Noise Assessment

NYNGAN SOLAR PLANT

MARCH 2013

ngh environmental

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SLR Consulting undertook a peer review of the noise assessment in December 2012, including providing correction factors to allow more accurate interpretation of the results of the conservative modelling approach applied in the construction noise assessment and endorsement of the report's conclusions.

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1 INTRODUCTION

1.1 PROPOSED WORKS

AGL Energy Limited (AGL) proposes to establish a solar plant on Lot 34, DP751328 approximately 10 kilometres west of the Nyngan township in Central West NSW (refer Appendix A). The proposed development would include the construction and operation of an up to 106 megawatt (MW) photovoltaic (PV) solar plant, including:

- Arrays of solar modules and cabling.
- A substation, site office, maintenance building and car park.
- Internal access tracks/ roads.
- A chain wire fence around the site boundary.
- An approximate 3 kilometre transmission line (132 kV) and easement between the solar plant and the electricity grid.
- An approximate 1.6 kilometre access road between the solar plant and Barrier Highway.

Potential noise impacts associated with the development would include:

- Noise and vibration associated with the construction phase of the Project. This would include noise from construction equipment operating on site.
- Operational noise associated with normal running of the solar plant. This would include noise from the substation, aeolian/corona noise from the transmission line and any maintenance works undertaken on site.

1.2 NOISE SENSITIVE RECEIVERS

Noise sensitive receivers in the vicinity of the proposed solar plant include four residential receivers. A map showing the locations of noise sensitive receivers and noise logging locations is provided in Figure 1-1.

As shown in Table 1-1, the closest residence (Tikkara, marked by noise log 1 in Figure 1-1) is associated with a landholder involved in the Nyngan Solar Plant proposal and as such potential noise impacts are not considered in detail for this residence. The closest non-involved landholder residences include two residences mapped by the Department of Lands (2012) north and south of noise log 3 (Redlands and Neerock; note only Redlands was observed to be occupied during the site inspection) and the residence shown at noise log 2 (Rutherglen).

Several other residences are located within ten kilometres of the works, but are further than 3.5 kilometres from the closest boundary of proposed works. Given the distance from works and presence of intervening vegetation, these residences are considered unlikely to be impacted by noise.

