0	130.0	-0.4	0.4	P
125.0	125.0	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	115.0	-0.4	0.4	P
110.0	110.0	-0.4	0.4	P
105.0	105.0	-0.4	0.4	P
100.0	100.0	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	90.0	-0.4	0.4	P
85.0	85.0	-0.4	0.4	P
80.0	80.0	-0.4	0.4	P
75.0	74.9	-0.4	0.4	P
70.0	69.9	-0.4	0.4	P
65.0	65.0	-0.4	0.4	P
60.0	60.0	-0.4	0.4	P
55.0	55.0	-0.4	0.4	P
50.0	50.0	-0.4	0.4	P
45.0	45.0	-0.4	0.4	P
40.0	40.0	-0.4	0.4	P
35.0	35.0	-0.4	0.4	P

Test 1/3 octave filter X= 12 fexact=15848.932Hz class 1

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	140.0	-0.4	0.4	P
135.0	134.9	-0.4	0.4	P
130.0	129.9	-0.4	0.4	P
125.0	124.9	-0.4	0.4	P
120.0	120.0	-0.4	0.4	P
115.0	114.9	-0.4	0.4	P

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110.0	109.9	-0.4	0.4	P
105.0	104.9	-0.4	0.4	P
100.0	99.9	-0.4	0.4	P
95.0	95.0	-0.4	0.4	P
90.0	89.9	-0.4	0.4	P
85.0	84.9	-0.4	0.4	P
80.0	79.9	-0.4	0.4	P
75.0	74.9	-0.4	0.4	P
70.0	69.9	-0.4	0.4	P
65.0	64.9	-0.4	0.4	P
60.0	59.9	-0.4	0.4	P
55.0	55.0	-0.4	0.4	P
50.0	49.9	-0.4	0.4	P
45.0	45.0	-0.4	0.4	P
40.0	40.0	-0.4	0.4	P
35.0	35.0	-0.4	0.4	P

Test Passed

Filter Test - IEC 61260 1/3octave: Relative attenuation - IEC 61260, #13

Test 1/3 octave filter X=-15 fexact=31.623Hz class 1

Nominal	Measured	LoLim	HiLim	Result
5.865	31.0	0.0	68.0	P
10.356	51.8	0.0	77.0	P
16.805	49.5	0.0	96.0	P
24.431	62.1	0.0	120.5	P
28.184	134.9	133.0	136.0	P
29.080	137.5	136.7	138.3	P
29.953	137.9	137.4	138.3	P
30.801	137.9	137.6	138.3	P
31.623	138.0	137.7	138.3	P
32.466	137.9	137.6	138.3	P
33.386	138.0	137.4	138.3	P
34.388	137.8	136.7	138.3	P
35.481	135.0	133.0	136.0	P
40.932	42.2	0.0	120.5	P
59.505	26.8	0.0	96.0	P
96.565	26.1	0.0	77.0	P
170.508	24.9	0.0	68.0	P

Test 1/3 octave filter X= 0 fexact=1000.000Hz class 1

Nominal	Measured	LoLim	HiLim	Result
185.462	38.3	0.0	68.0	P
327.477	50.2	0.0	77.0	P
531.427	48.8	0.0	96.0	P
772.574	61.7	0.0	120.5	P
891.251	135.0	133.0	136.0	P
919.577	137.6	136.7	138.3	P
947.190	138.0	137.4	138.3	P
974.019	137.9	137.6	138.3	P
1000.00	138.0	137.7	138.3	P
1026.67	138.0	137.6	138.3	P
1055.75	138.0	137.4	138.3	P
1087.46	137.7	136.7	138.3	P
1122.02	135.0	133.0	136.0	P
1294.37	42.5	0.0	120.5	P
1881.73	36.2	0.0	96.0	P
3053.65	35.6	0.0	77.0	P
5391.95	36.1	0.0	68.0	P

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Test 1/3 octave filter X= 12 fexact=15848.932Hz class 1

Nominal	Measured	LoLim	HiLim	Result
2939.37	52.7	0.0	68.0	P
5190.16	52.7	0.0	77.0	P
8422.54	55.3	0.0	96.0	P
12244.5	62.3	0.0	120.5	P
14125.4	135.0	133.0	136.0	P
14574.3	137.6	136.7	138.3	P
15012.0	137.9	137.4	138.3	P
15437.2	137.9	137.6	138.3	P
15848.9	137.9	137.7	138.3	P
16271.7	137.9	137.6	138.3	P
16732.6	137.9	137.4	138.3	P
17235.0	137.7	136.7	138.3	P
17782.8	134.9	133.0	136.0	P
20514.4	48.4	0.0	120.5	P
29823.4	48.6	0.0	96.0	P
48397.1	58.1	0.0	77.0	P
85456.6	60.0	0.0	68.0	P

Test Passed

Filter Test - IEC 61260 1/3octave: Relative attenuation at midband frequency- IEC 61260, #10

