

Environment Protection Authority

Approved methods for the measurement and analysis of environmental noise in NSW

Draft for consultation



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This document sets out minimum requirements and good practice methods for the measurement and analysis of environmental noise. It will be of interest to you if you are required, through an environment protection licence or statutory instrument, to measure or analyse environmental noise, or you are a consultant that carries out this work for persons regulated by the EPA.

1. Introduction

1.1. Purpose of this document

This document sets out:

- minimum requirements for the measurement and analysis of noise, including record-keeping
- good-practice methods for general circumstances.

The requirements in this document supplement the advice in the following noise guidelines and standards, which prevails in the event of any inconsistency:

- *Noise Policy for Industry* (EPA 2017)
- *Interim Construction Noise Guideline* (DECC 2009)
- *NSW Road Noise Policy* (DECCW 2011)
- *Rail Infrastructure Noise Guideline* (EPA 2013)
- *Assessing Vibration: a technical guideline* (DEC 2006)
- *Technical Basis for Guideline to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (Australia and New Zealand Environment Council 1990)

1.2. Relevant legislation

This document may be referred to in conditions attached to statutory instruments, such as licences or notices, issued by the NSW Environment Protection Authority (EPA) under environment protection legislation.

This document may also be referred to by other authorities in statutory instruments, such as development consents and approvals, where measurement and analysis of environmental noise is required.

1.3. What method to use

Industry is obliged to ensure compliance with monitoring requirements and limits specified in statutory instruments. All measurement and analysis to show compliance must:

- use the methodology specified in the relevant regulation, environment protection licence, notice or statutory instrument
- **or**
- if no methodology is specified in the relevant environment protection licence, notice or statutory instrument, use the methodology prescribed in this document.

For the purpose of this document, the methodology prescribed in this document includes the following components:

- measurement and analysis requirements specified in section 2
- good-practice methods described in section 3
- record-keeping requirements specified in section 4

This document is **not** applicable to measuring and analysing:

- noise from shooting ranges – such noise must be measured and analysed in accordance with procedures described in Schedule 2 of the Protection of the Environment Operations (Noise Control) Regulation 2017
- noise emissions from rail locomotives – advice is given in Australian Standard AS 2377:2002 *Acoustics: Methods for Measurement of Railbound Vehicle Noise* (see note below regarding use of latest standards)
- noise from wind turbine generators – advice is given in the *Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development* (DPE 2016)

The latest published version of the standards mentioned in this document must be used, as soon as practical after publication, taking into account any transitional period associated with the updated standard.

1.4 Who is this document for?

This document is for anyone required to measure and analyse environmental noise for a statutory purpose in NSW, including licensees and other persons regulated by the EPA. Consultants hired to monitor noise must also refer to it.

Licensees and other persons regulated by the EPA are responsible:

- for ensuring that they, or the consultants or others they use to measure and analyse environmental noise, are competent, as described in this document, and
- for complying with the requirements in this document.

2. Requirements for measuring and analysing noise

2.1. Instrumentation

Noise measurements for the purposes of determining compliance with a licence or consent must be based on the use of a Class 1 sound level meter as specified in AS/NZS IEC 61672.1:2019 *Electroacoustics: sound level meter specifications* (see note in section 1.3 regarding use of latest standard). Where sound level meters manufactured prior to 2019 are used to measure noise, you must report this, together with the standard(s) met by that instrument (for example Australian Standard IEC 61672.1:2013 or IEC 61672.1:2004).

These requirements also apply to statistical analysers, data loggers and storage devices used for measuring and (if applicable) analysing environmental noise.

The sound level meter must be calibrated by one of the following:

- a reference sound source (sound calibrator) specified in the instruction manual of that sound level meter
- **or**
- a sound calibrator producing the same nominal sound pressure level and frequency as a model specified in the instruction manual.

The sound calibrator must comply with the requirements set out in IEC 60942:2017

Electroacoustics: sound calibrators (see note in section 1.3 regarding use of latest standard) and be of the same class as the sound level meter.