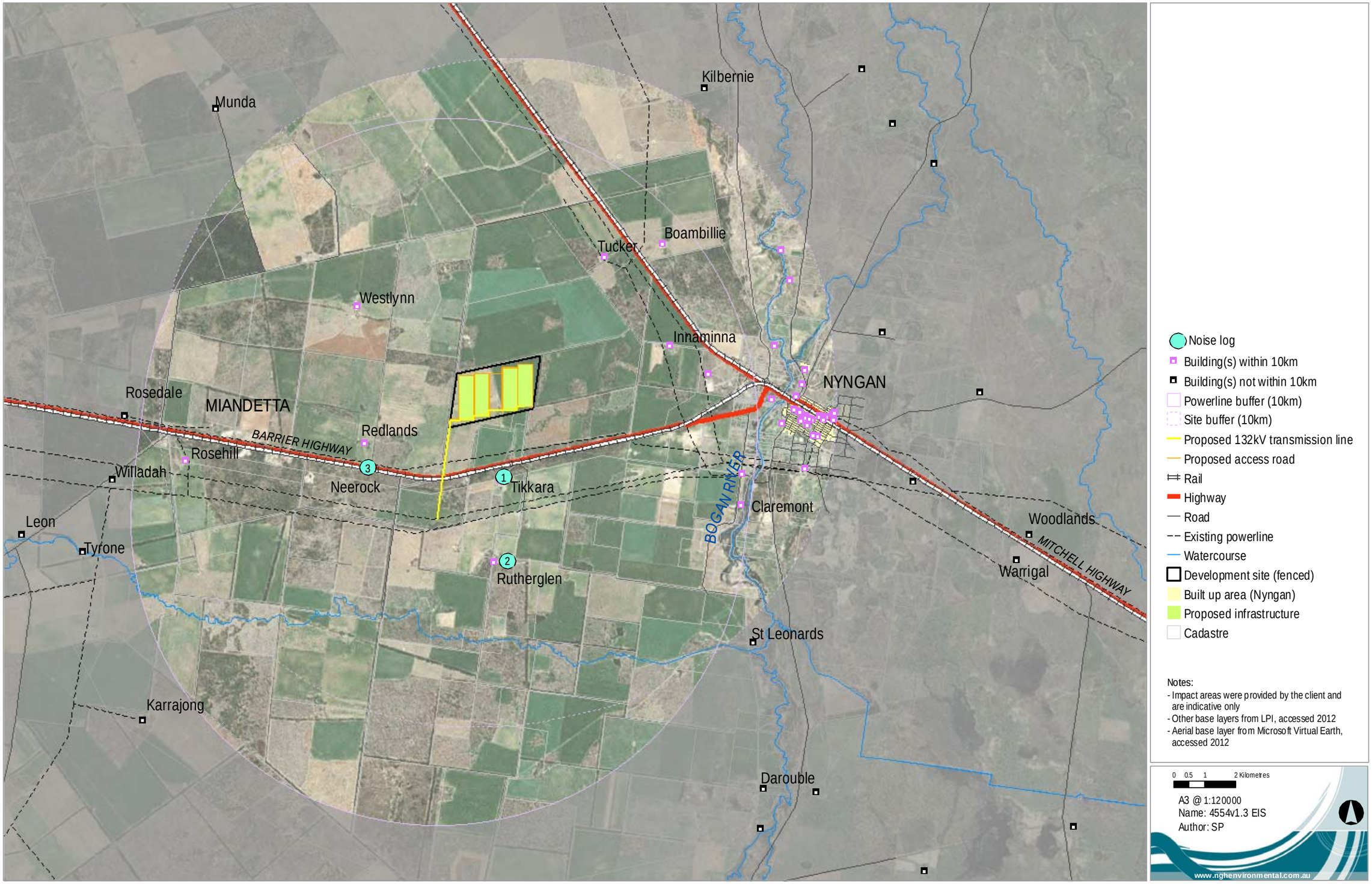


Figure 1-1 Noise sensitive receivers.

Table 1-1 Distance from proposed construction works to sensitive receivers.

Property Name	Reference used in future sections of the report	Sensitive receiver	Distance to proposed construction works in metres (m)		
			Solar plant	Transmission line	Site access point[1]
Tikkara	*Residence 1*	*Residence at noise log 1 (involved landholder)*	*2000*	*1800*	*1700*
Rutherglen	Residence 2	Residence at noise log 2	4550	2300	3135
Redlands	Residence 3	Residence north of noise log 3	2800	2650	2760
Neerock	Residence 4	Residence south of noise log 3	3700	2800	2930

1.3 OBJECTIVES

This report describes the methodology and findings of the Noise Assessment for the construction and operation of the proposed Nyngan Solar Plant and forms part of the Environmental Impact Statement (EIS) for the proposed project. This report details the main aspects of the proposed solar plant project, the acoustic criteria, the background noise measurements and the predicted noise levels at potentially impacted receivers from the proposed solar plant.

1.4 ASSESSMENT PROCEDURE

1.4.1 Construction noise

In general, the construction noise assessment procedure contains the following steps:

1. Establish the pre-existing background noise level at the three nearest non-involved receivers through background noise monitoring.
2. Predict solar plant, transmission line and road construction noise levels at the three nearest receivers during solar plant construction activities.
3. Assess the acceptability of construction noise at each relevant receiver to the established limits.

Noise mitigation is considered in light of the results, in Section 2.4.

1.4.2 Operational noise

The operational noise assessment:

[1] The exact site access point from the Barrier Highway is yet to be determined, but is likely to be east and within 100 metres of the proposed transmission line. The closest distance from receivers to this section of the highway is used in noise calculations.

1. Considers likely operational noise from the solar plant components.
2. Predicts solar plant and transmission line noise levels at the closest receiver during solar plant operation.
3. Assesses the acceptability of operational noise at the closest receiver.

1.4.3 Limitations

The calculations provided in this assessment consider the location and noise source and do not factor in external parameters such as wind or wall buffers that might affect noise travel. These external factors are discussed in Section 2.3 to facilitate the interpretation of results.

Noise impacts from construction vehicle access along the existing access track adjacent to the railway line to the proposed transmission line easement south of the Barrier Highway are not assessed. Large construction machinery would only enter and exit this proposed easement a limited number of times, with daily transport of construction staff to this area made using light vehicles. Given the closest residence is an involved landholder, combined with the presence of existing screening vegetation and existing traffic noise from the Barrier Highway, noise impacts from access along this track are not considered likely.