Nominal f[Hz]	Measured [dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
19.953	137.9	137.6	138.4	P
25.119	137.9	137.6	138.4	P
31.623	138.0	137.6	138.4	P
39.811	137.9	137.6	138.4	P
50.119	138.0	137.6	138.4	P
63.096	137.9	137.6	138.4	P
79.433	138.0	137.6	138.4	P
100.000	138.0	137.6	138.4	P
125.893	137.9	137.6	138.4	P
158.489	138.0	137.6	138.4	P
199.526	137.9	137.6	138.4	P
251.189	137.9	137.6	138.4	P
316.228	138.0	137.6	138.4	P
398.107	137.9	137.6	138.4	P
501.187	138.0	137.6	138.4	P
630.957	138.0	137.6	138.4	P
794.328	138.0	137.6	138.4	P
1000.00	138.0	137.6	138.4	P
1258.93	137.9	137.6	138.4	P
1584.89	137.9	137.6	138.4	P
1995.26	137.9	137.6	138.4	P
2511.89	137.9	137.6	138.4	P
3162.28	137.9	137.6	138.4	P
3981.07	137.9	137.6	138.4	P
5011.87	137.9	137.6	138.4	P
6309.57	137.9	137.6	138.4	P
7943.28	138.0	137.6	138.4	P
10000.0	138.0	137.6	138.4	P
12589.3	137.9	137.6	138.4	P
15848.9	137.9	137.6	138.4	P
19952.6	137.9	137.6	138.4	P

Test Passed

Certificate Number: 2100

Electrical signal tests of frequency weightings - IEC 61672-3 Ed.2.0 #13

A-Weighted results: Free field

Frequency	SLM Val (dB)	SLM U (dB)	Microphone Val (dB)	Microphone U (dB)	Case Refl. Val (dB)	Case Refl. U (dB)	Wind Screen Val (dB)	Wind Screen U (dB)	Uncert (dB)	Tol (dB)	Result (dB)	
63 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
125 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
250 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
500 Hz	-0.1	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.1	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	0.0	0.1	0.1	0.0	0.1	0.2			0.2	+-1.0	0.2	P
4 kHz	0.0	0.1	0.1	0.0	0.0	0.2			0.2	+-1.0	0.1	P
8 kHz	0.0	0.1	0.3	0.0	0.2	0.2			0.2	+1.5/-2.5	0.5	P
16 kHz	0.1	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.9	P

C-Weighted results: Free field

Frequency	SLM Val (dB)	SLM U (dB)	Microphone Val (dB)	Microphone U (dB)	Case Refl. Val (dB)	Case Refl. U (dB)	Wind Screen Val (dB)	Wind Screen U (dB)	Uncert (dB)	Tol (dB)	Result (dB)	
63 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
125 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
250 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
500 Hz	0.0	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.2	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	0.0	0.1	0.1	0.0	0.1	0.2			0.2	+-1.0	0.2	P
4 kHz	0.0	0.1	0.1	0.0	0.0	0.2			0.2	+-1.0	0.1	P
8 kHz	0.0	0.1	0.3	0.0	0.2	0.2			0.2	+1.5/-2.5	0.5	P
16 kHz	0.0	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.8	P

Z-Weighted results: Free field

Frequency	SLM Val (dB)	SLM U (dB)	Microphone Val (dB)	Microphone U (dB)	Case Refl. Val (dB)	Case Refl. U (dB)	Wind Screen Val (dB)	Wind Screen U (dB)	Uncert (dB)	Tol (dB)	Result (dB)	
63 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
125 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
250 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
500 Hz	0.0	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.2	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	-0.1	0.1	0.1	0.0	0.1	0.2			0.2	+-1.0	0.1	P
4 kHz	0.0	0.1	0.1	0.0	0.0	0.2			0.2	+-1.0	0.1	P
8 kHz	0.0	0.1	0.3	0.0	0.2	0.2			0.2	+1.5/-2.5	0.5	P
16 kHz	-0.1	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.7	P

The actual frequency response of PCB / 377B02 LW137491 has been used for the calculations.
Test Passed
The overall frequency response of the sound level meter, nominal case reflections and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 1 sound level meter.

Unit 3, 4 Tombo Street, Capalaba, QLD 4157
07 3245 1730
enquiries@calibretechnology.com.au

Certificate Number: 1599

CERTIFICATE OF CALIBRATION

Certificate Number: **1599** **NATA Accreditation No: 15841**

Customer:
Noise Measurement Services
18 Lade Street, Enoggera, QLD 4051
Max Thorne

Test object:	**Manufacturer:**	**Test object:**	**Serial no:**	**ID:**
Sound level meter	Larson Davis	LD831	0003339	1599
Microphone:	PCB	377B02	LW137484	1599
Preamplifier	PCB	PRM831	026978	1599
Calibrator	None			
Wind screen	None			

Environmental conditions:	**Pressure:**	**Temperature:**	**Relative humidity:**
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Conditions before measurement:	102.45 ±0.03 kPa	23.1 ±0.4 °C	44.2 ±2.8 %RH
Conditions after measurement:	102.16 ±0.03 kPa	25.0 ±0.4 °C	43.0 ±2.8 %RH

The measurements are performed according to the *IEC 61672 Sound level meters - Part 3: Periodic tests, DIN 45657 Sound Level Meters - Requirements for Special Applications* and *IEC 61260 Electroacoustics - Octave-band and fractional-octave-band filters.*

The expanded uncertainty of measurement is reported at approximately 95% confidence level with a coverage factor k, of 2.