If a sound calibrator designed or manufactured prior to 2017 is used to calibrate a sound level meter, you must report this, together with the standard/s met by that sound calibrator (for example, IEC 60942:2003 *Electroacoustics: sound calibrators*).

The reference sound source used to measure environmental noise must be calibrated over its full frequency and dynamic ranges by a technical facility or laboratory accredited by the National Association of Testing Authorities (NATA). This calibration must occur at intervals not exceeding two years.

Any other recording instrumentation, where applicable, must be calibrated over its full frequency and dynamic ranges by a technical facility or laboratory accredited by NATA. This shall occur at intervals not exceeding two years.

Instrumentation used to measure meteorological conditions must meet the specifications set out in section 6.3.4 of Australian Standard AS 1055:2018 *Acoustics: description and measurement of environmental noise* (see note in section 1.3 regarding use of latest standard).

2.2. Competence

Any person measuring and analysing environmental noise must be appropriately qualified and experienced in acoustics to a standard sufficient to enable that person to accurately interpret and apply the advice set out in acoustics standards, guidelines and policies (**competent person**).

A competent person must satisfy one or more of the following:

- have qualifications and/or experience sufficient to fulfil the requirements of 'member' grade of the Australian Acoustical Society

- undertake the duties of an acoustic consultant on behalf of a consultancy firm that is a member of the Association of Australasian Acoustical Consultants
- have a recognised tertiary qualification in a discipline pertinent to acoustics
- be able to demonstrate competence through professional experience and/or technical expertise to the satisfaction of the EPA.

2.3. Calibration field checks

Field calibration checks of the instrumentation must be carried out with a reference sound source before and after measurements are made.

The calibration of measurement instrumentation must be checked, and any necessary adjustments made, immediately before the sound level meter is used to make measurements (pre-measurement check). The sound level meter must be checked again immediately after making those measurements (post-measurement check).

Check the calibration by performing a field calibration, using a reference sound source. If the noise level recorded during the post-measurement check differs by more than 1.0 decibel from the noise level recorded during the pre-measurement check, all measurements made in the intervening period must be disregarded. Calibration with a reference sound source must be undertaken in accordance with the instructions provided by the manufacturer of the sound level meter and calibration reference sound source.

2.4. Noise descriptors to be measured

The noise descriptor and measurement time interval (T) used must be as specified in any licence, consent or condition relevant to the purpose of the measurement.

Where there is no requirement specified the following must be used:

- equivalent A-weighted continuous sound level ($L_{Aeq,T}$)
- maximum A-weighted sound pressure level ($L_{AFmax,T}$)
- A-weighted sound pressure level that is exceeded for 90% of the measurement time ($L_{AF90,T}$).

A measurement time interval of 15 minutes with a 'fast' (F) time weighting must be used for statistical descriptors, unless otherwise specified.

Other descriptors and alternative measurement time periods may be sampled and analysed to adequately characterise, quantify and describe the environmental noise source under consideration.

Measurements of octave bands, one-third octave bands or narrow-band measurements may be necessary to analyse noise over the frequency range, for example to determine the applicability of modifying factors to account for annoying characteristics of noise, such as tonality. The frequency range and limitations of the instrument/s used **must** be considered, particularly where low-frequency noise is anticipated.

Definitions of noise descriptors, as that term is used in this document, including definitions of the basic quantities and symbols used for the description of environmental noise, are those set out in Australian Standard AS 1055:2018 *Acoustics: description and measurement of environmental noise* (see note in section 1.3 regarding use of latest standard).

2.5. Contemporaneous notes

The person making the noise level measurements must take and keep contemporaneous notes.

The purpose of these notes is to capture information relevant to the measurement and analysis of environmental noise. The notes must include detailed and transparent information sufficient to allow a competent person to evaluate whether the reported measurements, and the conclusions drawn from them, are credible.