2 CONSTRUCTION NOISE

2.1 POLICY SETTING

2.1.1 NSW Interim Construction Noise Guidelines (ICNG)

The *Interim Construction Noise Guideline* (DECC 2009) sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. The guideline sets out Noise Management Levels (NMLs) at residences, and how they are to be applied, as presented in Table 2-1. This approach intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The proposed solar plant site is surrounded by predominantly rural activities on large holdings. There are 18 rural residential properties within 10 kilometres of the site, while the Nyngan township is located just within 10 kilometres of the site (refer Figure 1-1).

Table 2-1 ICNG recommended noise management levels for residences.

Time of day	Management level LAeq (15minute) [1]	How to apply
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise affected RBL [2] + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Note 2: RBL = Rating Background Level

2.2 IMPACT ASSESSMENT

2.2.1 Background noise monitoring

Background noise monitoring using a handheld noise logger was carried out by **ngh**environmental on 16 and 17 May 2012 at the four closest sensitive receivers and a Rating Background Level (RBL) was extrapolated at each receiver location to assist in the determination of limits for construction noise at non-involved landholder receivers (Table 2-2).

The proposal site is located in a rural environment. Intermittent noise would currently be emitted from a variety of sources, including farm vehicles and machinery, animals, and traffic noise from the Barrier Highway (particularly trucks), and the Nyngan-Cobar railway.

Table 2-2 Background noise levels and allowable noise levels at the 3 closest non-involved sensitive receivers.

Sensitive receiver	Rating background level during standard working hours (LA90 (15 minutes))	Allowable noise level during standard working (RBA + 10 dB)	Highly affected noise level
Residence 1 - at noise log 1 (involved landholder)	*32.4 dBA*	*42.4 dBA*	*75 dBA*
Residence 2 - at noise log 2	34.9 dBA	44.9 dBA	75 dBA
Residence 3- north of noise log 3	33.7 dBA	43.7 dBA	75 dBA
Residence 4 - south of noise log 3	33.7 dBA	43.7 dBA	75 dBA

2.2.2 Construction noise impacts

Sources of noise during the construction of the solar plant would include the use of on-site machinery, vehicle movements and other construction-related activities. The noise impacts from construction activities associated with the proposed solar plant have been assessed separately from the construction activities associated with the construction of the transmission line and the main access road, which are closer to the sensitive receivers than construction works on the solar plant itself.

Two noise impact predictions were analysed for the three nearest non-involved sensitive receivers with one prediction taking into account the typical noise levels of individual pieces of equipment to be used for the works and the other prediction taking into account the combined noise levels of the 10 noisiest pieces of equipment working concurrently. The combined maximum noise level was calculated using a decibel calculator (Appendix B).

Solar plant infrastructure (solar panels, electrical (cabling), buildings, security fence, internal roads/tracks)

Typical noise levels of equipment to be used are provided in Table 2-3 below, together with expected noise levels at the non-involved sensitive receiver locations. These calculations are based on noise emissions from the closest part of the proposed solar plant site (excluding the proposed transmission line and main access road) to the receiver. Typical sound power levels for individual pieces of equipment are sourced from *Australian Standard 2436 – 2010 Guide to noise and vibration control on construction, demolition and maintenance sites.*

Table 2-3 Noise predictions at 3 closest non-involved sensitive receivers.

Plant description	Sound power level at source (dBA)	Noise Level at sensitive receivers (dBA)			Exceed allowable noise level?			Exceed highly affected noise level at any residence (75 dBA)?
		Residence 2	Residence 3	Residence 4	Residence 2 (44.9 dBA)	Residence 3 (43.7 dBA)	Residence 4 (43.7 dBA)	
Air Compressor (power tools)	101	19.86	24.08	21.66	No	No	No	No
Backhoe	104	22.86	27.08	24.66	No	No	No	No
Bulldozer	108	26.86	31.08	28.66	No	No	No	No
Compactor	113	31.86	36.08	33.66	No	No	No	No
Concrete Pump	108	26.86	31.08	28.66	No	No	No	No
Concrete Saw	117	35.86	40.08	37.66	No	No	No	No
Concrete Truck	109	27.86	32.08	29.66	No	No	No	No
Dump Trucks	117	35.86	40.08	37.66	No	No	No	No
Excavator	107	25.86	30.08	27.66	No	No	No	No
Front End Loader	113	31.86	36.08	33.66	No	No	No	No
Generators	99	17.86	22.08	19.66	No	No	No	No