Accredited for compliance with ISO/IEC 17025.

Date of calibration: 13/07/17
Date of issue: 13/07/17
Authorised Signatory:

Beau Weyers

Certificate Number: 1599

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Statement of Conformity.
The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. However, No general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC61672-1 because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conforms to the requirements of IEC 61672-1:2002, and because the periodic tests of IEC 61672-3 cover only a limited subset of the specifications in IEC 61672-1.

Uncertainty
For all tests, the expanded uncertainty of measurement is reported at approximately 95% confidence level with a coverage factor k, of 2. Except where noted otherwise, the results provided in this report are associated with the following expanded uncertainties:
Electrical tests: 0.09 dB
Toneburst: 0.09 dB
Acoustic tests:
0.13 dB for 31.5Hz <= f < 2kHz
0.14 dB for 2kHz <= f < 8kHz
0.16 dB for 8kHz <= f < 12.6kHz
0.10 dB for 1kHz
Bandpass filters:
0.1 dB for attenuation less than 4 dB
0.15 dB for attenuation less above 4 dB to 18 dB
0.25 for attenuation 18 dB to 80 dB

Traceability
The measured values are traceable to the following laboratories:
Sound Pressure Level: National Measurement Institute, Australia
Voltage: TRVMS, Australia
Frequency: TRVMS, Australia
Ambient Pressure: Thales, Australia
Temperature: Thales, Australia
Relative Humidity: Thales, Australia

Test Overview
The verification measurements have been performed using the calibration system Nor1504A with software type Nor1019.

The calibration has been undertaken in accordance with the procedures described in the Calibre Technology Acoustic Calibration Manual. For further details of the procedures, please contact the laboratory.
Tests undertaken in accordance with IEC 61672-3 include both acoustical and electrical tests. The acoustical tests undertaken include the acoustical part of the self-noise test and the acoustical verification of the frequency response. A special adapter with a suitable electrical characteristic is used.
All other tests undertaken are electrical tests. For these tests, signals are fed to the sound measuring device through an adapter that resembles the microphone signal.

Detailed measurement results are printed on the following pages.
Each of the verification test points has a Result indication (P, U, or N) that tells the obtained result of the actual test.
P = the result is Passed
U = due to the Uncertainty of the measurement it is not possible to state if the result is passed or not
N = the result is Not passed
All verification tests must have a Passed indication in order to fulfill the requirements in the standard.

Acoustical levels are stated relative to 20µPa. Other dB levels are relative values.

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Measurement Results:	
Indication at the calibration check frequency - IEC61672-3 Ed.2 #10	Passed
Self-generated noise - IEC 61672-3 Ed.2 #11	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.2.0 #13	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.2.0 #13	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 #13	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 #14	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.2 #16	Passed
Toneburst response - IEC 61672-3 Ed.2.0 #18	Passed
Peak C sound level - IEC 61672-3 Ed.2.0 #19	Passed
Overload indication - IEC 61672-3 Ed.2.0 #20	Passed
High level stability test - IEC 61672-3 Ed.2.0 #21	Passed
Long term stability test - IEC 61672-3 Ed.2.0 #15	Passed
DIN 45657: Statistical Distribution Test - According to DIN 45657 #3.3	Passed
Filter Test 1/1octave: Linear operating range - IEC 61260, #4.6 & #5.5	Passed
Filter Test 1/1octave: Relative attenuation - IEC 61260, #4.4 & #5.3	Passed
Insertion Loss at Midband Frequency of a Filter Set (Octave Band)	Passed
Filter Test 1/3octave: Linear operating range - IEC 61260, #4.6 & #5.5	Passed
Filter Test 1/3octave: Relative attenuation - IEC 61260, #4.4 & #5.3	Passed
Insertion Loss at Midband Frequency of a Filter Set (One-third Octave Band)	Passed
Combined electrical and acoustical test - IEC 61672-3 Ed.2.0 #13	Passed

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Results

Indication at the calibration check frequency - IEC61672-3 Ed.2 #10
Reference Calibrator: WSC3 - B&K4226_1k_114dB
Reference calibrator level: 114.03
Before calibration:
Environmental corrections: 0.00
Other corrections:
Notional level: 114.03
Calibrator level before adjustment: 114.2
After calibration:
Environmental corrections: 0.00
Other corrections:
Notional level: 114.03
Reference calibrator level after calibration: 114.0
Associated Calibrator: - -
Associated calibrator level: Not calibrated
Test Passed