The notes must include, as a minimum, descriptions of the following:

- the results of the acoustics measurements
- the measurement instrumentation and the serial numbers of instruments used
- the qualifications and/or experience of the person undertaking the measurements
- the purpose of the measurements
- for each measurement, the time, date, location and a description of the surrounding area
- the prevailing conditions, including meteorology, observed during the measurements
- the measurement procedure used, including any reference method
- the noise source under investigation
- any adjustments made to the measurements, with full justification and supporting information provided.

Record-keeping requirements are set out in section 4 of this document.

2.6. Measurement location

Noise measurement for ensuring compliance with the conditions of an environment protection licence, notice or statutory instrument must be carried out at the location specified in the relevant environment protection licence, notice or statutory instrument.

Noise measurements for this purpose are generally measured as **free-field** noise levels where the influence of reflecting structures (other than the ground) is minimised.

Outdoor (free-field) measurements must be undertaken at least 3.5 m from any reflecting structure (other than the ground) and at a height of 1.2–1.5 m above ground level or the floor of interest if pertinent to a building, unless good acoustic practice means that a different position is more appropriate. If you use a different position, you must record the position and the justification for using it in the contemporaneous notes of the measurement (as per section 2.5 of this document). You should consider the advice in section 6.2 of AS 1055: 2018.

If circumstances preclude direct free-field measurements, and measured noise levels are affected by noise from a reflective surface (other than the ground), you must report both the measured façade noise level and an estimated free-field noise level. The correction applied to determine the free-field noise level must be supported with evidence to justify the correction factor applied.

In the case of industrial noise at residential premises or an area reserved for passive recreation (e.g. national park), you must take measurements:

- at the residence's property boundary closest to the industrial premises, where the residence is situated 30 metres or less from the property boundary
- in an area within 30 metres of a residence façade, but not closer than 3 metres where any residence on the property is situated more than 30 metres from the property boundary closest to the industrial premises
- in an area within 50 metres of the boundary of an area reserved for passive recreation (e.g. a national park).

Where there is no residence, take measurements at the reasonably most-affected point at the location.

Where it is not feasible to measure noise levels at higher building floors, adjustments to the measured level may be required. In this case, you must give justification and evidence that the adjustment is appropriate for the situation.

Measurements should be made at times and places relevant to determining the contribution of the noise source(s) of interest. If you cannot measure the noise source(s) of interest directly at a defined location (for example due to the presence of extraneous noise), you must report and justify with sufficient information the measurements and/or the calculations made at an alternative location (and any correction).

2.7. Background noise

Background noise measurements must be undertaken in accordance with the procedures in fact sheets A and B within the document *Noise Policy for Industry* (EPA 2017).

Note: if you are determining compliance with statutory noise limits that are expressed as a relative change over the background noise level (for example, a limit of rating background noise level + 5dB), then you must reference the background noise level that has been used to derive those statutory noise limits and is reported in an Environmental Impact Statement (or similar) submitted as part of a statutory process (for example a planning modification or licence variation).

2.8. Corrections for annoying noise characteristics

Measurements to determine compliance with noise limits referenced in a statutory instrument must take into consideration any correction for annoying noise characteristics where these are identified. The appropriate procedure is set out in fact sheet C of the *Noise Policy for Industry* (EPA 2017).

2.9. Meteorological conditions

If meteorological conditions are likely to affect the measurements of noise, these must be considered and corrections applied (as appropriate), reported and justified. General advice on minimising the effects of meteorological conditions is described in section 6.3 of AS 1055:2018. Advice in relevant standards, policies and guidelines may also be appropriate, including fact sheet D of the *Noise Policy for Industry*. Note that other requirements relevant to minimising the effects of meteorological conditions on noise measurements may be specified in an environment protection licence or other instrument.

2.10. Reporting noise levels

Report measured noise levels to the nearest integer.

3. Good practice for measuring and analysing noise

3.1. General principles

This section sets out the principles that must be considered in order to measure and analyse environmental noise.