Plant description	Sound power level at source (dBA)	Noise Level at sensitive receivers (dBA)			Exceed allowable noise level?			Exceed highly affected noise level at any residence (75 dBA)?
		Residence 2	Residence 3	Residence 4	Residence 2 (44.9 dBA)	Residence 3 (43.7 dBA)	Residence 4 (43.7 dBA)	
Grader	110	28.86	33.08	30.66	No	No	No	No
Mobile Crane	104	22.86	27.08	24.66	No	No	No	No
Piling (bored)	111	29.86	34.08	31.66	No	No	No	No
Pneumatic hand tools	116	34.86	39.08	36.66	No	No	No	No
Vibratory Roller	108	26.86	31.08	28.66	No	No	No	No
Water Cart	107	25.86	30.08	27.66	No	No	No	No
Combined equipment (10 most noisy)	123.5	42.36	46.58	44.16	No	Yes	Yes	No

Given the typical noise levels of individual pieces of construction equipment, no individual piece of equipment is likely to exceed the target noise level at any of the non-involved sensitive receivers.

Given the typical noise calculation of the 10 most noisy construction equipment working concurrently, the noise associated with solar plant activities would exceed the target noise level of 43.7 dBA, at both Residences 3 and 4. The target noise level of 44.9 dBA would not be exceeded at Residence 2.

Impacts are likely to be intermittent as works would be undertaken at different parts of the site for varied periods.

Transmission line and main access road

Typical noise levels of equipment to be used are provided in Table 2-4 below, together with expected noise levels at the sensitive receiver locations. These calculations are based on noise emissions from the closest part of the proposed transmission line and main access road to the receiver. Typical sound power levels for individual pieces of equipment are sourced from *Australian Standard 2436 – 2010 Guide to noise and vibration control on construction, demolition and maintenance sites.*

Table 2-4 Noise predictions at 3 closest non-involved sensitive receivers.

Plant description	Sound power level at source (dBA)	Noise level at sensitive receivers (dBA)			Exceed allowable noise level?			Exceed highly affected noise level at any residence (75 dBA)?
		Residence 2	Residence 3	Residence 4	Residence 2 (44.9 dBA)	Residence3 (43.7 dBA)	Residence 4 (43.7 dBA)	
Air Compressor (power tools)	101	25.79	24.56	24.08	No	No	No	No
Backhoe	104	28.79	27.56	27.08	No	No	No	No
Bulldozer	108	32.79	31.56	31.08	No	No	No	No
Compactor	113	37.79	36.56	36.08	No	No	No	No
Concrete Pump	108	32.79	31.56	31.08	No	No	No	No
Concrete Saw	117	41.79	40.56	40.08	No	No	No	No
Concrete Truck	109	33.79	32.56	32.08	No	No	No	No
Dump Trucks	117	41.79	40.56	40.08	No	No	No	No
Excavator	107	31.79	30.56	30.08	No	No	No	No
Front End Loader	113	37.79	36.56	36.08	No	No	No	No
Generators	99	23.79	22.56	22.08	No	No	No	No

Plant description	Sound power level at source (dBA)	Noise level at sensitive receivers (dBA)			Exceed allowable noise level?			Exceed highly affected noise level at any residence (75 dBA)?
		Residence 2	Residence 3	Residence 4	Residence 2 (44.9 dBA)	Residence3 (43.7 dBA)	Residence 4 (43.7 dBA)	
Grader	110	34.79	33.56	33.08	No	No	No	No
Mobile Crane	104	28.79	27.56	27.08	No	No	No	No
Piling (bored)	111	35.79	34.56	34.08	No	No	No	No
Pneumatic hand tools	116	40.79	39.56	39.08	No	No	No	No
Vibratory Roller	108	32.79	31.56	31.08	No	No	No	No
Water Cart	107	31.79	30.56	30.08	No	No	No	No
Combined equipment (10 most noisy)	123.5	48.29	47.06	46.58	Yes	Yes	Yes	No

Given the typical noise levels of individual pieces of construction equipment used for the construction of the transmission line and main access road, no individual piece of equipment is likely to exceed the target noise level at any of the residences.

Given the typical noise calculation of the 10 most noisy construction equipment working concurrently, the noise associated with construction activities for the transmission line and main access road would exceed the respective target noise levels at all three residences.

Construction of the transmission line and main access road are likely to be shorter in duration than solar plant construction works and impacts are likely to be intermittent as works would be undertaken at different parts of the site for varied periods.