Self-generated noise - IEC 61672-3 Ed.2.0 #11

Network	Level (dB)	Comment			
A	16.7	19.0	0.09		Microphone installed
A	11.0	15.0	0.09	P	Equivalent capacity
C	11.6	22.0	0.09	P	Equivalent capacity
Z	19.5	25.0	0.09	P	Equivalent capacity

Test Passed

Frequency weightings: A Network - IEC 61672-3 Ed.2.0 #13.3

Freq (Hz)	Ref. (dB)	Meas. (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	96.0	95.9	1.0	-1.0	0.09	-0.1	P
125.9	96.0	95.9	1.0	-1.0	0.09	-0.1	P
251.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
501.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P
1995.3	96.0	95.9	1.0	-1.0	0.09	-0.1	P
3981.1	96.0	95.9	1.0	-1.0	0.09	-0.1	P
7943.3	96.0	95.9	1.5	-2.5	0.09	-0.1	P
15848.9	96.0	96.0	2.5	-16.0	0.09	0.0	P

Test Passed

Frequency weightings: C Network - IEC 61672-3 Ed.2.0 #13.3

Freq (Hz)	Ref. Level (dB)	Meas. Value (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	96.0	95.9	1.0	-1.0	0.09	-0.1	P
125.9	96.0	96.0	1.0	-1.0	0.09	0.0	P
251.2	96.0	95.9	1.0	-1.0	0.09	-0.1	P
501.2	96.0	96.0	1.0	-1.0	0.09	0.0	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P
1995.3	96.0	96.0	1.0	-1.0	0.09	0.0	P
3981.1	96.0	95.9	1.0	-1.0	0.09	-0.1	P
7943.3	96.0	95.9	1.5	-2.5	0.09	-0.1	P
15848.9	96.0	96.0	2.5	-16.0	0.09	0.0	P

Test Passed

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Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 #13.3

Freq (Hz)	Ref. Level (dB)	Meas. Value (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
125.9	96.0	96.0	1.0	-1.0	0.09	0.0	P
251.2	96.0	96.0	1.0	-1.0	0.09	0.0	P
501.2	96.0	96.0	1.0	-1.0	0.09	0.0	P
1000.0	96.0	96.0	0.7	-0.7	0.09	0.0	P
1995.3	96.0	96.0	1.0	-1.0	0.09	0.0	P
3981.1	96.0	96.0	1.0	-1.0	0.09	0.0	P
7943.3	96.0	96.1	1.5	-2.5	0.09	0.1	P
15848.9	96.0	95.9	2.5	-16.0	0.09	-0.1	P

Test Passed

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 #14

Weightings Time	Netw	Ref. (dB)	Measured (dB)	Lim. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
Fast	A	114.0	114.0	0.1	-0.1	0.09	0.0	P
Fast	C	114.0	114.0	0.1	-0.1	0.09	0.0	P
Fast	Z	114.0	113.9	0.1	-0.1	0.09	-0.1	P
Slow	A	114.0	114.0	0.1	-0.1	0.09	0.0	P
Leq	A	114.0	114.0	0.1	-0.1	0.09	0.0	P

Test Passed

Level linearity on the reference level range - IEC 61672-3 Ed.2.0 #16

Full scale setting: 140dB

The following measurements are SPL measurements

Measured at 8 kHz

Ref. (dB)	Measured (dB)	Lim. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
114.0	114.0	0.8	-0.8	0.09	0.0	P
119.0	119.0	0.8	-0.8	0.09	0.0	P
124.0	124.0	0.8	-0.8	0.09	0.0	P
129.0	129.0	0.8	-0.8	0.09	0.0	P
134.0	134.0	0.8	-0.8	0.09	0.1	P
135.0	134.9	0.8	-0.8	0.09	0.0	P
136.0	135.9	0.8	-0.8	0.09	0.0	P
137.0	136.9	0.8	-0.8	0.09	0.0	P
114.0	114.0	0.8	-0.8	0.09	0.0	P
109.0	109.0	0.8	-0.8	0.09	0.0	P
104.0	104.0	0.8	-0.8	0.09	0.0	P
99.0	99.0	0.8	-0.8	0.09	0.0	P
94.0	94.0	0.8	-0.8	0.09	0.0	P
89.0	89.0	0.8	-0.8	0.09	0.0	P
84.0	84.0	0.8	-0.8	0.09	0.0	P
79.0	79.0	0.8	-0.8	0.09	0.0	P
74.0	74.0	0.8	-0.8	0.09	0.0	P
69.0	69.0	0.8	-0.8	0.09	0.0	P
64.0	64.0	0.8	-0.8	0.09	0.0	P
59.0	59.0	0.8	-0.8	0.09	0.0	P
54.0	54.0	0.8	-0.8	0.09	0.0	P
49.0	49.0	0.8	-0.8	0.09	0.0	P
44.0	44.0	0.8	-0.8	0.09	0.0	P
39.0	39.0	0.8	-0.8	0.09	0.0	P
34.0	34.0	0.8	-0.8	0.09	0.0	P
30.0	30.0	0.8	-0.8	0.09	0.0	P
29.0	29.0	0.8	-0.8	0.09	0.0	P