This section does not replace any other requirements of this document or set out detailed step-by-step procedures. It should be considered in the context and intended purpose of the particular measurement being undertaken.

Measurement and analysis of environmental noise, and interpretation of the technical information in this document, should only be undertaken by a person who is competent and experienced in environmental acoustics, as described in section 2.

A competent person must take appropriate action to account for factors that can affect noise emissions and noise measurements. These actions must be justified and recorded with sufficient technical detail and evidence, as required by section 4.

The measurement and analysis of environmental noise should be guided by the generic methods described in Australian Standard 1055:2018 *Acoustics: description and measurement of environmental noise* (see note in section 1.3 regarding use of latest standard).

Best-practice recommendations for the measurement and analysis of environmental noise include, but are not limited to, the following:

- Use appropriate measurement equipment to gather data relevant to the circumstances.
- Take measurements at the relevant time and place of interest for the purpose of the measurement.
- Take measurements when the premises or activity is operating (or not) in a manner relevant to the purpose of the measurements and during appropriate time periods (for example day, evening or night).
- Ensure the measurement time intervals are representative in order to capture (or exclude) noise from the premises or activity (for example, to take account of short-term variations in operations).
- Take measurements only when meteorological conditions are appropriate and do not adversely influence the results (see section 2.9).
- Select a suitable location from which to measure noise, where the measurement will be representative of noise source(s) of interest at an identified noise-sensitive receiver or assessment location. Information must be reported to justify the selection of the measurement location with reference to applicable policy, licence, consent or notice requirements, etc.
- Take steps to exclude extraneous noise from the measurement and provide supporting information and justification for any corrections applied to the measured noise level.
- Provide clear justification for carrying out noise calculations or predictions instead of undertaking noise measurements. For example, calculations may be used in circumstances where it is not possible to directly measure noise from an activity or premises due to the presence of extraneous noise. Calculations must not be used in lieu of measurements for reasons of convenience.
- Use tools and methods of analysis appropriate for the circumstances.

3.2. Measurement considerations

The duration of measurements should be representative of the operation of the activity or premises being assessed. The recommended minimum measurement duration is 15 minutes unless otherwise specified in writing by the EPA, or where advice in relevant standards, policies or guidelines sets out alternative requirements. The duration of measurement used must be justified and reported.

If noise is intermittent or variable, adjust the measurement duration to obtain a representative sample of the noise under consideration, for example by measuring several periods or cycles of

operation or part of a cycle to derive a representative outcome. Any such adjustment must be justified and reported.

Any comparison between measurements of a noise source and measurements when the noise source is not present should be carried out over comparable measurement periods and during comparable conditions and locations to ensure that any comparison is representative.

Take measurements when the activity or premises is operating in a manner relevant to the purpose of the noise measurements. To obtain representative measurements, you may have to make several, under varying operating conditions.

3.3. Extraneous noise and measuring noise at locations other than the most-affected noise-sensitive receiver

It may be impossible to directly measure and quantify noise from a premises or activity at a noise-sensitive receiver (see *Glossary*) for one or both of the following reasons:

- Extraneous or intervening noise sources are unduly influencing the measurement.
- It is not possible to gain access to the noise-sensitive receiver.

In these circumstances you may have to do one or more of the following to quantify noise:

- Measure at an alternative location where noise from the source of interest is representative of the noise at the location of the noise-sensitive receiver.
- Adjust the measured noise level to exclude the impact of extraneous noise.
- Use an alternative method to determine the noise level at the location of the noise-sensitive receiver.

When noise at a noise-sensitive receiver cannot be measured and you adopt alternative procedures, you must report those alternative procedures with enough information and evidence to justify the outcome and recommendation arising from the measurements and their analysis.

3.4. Analysis of noise measurements

Analysis of noise measurements can provide additional information relating to the acoustic environment. For example, it may be possible to characterise noise and quantify noise contributions from the source(s) of interest and extraneous sources.