2.3 INTERPRETATION OF RESULTS

The prediction methodology and calculations presented in Section 2.2 are conservative. They assume hemispherical spreading which only accounts for divergence losses (i.e., distance spreading). Additional factors can affect the resultant noise level at the surrounding noise sensitive receivers. These factors are described below:

- **Atmospheric Absorption** – Atmospheric absorption is the mechanism by which acoustic energy is absorbed by particles in the atmosphere. The level of reduction due to air absorption depends on the air pressure, temperature, humidity, frequency and distance. For the closest dwellings, which are typically more than 2 kilometres from the site, losses due to atmospheric absorption would be between 5 and 7 dBA.
- **Ground Effects** – A travelling acoustic wave will interact with the ground surface which separates the source from the receiver. This interaction will affect the resultant noise level depending on the porosity of the ground, the frequency of noise and distance to the source. Where the ground is hard (such as asphalt and water) some acoustic energy is reflected increasing the resultant noise level. Where the ground is soft and porous (such as fields and grass) energy is absorbed reducing the resultant noise level. As the area surrounding the project site is covered in grassy fields and assuming typical distances between 1 and 2 kilometres, losses due to ground absorption would be between 6 and 7 dBA.
- **Wind Effects** – Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of noise. As the strength of the wind increases, the noise produced by the wind will obscure other noise sources. Section 5.3 of the NSW DECC Industrial Noise Policy (INP), dated January 2000, provides some guidance regarding the consideration of wind noise effects:

  "Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where the source to receiver wind speeds of 3 m/s or below occurs for 30% of the time or more in any assessment period in any season."

  For the receivers nearest the Solar Plant this would occur during light northerly winds. Seasonal Bureau of Meteorology (BOM) data for Nyngan Airport was reviewed to determine if wind effects enhancing noise propagation should be considered. In all cases winds with a northerly component of speeds less than 3 m/s occurred for less than 10% of the time. As such, wind effects are not a feature of the Nyngan area and should not be considered.
- **Shielding Effects** (i.e., wall buffers) – An intervening structure or change in elevation (i.e., a hill or berm) between the receiver and source of noise will provide some shielding. Typical reductions achieved by blocking line of sight from the source to receiver are in the order of 5 dBA. As there are no buildings or significant changes in elevation between the receivers and site, there would be minimal shielding effects.
- **Temperature Inversions** – Temperature inversions, when they occur, have the ability to enhance noise levels to particular receivers by bending upward travelling sound waves back towards the ground. It should be noted however that temperature inversions predominantly occur at night. As the construction works will only occur during daylight hours, the likelihood of a temperature inversion is minimal.

The cumulative effect from the above limitations for a receiver 1 kilometre from a source is shown below.

Table 2-5 Effect of limitations on noise levels at receiver located 1 kilometre from source.

Atmospheric absorption	Ground absorption	Wind effects	Shielding effects	Temperature inversion	Combined effects
-5 dBA	-6 dBA	0 dBA	0 dBA	0 dBA	-11 dBA

The above results show that for a receiver at a distance 1 kilometre from the noise source, there would be an additional loss of 11 dBA which has not been accounted for in the calculations. It should also be noted that where the distances are larger, as is the case for most of the receivers surrounding the solar plant, the effects of ground and atmospheric absorption would be larger.

Whilst the combined effects are shown to exceed the noise criteria at Redlands and Neerock, noise from the facility would actually comply with the limits if the additional effects of ground and atmospheric absorption are accounted for, as shown in Table 2-6 below.

Table 2-6 Predicted noise levels from construction of solar plant.

Property name	Reference used in report	Noise level at receiver[2]	Adjusted noise level at receiver[3 c]	NML – noise affected	Compliance / margin
Tikkara	Residence 1[4]	49 dBA	38 dBA	42 dBA	YES / 4 dBA
Rutherglen	Residence 2	42 dBA	31 dBA	45 dBA	YES / 14 dBA
Redlands	Residence 3	47 dBA	36 dBA	44 dBA	YES / 8 dBA
Neerock	Residence 4	44 dBA	33 dBA	44 dBA	YES / 11 dBA

The above results show that construction noise from works at the main solar plant area will comply at all dwellings, including the project-involved property at Residence 1 (Tikkara).

Table 2-7 shows the predicted noise levels from construction of the transmission line and main access road.

Table 2-7 Predicted noise levels from construction of transmission line and main access road.