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28.0	28.0	0.8	-0.8	0.09	0.0	P
27.0	27.0	0.8	-0.8	0.09	0.0	P
26.0	26.1	0.8	-0.8	0.09	0.1	P

Test Passed

Toneburst response - IEC 61672-3 Ed.2.0 #18

Burst type	Ref. (dB)	Measured (dB)	Lim. (dB)	Lim. (dB)	Uncert. (dB)	Dev. (dB)	Result
Fast 200 mSec	137.0	137.0	0.5	-0.5	0.09	0.0	P
Fast 2.0 mSec	120.0	119.7	1.0	-1.5	0.09	-0.3	P
Fast 0.25 mSec	111.0	110.6	1.0	-3.0	0.09	-0.4	P
Slow 200 mSec	130.6	130.5	0.5	-0.5	0.09	-0.1	P
Slow 2.0 mSec	111.0	110.8	1.0	-3.0	0.09	-0.2	P
Leq 200 mSec	121.0	121.0	0.5	-0.5	0.09	0.0	P
Leq 2.0 mSec	101.0	100.8	1.0	-1.5	0.09	-0.2	P
Leq 0.25 mSec	92.0	91.9	1.0	-3.0	0.09	-0.1	P

Test Passed

Peak C sound level - IEC 61672-3 Ed.2.0 #19

Pulse Type	Pulse Freq. (Hz)	Ref. RMS (dB)	Ref. Peak (dB)	Measured Value (dB)	Lim. (+/-dB)	Uncert. (dB)	Dev. (dB)	Result
1 cycle	8k	131.0	134.4	133.8	2.0	0.09	-0.6	P
Pos 1/2 cycle	500	134.0	136.4	136.2	1.0	0.09	-0.2	P
Neg 1/2 cycle	500	134.0	136.4	136.2	1.0	0.09	-0.2	P

Test Passed

Overload indication - IEC 61672-3 Ed.2.0 #20

	Measured (dB)	Lim. (+/-dB)	Uncert. (dB)	Result
Level difference of positive and negative pulses:	0.1	1.5	0.09	P
Positive 1/2 cycle 4 kHz. Overload occurred at:	140.4			
Negative 1/2 cycle 4 kHz. Overload occurred at:	140.3			

Test Passed

High level stability test - IEC 61672-3 Ed.2.0 #21
Test signal: Sine wave at 1 kHz

Initial level (dB)	Final level (dB)	Diff. (dB)	Lim. value (dB)	Uncert. (dB)	Result
139.9	139.9	0.0	0.1	0.09	P

Test Passed

Long term stability test - IEC 61672-3 Ed.2.0 #15
Test signal: Sine wave at 1 kHz

Time inteval (mm:SS)	StartLevel (dB)	StopLevel (dB)	Difference (dB)	Tolerence (dB)	Result
26:34	114.0	114.0	0.0	0.1	P

Test Passed

DIN 45657 (2013): Statistical Distribution Test #5.2

Ln %	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Uncert. Value (dB)	Result Value (dB)
1%	140.4	140.7	0.5	0.3	P
5%	138.0	138.3	0.5	0.3	P

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10%	135.0	135.3	0.5	0.3	P
50%	111.0	111.1	0.5	0.1	P
90%	87.0	86.9	0.5	-0.1	P
95%	84.0	83.9	0.5	-0.1	P
LeqA	129.8	129.9	0.5	0.1	P

Test Passed

Filter Test - IEC 61260 1/1octave: Linear operating range - IEC 61260, #4.6 & #5.5

Test 1/1 octave filter X=-5 fexact=31.623Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.7	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P
115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	79.9	-0.3	0.3	P
75.0	74.9	-0.3	0.3	P
70.0	70.0	-0.3	0.3	P
65.0	65.0	-0.3	0.3	P
60.0	60.0	-0.3	0.3	P
55.0	54.9	-0.3	0.3	P
50.0	49.9	-0.3	0.3	P
45.0	44.9	-0.3	0.3	P
40.0	39.9	-0.3	0.3	P
35.0	34.9	-0.3	0.3	P

Test 1/1 octave filter X= 0 fexact=1000.000Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.8	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P
115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	79.9	-0.3	0.3	P
75.0	74.9	-0.3	0.3	P
70.0	69.9	-0.3	0.3	P
65.0	64.9	-0.3	0.3	P
60.0	60.0	-0.3	0.3	P
55.0	55.0	-0.3	0.3	P
50.0	50.0	-0.3	0.3	P
45.0	45.0	-0.3	0.3	P
40.0	40.0	-0.3	0.3	P
35.0	35.0	-0.3	0.3	P