Below is an overview of good practice and common analysis methods. The method(s) used for analysis must be reported and supported by sufficient information to justify the method(s) and allow a competent person to evaluate the analysis outcomes. The limitations of each method, including any related to equipment and software in the analysis chain, should be noted in the report.

3.4.1. Post-processing

Post-processing means the analysis of noise measurements (including audio data) after they have been captured by a sound level meter (or equivalent system). Post-processing may include statistical analysis, pattern recognition or machine learning to enable source identification.

Try to avoid the need for post-processing, where that is practicable. For example, you could make additional measurements to exclude extraneous noise rather than using post-processing to remove extraneous noise from measurement data.

You must report post-processing procedures and provide sufficient information (including any limitations and assumptions) to ensure that the stated outcomes are credible.

3.4.2. Frequency analysis

Frequency analysis measurement should be compliant with AS 4476:1997 *Acoustics: octave-band and fractional-octave-band filters* or AS IEC 61260.1:2019 *Electroacoustics: octave-band and fractional-octave-band-filters specification*. If filters do not comply with either of these standards, you must provide justification.

If the frequency content of interest extends beyond the frequency range limitations set out in these standards, you must report this. If measurement or analysis is undertaken outside the filter range specified in these standards, the performance of alternative filters should be reported and be consistent with an appropriate standard. This is to ensure the outcome is consistent with the standards to the greatest extent possible and can be relied on for regulatory decision-making.

3.4.3. Audio recordings

Audio recordings may be used to supplement the noise measurements. Critical listening to audio can be used to identify and characterise noise sources and derive source or event noise levels.

The making and storage of audio recordings must comply with all legislative requirements, including the *Privacy and Personal Information Protection Act 1998* and the *Surveillance Devices Act 2007*.

3.4.4. Microphone array systems

Analysis of multiple signals from microphone arrays can provide additional information to determine the source's location and direction and help to identify the source and its contribution. If you use a microphone array to quantify noise levels (in isolation or with other methods), you must report and justify the method used, including any limitations.

If you use multiple microphone signals to determine direction, contribution or other descriptors, you should fully document the processing methods used and support them with evidence, to demonstrate that the measurement is valid within the appropriate level of accuracy. All equipment in the measurement chain must meet the requirements set out in section 2.

3.5. Calculation of noise

It is better to measure noise than to calculate it. If you use noise predictions instead of, or to supplement, noise measurements, you must report and justify the calculation method and any assumptions. The reported outcome of noise predictions must include the information described in section 11 of AS 1055:2018 along with any other relevant information.

You should provide a comparison of the predicted noise level against a measured noise level at a reference point or series of points for existing noise sources. You also need to provide and justify details of any calibration corrections applied to the predicted levels.

4. Record-keeping

4.1. General requirements

The following records must be kept for any measurement and analysis required by a statutory instrument. The licensee must retain them for four years and provide them to the EPA if and when requested or required. Records must include, but are not limited to, the following:

- descriptors specified by section 2.4 and any additional appropriate descriptors

- spectrum or specific frequency sound levels relevant to the study (such as $L_{eq,T}$ 1/3 octaves and $L_{n\%T}$ 1/3 octaves)
- the measured, estimated or calculated noise level from the noise source(s) of interest in the relevant sound level descriptor
- the measured, estimated or calculated noise contribution from extraneous noise source(s) in the relevant sound level descriptor, if appropriate
- event sound levels and other relevant sound level data to determine and demonstrate compliance with licence conditions, including the A-weighted maximum noise level (L_{max}) and $L_{n1,T}$.

You must also record and keep a description of:

- each noise source and its location relative to the measurement position, as far as is reasonably practicable
- the type of each noise source (for example, air-conditioner or moving plant)
- the character of each noise source (for example broadband, tonal, steady-state or impulsive) and any correction applied to account for annoying characteristics
- the operating condition of each noise source and whether the operating condition and noise output are representative of average maximum output (see *Glossary*).