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Test 1/1 octave filter X= 4 fexact=15848.932Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.8	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P
115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	79.9	-0.3	0.3	P
75.0	74.9	-0.3	0.3	P
70.0	69.9	-0.3	0.3	P
65.0	64.9	-0.3	0.3	P
60.0	59.9	-0.3	0.3	P
55.0	55.1	-0.3	0.3	P
50.0	49.9	-0.3	0.3	P
45.0	44.9	-0.3	0.3	P
40.0	39.9	-0.3	0.3	P
35.0	34.9	-0.3	0.3	P

Test Passed

Filter Test - IEC 61260 1/1octave: Relative attenuation - IEC 61260, #4.4 & #5.3

Test 1/1 octave filter X=-5 fexact=31.623Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
1.995	36.5	0.0	63.0	P
3.981	60.2	0.0	76.0	P
7.943	71.8	0.0	95.5	P
15.849	70.7	0.0	120.0	P
22.387	134.8	133.5	135.7	P
24.406	137.7	136.9	138.2	P
26.607	137.9	137.6	138.2	P
29.007	137.9	137.8	138.2	P
31.623	137.9	137.9	138.2	P
34.475	137.9	137.8	138.2	P
37.584	138.0	137.6	138.2	P
40.973	137.9	136.9	138.2	P
44.668	134.8	133.5	135.7	P
63.096	33.2	0.0	120.0	P
125.893	31.9	0.0	95.5	P
251.189	31.6	0.0	76.0	P
501.187	32.2	0.0	63.0	P

Test 1/1 octave filter X= 0 fexact=1000.000Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
63.096	49.1	0.0	63.0	P
125.893	67.8	0.0	76.0	P
251.189	75.4	0.0	95.5	P
501.187	71.3	0.0	120.0	P
707.946	134.8	133.5	135.7	P
771.792	137.7	136.9	138.2	P
841.395	137.9	137.6	138.2	P
917.276	137.9	137.8	138.2	P

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1000.00	137.9	137.9	138.2	P
1090.18	137.9	137.8	138.2	P
1188.50	137.9	137.6	138.2	P
1295.69	137.9	136.9	138.2	P
1412.54	134.8	133.5	135.7	P
1995.26	46.1	0.0	120.0	P
3981.07	46.3	0.0	95.5	P
7943.28	45.2	0.0	76.0	P
15848.9	47.1	0.0	63.0	P

Test 1/1 octave filter X= 4 fexact=15848.932Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
1000.00	56.7	0.0	63.0	P
1995.26	67.6	0.0	76.0	P
3981.07	74.6	0.0	95.5	P
7943.28	70.7	0.0	120.0	P
11220.2	134.8	133.5	135.7	P
12232.1	137.8	136.9	138.2	P
13335.2	138.0	137.6	138.2	P
14537.8	137.9	137.8	138.2	P
15848.9	137.9	137.9	138.2	P
17278.3	137.8	137.8	138.2	P
18836.5	137.7	137.6	138.2	P
20535.3	137.6	136.9	138.2	P
22387.2	134.1	133.5	135.7	P
31622.8	71.1	0.0	120.0	P
63095.7	67.0	0.0	95.5	P
125893	61.1	0.0	76.0	P
200000	50.7	0.0	63.0	P

Test Passed

Insertion Loss at Midband Frequency of a Filter Set (Octave Band)

Instrument Class = 0

Reference SPL = 114 dB

Frequency Base = 2

Octave Band	Frequency	Filter Out	Filter In	Diff	U95	Pass/Fail
16	15.625	114.0	114.0	0.0	0.1	P
31.5	31.250	114.0	114.0	0.0	0.1	P
63	62.500	114.0	114.0	0.0	0.1	P
125	125.000	114.0	114.0	0.0	0.1	P
250	250.000	114.0	114.0	0.0	0.1	P
500	500.000	114.0	114.0	0.0	0.1	P
1000	1,000.000	114.0	114.0	0.0	0.1	P
2000	2,000.000	114.0	114.0	0.0	0.1	P
4000	4,000.000	114.0	114.0	0.0	0.1	P
8000	8,000.000	114.1	114.0	-0.1	0.1	P
16000	16,000.000	113.9	114.0	0.1	0.1	P

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Filter Test - IEC 61260 1/3octave: Linear operating range - IEC 61260, #4.6 & #5.5

Test 1/3 octave filter X=-15 fexact=31.623Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.7	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P
115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	79.9	-0.3	0.3	P
75.0	74.9	-0.3	0.3	P
70.0	70.0	-0.3	0.3	P
65.0	65.0	-0.3	0.3	P
60.0	60.0	-0.3	0.3	P
55.0	55.0	-0.3	0.3	P
50.0	49.9	-0.3	0.3	P
45.0	44.9	-0.3	0.3	P
40.0	40.0	-0.3	0.3	P
35.0	35.0	-0.3	0.3	P

Test 1/3 octave filter X= 0 fexact=1000.000Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.8	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P
115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	80.0	-0.3	0.3	P
75.0	74.9	-0.3	0.3	P
70.0	69.9	-0.3	0.3	P
65.0	64.9	-0.3	0.3	P
60.0	60.0	-0.3	0.3	P
55.0	55.0	-0.3	0.3	P
50.0	50.0	-0.3	0.3	P
45.0	45.0	-0.3	0.3	P
40.0	40.0	-0.3	0.3	P
35.0	35.0	-0.3	0.3	P

Test 1/3 octave filter X= 12 fexact=15848.932Hz class 0

Nominal L[dB]	Measured L[dB]	LoLim L[dB]	HiLim L[dB]	Result [P/F]
140.0	139.7	-0.3	0.3	P
135.0	134.9	-0.3	0.3	P
130.0	129.9	-0.3	0.3	P
125.0	124.9	-0.3	0.3	P
120.0	119.9	-0.3	0.3	P

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115.0	114.9	-0.3	0.3	P
110.0	109.9	-0.3	0.3	P
105.0	104.9	-0.3	0.3	P
100.0	99.9	-0.3	0.3	P
95.0	94.9	-0.3	0.3	P
90.0	89.9	-0.3	0.3	P
85.0	84.9	-0.3	0.3	P
80.0	79.9	-0.3	0.3	P
75.0	74.8	-0.3	0.3	P
70.0	69.9	-0.3	0.3	P
65.0	64.9	-0.3	0.3	P
60.0	59.9	-0.3	0.3	P
55.0	54.9	-0.3	0.3	P
50.0	50.0	-0.3	0.3	P
45.0	44.9	-0.3	0.3	P
40.0	39.9	-0.3	0.3	P
35.0	35.0	-0.3	0.3	P

Test Passed

Filter Test - IEC 61260 1/3octave: Relative attenuation - IEC 61260, #4.4 & #5.3

Test 1/3 octave filter X=-15 fexact=31.623Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
5.865	56.7	0.0	63.0	P
10.356	62.4	0.0	76.0	P
16.805	70.7	0.0	95.5	P
24.431	72.0	0.0	120.0	P
28.184	134.9	133.5	135.7	P
29.080	137.5	136.9	138.2	P
29.953	137.9	137.6	138.2	P
30.801	137.9	137.8	138.2	P
31.623	137.9	137.9	138.2	P
32.466	137.9	137.8	138.2	P
33.386	137.9	137.6	138.2	P
34.388	137.7	136.9	138.2	P
35.481	135.0	133.5	135.7	P
40.932	42.3	0.0	120.0	P
59.505	32.1	0.0	95.5	P
96.565	31.7	0.0	76.0	P
170.508	27.9	0.0	63.0	P

Test 1/3 octave filter X= 0 fexact=1000.000Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
185.462	59.2	0.0	63.0	P
327.477	63.1	0.0	76.0	P
531.427	69.7	0.0	95.5	P
772.574	71.8	0.0	120.0	P
891.251	134.9	133.5	135.7	P
919.577	137.5	136.9	138.2	P
947.190	137.9	137.6	138.2	P
974.019	137.9	137.8	138.2	P
1000.00	137.9	137.9	138.2	P
1026.67	137.9	137.8	138.2	P
1055.75	137.9	137.6	138.2	P
1087.46	137.7	136.9	138.2	P
1122.02	134.9	133.5	135.7	P
1294.37	44.1	0.0	120.0	P
1881.73	42.1	0.0	95.5	P

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3053.65	40.8	0.0	76.0	P
5391.95	41.7	0.0	63.0	P

Test 1/3 octave filter X= 12 fexact=15848.932Hz class 0

Nominal f[Hz]	Measured L[dB]	LoLim [dB]	HiLim [dB]	Result [P/F]
2939.37	59.0	0.0	63.0	P
5190.16	62.1	0.0	76.0	P
8422.54	67.8	0.0	95.5	P
12244.5	72.3	0.0	120.0	P
14125.4	134.9	133.5	135.7	P
14574.3	137.5	136.9	138.2	P
15012.0	137.9	137.6	138.2	P
15437.2	137.9	137.8	138.2	P
15848.9	137.9	137.9	138.2	P
16271.7	137.8	137.8	138.2	P
16732.6	137.8	137.6	138.2	P
17235.0	137.6	136.9	138.2	P
17782.8	134.8	133.5	135.7	P
20514.4	49.5	0.0	120.0	P
29823.4	49.1	0.0	95.5	P
48397.1	42.0	0.0	76.0	P
85456.6	40.3	0.0	63.0	P

Test Passed

Insertion Loss at Midband Frequency of a Filter Set (One-third Octave Band)