In addition, you must record and keep a qualitative description of:

- how each noise source affects the area (for example whether it is loud relative to other noise in the area; is noticeable or annoying due to its character; or occurs during sensitive periods, such as evenings, nights or weekends)
- extraneous noise and an estimate of its contribution to the acoustic environment and its duration during the measurement period.

4.2. Measurement techniques

You must make and keep records of:

- the type of instrumentation used, including the make, model, serial number and date of the most recent laboratory calibration. This applies to the sound level meter, sound calibrator and any other instrumentation used to measure and analyse environmental noise, as appropriate
- the measurement procedure or method used to measure environmental noise, with reference to the minimum requirements in section 2 and the best-practice methods in section 3, as appropriate
- the results of pre- and post-measurement calibration checks
- a description of the measurement time intervals and reference time. Where the measurement time interval (T) is not 15 minutes, provide justification
- the date and time of the measurement
- details of any measurement and methods used to process and analyse data
- details of the measurement location, including justification in the event that measurements are undertaken at alternative or intermediate locations
- a map or plan showing the measurement location, significant structures, sources of noise and location of noise-sensitive receivers.

Where noise levels are derived by calculation, explain why it was necessary to calculate, rather than measure, noise. Your justification must include details of the calculation method, including all inputs and assumptions. Where relevant, give a comparison of the calculated noise level with a measured level at reference points to provide calibration or verification of the calculation approach.

4.3. Prevailing meteorological conditions

You must make and keep records of:

- the prevailing meteorological conditions at the measurement location and other relevant locations. These must include at minimum the wind speed and direction, precipitation and temperature
- details of the instruments used to measure the meteorological conditions
- the location of the meteorological measurements, with justification that the location is appropriate
- a description of the intervening land (and any structures) between the measurement location(s) and the noise source(s), with a qualitative assessment of whether these have affected measurements along with any corrections
- the location of reflecting surfaces (other than the ground) and any adjustments made for the presence or absence of reflecting surfaces
- a detailed description of each noise source of interest and the influence of meteorological (or other) conditions during measurement/s, including any variability in each noise source, such as
 - times of operation, including temporal variation or impulsive noise events
 - presence and duration of other noise sources during the measurement period
- the likely effect of the meteorological conditions to determine whether prevailing conditions (for example wind speed at microphone height and the propagation of noise) have adversely influenced measurement accuracy.

5. Glossary

Term	Definition
annoying characteristics	Those characteristics of a noise source that are defined in fact sheet C in <i>Noise Policy for Industry</i> (EPA 2017).
assessment period	The period in a day over which assessments are made as defined in a relevant statutory instrument or guideline.
audio recording	The recording of audio using a microphone and storage device.
background noise	The underlying level of noise present in ambient noise, generally excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{AF90} descriptor.
blasting	The use of explosives in a controlled manner to fracture, break and/or move materials such as rock.
calibration reference sound source	A device used to test the accuracy of a sound level meter that conforms with IEC 60942:2017 <i>Electroacoustics: sound calibrators</i> (see note in section 1.3 regarding use of latest standard). It produces a known pressure field within a cavity where the sound level meter's microphone is placed to test the meter against this reference.
decibel (dB)	A measure of sound level. The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity or other parameters. In the case of sound pressure, it is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure squared to a reference sound pressure squared.
decibel, A-weighted dB(A)	Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction. They may also include traffic generated by holiday periods and special events, such as concerts or sporting events. Normal daily traffic noise is not considered to be extraneous.
environment protection licence	A licence issued under Chapter 3 of the <i>Protection of the Environment Operations Act 1997</i> , authorising the carrying out of scheduled development work or scheduled activities or controlling the pollution of water arising from non-scheduled activities. For the purpose of this document the term includes licences in force and surrendered or suspended licences.
frequency	The number of times that a vibration or periodic function occurs or repeats itself in one second, measured in Hertz (Hz).
impulsive noise	The sudden onset of a sound as defined in Appendix E of AS 1055:2018 <i>Acoustics: description and measurement of environmental noise</i> .