Instrument Class = 0

Reference SPL = 114 dB

Frequency Base = 2

Octave Band	Frequency	Filter Out	Filter In	Diff	U95	Pass/Fail
12.5	12.402	113.9	114.0	0.1	0.1	P
16	15.625	113.9	114.0	0.1	0.1	P
20	19.686	113.9	114.0	0.1	0.1	P
25	24.803	114.0	114.0	0.0	0.1	P
31.5	31.250	114.0	114.0	0.0	0.1	P
40	39.373	114.0	114.1	0.1	0.1	P
50	49.606	114.0	114.0	0.0	0.1	P
63	62.500	114.0	114.0	0.0	0.1	P
80	78.745	114.0	114.0	0.0	0.1	P
100	99.213	114.0	114.0	0.0	0.1	P
125	125.000	114.0	114.0	0.0	0.1	P
160	157.490	114.0	114.0	0.0	0.1	P
200	198.425	114.0	114.0	0.0	0.1	P
250	250.000	114.0	114.0	0.0	0.1	P
315	314.980	114.0	114.0	0.0	0.1	P
400	396.850	114.0	114.0	0.0	0.1	P
500	500.000	114.0	114.0	0.0	0.1	P
630	629.961	114.0	114.0	0.0	0.1	P
800	793.701	114.0	114.0	0.0	0.1	P
1000	1,000.000	114.0	114.0	0.0	0.1	P
1250	1,259.921	114.0	114.0	0.0	0.1	P

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1600	1,587.401	114.0	114.0	0.0	0.1	P
2000	2,000.000	114.0	114.0	0.0	0.1	P
2500	2,519.842	114.0	114.0	0.0	0.1	P
3150	3,174.802	114.0	114.0	0.0	0.1	P
4000	4,000.000	114.0	114.0	0.0	0.1	P
5000	5,039.684	114.0	114.0	0.0	0.1	P
6300	6,349.604	114.0	114.0	0.0	0.1	P
8000	8,000.000	114.1	114.0	-0.1	0.1	P
10000	10,079.368	114.1	114.0	-0.1	0.1	P
12500	12,699.208	114.0	113.9	-0.1	0.1	P
16000	16,000.000	114.0	113.9	-0.1	0.1	P
20000	20,158.737	113.8	113.9	0.1	0.1	P

Electrical signal tests of frequency weightings - IEC 61672-3 Ed.2.0 #13

A-Weighted results: Free field

Frequency	SLM		Microphone		Case Refl.		Wind Screen		Uncert	Tol	Result	
	Val	U	Val	U	Val	U	Val	U				
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
125 Hz	-0.1	0.1	0.1	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
250 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
500 Hz	-0.1	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.1	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	-0.1	0.1	-0.1	0.0	0.1	0.2			0.2	+-1.0	-0.1	P
4 kHz	-0.1	0.1	-0.5	0.0	0.0	0.2			0.2	+-1.0	-0.6	P
8 kHz	-0.1	0.1	-0.8	0.0	0.2	0.2			0.2	+1.5/-2.5	-0.7	P
16 kHz	0.0	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.8	P

C-Weighted results: Free field

Frequency	SLM		Microphone		Case Refl.		Wind Screen		Uncert	Tol	Result	
	Val	U	Val	U	Val	U	Val	U				
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
125 Hz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-1.0	0.0	P
250 Hz	-0.1	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.2	P
500 Hz	0.0	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.2	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	0.0	0.1	-0.1	0.0	0.1	0.2			0.2	+-1.0	0.0	P
4 kHz	-0.1	0.1	-0.5	0.0	0.0	0.2			0.2	+-1.0	-0.6	P
8 kHz	-0.1	0.1	-0.8	0.0	0.2	0.2			0.2	+1.5/-2.5	-0.7	P
16 kHz	0.0	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.8	P

Z-Weighted results: Free field

Frequency	SLM		Microphone		Case Refl.		Wind Screen		Uncert	Tol	Result	
	Val	U	Val	U	Val	U	Val	U				
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
125 Hz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-1.0	0.0	P
250 Hz	0.0	0.1	0.0	0.0	-0.1	0.1			0.1	+-1.0	-0.1	P
500 Hz	0.0	0.1	0.1	0.0	0.1	0.1			0.1	+-1.0	0.2	P
1 kHz	0.0	0.1	0.1	0.0	-0.1	0.1			0.1	+-0.7	0.0	P
2 kHz	0.0	0.1	-0.1	0.0	0.1	0.2			0.2	+-1.0	0.0	P
4 kHz	0.0	0.1	-0.5	0.0	0.0	0.2			0.2	+-1.0	-0.5	P
8 kHz	0.1	0.1	-0.8	0.0	0.2	0.2			0.2	+1.5/-2.5	-0.5	P
16 kHz	-0.1	0.1	0.4	0.0	0.4	0.3			0.3	+2.5/-16.0	0.7	P

The actual frequency response of PCB / 377B02 LW137484 has been used for the calculations.
Test Passed

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The overall frequency response of the sound level meter, nominal case reflections and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 1 sound level meter.

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