Term	Definition
$L_{Aeq, T}$	The time-averaged sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, with a measurement time interval 'T', has the same mean square sound pressure level as a sound under consideration with a level that varies with time (AS 1055:2018 <i>Acoustics: description and measurement of environmental noise</i>).
$L_{AF90, T}$ dB	The A-weighted sound pressure level measured using fast-time weighting that is exceeded for 90% of the time over a measurement time interval 'T'. This is a measure of background noise.
L_{Amax}	The maximum sound pressure level of an event measured with a sound level meter satisfying AS/NZS IEC 61672.1:2019 <i>Electroacoustics: sound level meter specifications</i> (or as described in superseded versions of IEC 61672.1) set to 'A' frequency weighting and fast-time weighting.
licensee	The holder of an environment protection licence under the <i>Protection of the Environment Operations Act 1997</i> .
most-affected points or locations	Locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.
noise-sensitive receiver or land use	Land uses that are sensitive to noise, such as residential areas, churches, schools and recreational areas
octave band	The grouping of sound levels by frequency as defined in AS 4476:1997 <i>Acoustics: octave-band and fractional-octave-band filters</i> , where the ratio of the upper frequency to the lower frequency is 2.
premises	As defined in the <i>Protection of the Environment Operations Act 1997</i> or another relevant statutory instrument, such as an environment protection licence.
receiver	The noise-sensitive land use at which noise from a development can be heard.
third octave bands	The grouping of sound levels by frequency bands using one-third of an octave band as defined in AS 4476:1997 <i>Acoustics: octave-band and fractional-octave-band filters</i> . The ratio of upper band frequency to lower band frequency is an octave ratio raised to an exponent equal to the applicable bandwidth designator. For one-third octaves, the frequency ratio is $f_2/f_1 = G^{1/3}$.
tonality	Noise containing a prominent frequency and characterised by a definite pitch.

Appendix 1: Guidelines and Standards

A1.1 Noise policies and guidelines

Approved Methods for Testing Noise Emissions (NSW Government Gazette 98 of 1 September 2017)

Assessing Vibration: a technical guideline (DEC 2006)

Interim Construction Noise Guideline (DECC 2009)

Noise Guide for Local Government (EPA 2013)

Noise Policy for Industry (EPA 2017), including:

- *'A Guide to the Noise Policy for Industry' (EPA 2017)*
- *'Implementation and Transitional Arrangements for the Noise Policy for Industry' (EPA 2017) (as amended or replaced from time to time)*

NSW Industrial Noise Policy (EPA 2000)

NSW Road Noise Policy (DECCW 2011)

Rail Infrastructure Noise Guideline (EPA 2013)

Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC 1990)

Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development (DPE 2016)

A1.2 Australian and international standards

International Electrotechnical Commission 2003, IEC 60942:2003 *Electroacoustics: sound calibrators*

International Electrotechnical Commission 2013, IEC 61672.1:2019 *Electroacoustics: sound level meters – Part 1: specifications*

International Electrotechnical Commission 2017, IEC 60942:2017 *Electroacoustics: sound calibrators*

Standards Australia 1997, AS 4476:1997 *Acoustics: octave-band and fractional-octave-band filters*

Standards Australia 2002, AS 2377:2002 *Acoustics: methods for measurement of railbound vehicle noise*

AS/NZS IEC 61672.1:2019 *Electroacoustics: sound level meter specifications*

Standards Australia 2013, AS IEC 61672.1:2013 *Electroacoustics – Sound level meters – Part 1: Specifications*

Standards Australia 2004, AS IEC 61672.1:2004 *Electroacoustics – Sound level meters – Part 1: Specifications*

Standards Australia 2018, AS 1055:2018 *Acoustics: description and measurement of environmental noise*

Standards Australia 2019, AS IEC 61260.1:2019 *Electroacoustics: octave-band and fractional-octave-band filters specification*