Property name	Reference used in report	Noise level at receiver[4]	Adjusted noise level at receiver[5]	NML – noise affected	Compliance / margin
Tikkara	Residence 1[6]	50 dBA	39 dBA	42 dBA	YES / 3 dBA
Rutherglen	Residence 2	48 dBA	37 dBA	45 dBA	YES / 8 dBA
Redlands	Residence 3	47 dBA	36 dBA	44 dBA	YES / 8 dBA
Neerock	Residence 4	47 dBA	36 dBA	44 dBA	YES / 8 dBA

[2] This dwelling has been identified as project-involved and not been considered in the assessment.

[3] Noise levels have been adjusted to account for atmospheric and ground absorption

[4] Predicted noise levels as presented in Table 2.1 of the report, which account for divergence losses only.

Where ground and air absorption affects are also included, noise from construction activities at the transmission line / main access road area would also comply at all receivers.

Whilst the Tikkara property (i.e., Residence 1) is project involved, predictions have also been provided to determine compliance or otherwise. The results presented show that noise from construction works at the transmission line area will comply at this dwelling.

2.4 CONSTRUCTION NOISE MITIGATION MEASURES

While construction noise impacts have been shown to be compliant at all receivers, a series of mitigation measures are recommended to further minimise noise impacts during construction.

Table 2-8 Construction noise mitigation measures.

Activity	Mitigation measure
Induction	The employee and contractor induction should inform all site personnel about noise management measures, construction hours and nearest sensitive receivers.
	All employees are responsible for managing noise from their work activities and working in a manner to reduce noise.
Hours	Works are to be carried out during standard work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).
	Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.
	Where reasonable and feasible, noisy activity will be carried out in the least sensitive time periods (to be determined through community consultation).
CEMP	A Construction Noise Management Plan should be prepared as part of the Construction Environmental Management Plan.
Consultation	Community consultation would be ongoing for residences within close proximity to the works. The information would include details of: • The proposed works. • The duration and nature of the works during construction. • What works are expected to be noisy. • What is being done to minimise noise. • When respite periods will occur. • Regular updates on progress of works.
	For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement.
Plant, equipment and methods	Ensure equipment is operated and maintained in accordance with the manufacturer's instructions including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in compressed air lines and shutting down equipment not in use.
	Avoid the operation of noisy equipment near noise-sensitive areas and where possible, loading and unloading should be conducted away from sensitive areas.
	Position plant and equipment on site in a position that provides the most acoustic shielding from buildings and topography. Plant known to emit noise in one direction should be orientated, where practicable to screen the emissions.

Activity	Mitigation measure
	Where feasible and reasonable install less annoying alternatives to the typical 'beeper' alarms taking into account the requirements of the Occupational Health and Safety legislation, e.g., Multi-frequency alarms and smart alarms.
	Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).

3 OPERATIONAL NOISE

3.1 POLICY SETTING

3.1.1 NSW Industrial Noise Policy

The *NSW Industrial Noise Policy* (INP) (EPA 2000) specifies noise criteria to protect the community from excessive intrusive noise. According to this policy, noise levels within a rural residential area from industrial noise sources should not normally exceed the acceptable levels specified below.

Table 3-1 NSW Industrial Noise Policy amenity goals.

Receiver type	Indicative noise amenity area	Time of day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

3.2 IMPACT ASSESSMENT

3.2.1 Background noise monitoring

Background noise data collected to assess construction noise were also used to assess operational noise. Refer to Section 2.2.1 for background noise monitoring results.

3.2.2 Operational noise impacts

During operation, sources of noise from the solar plant would be from the electrical substation, on-site transformers and occasional maintenance activities. Sources of noise from the transmission line would include aeolian and corona discharge.

Solar plant

Substation noise

The substation would be located near the southwest corner of the site, with power generated in the solar plant transformed in the substation to grid voltage via a 33 / 132 kV transformer.

Australian Standard AS 60076 Part 10 2009 *"Power Transformers – Determination of Sound Levels"* specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the substation is not yet available, a conservative assumption is provided below based on a 250 MVA facility, with the installation meeting the requirements of AS 60076. AS 60076 indicates that a transformer of this capacity may produce sound power levels up to 100 dBA. The predicted noise level at the closest property (Tikkara, 2.4 kilometres south of the solar plant's substation) is 13 dBA, which is well below ambient background noise levels.

Given that a conservatively large power rating has been assumed, and that all noise sensitive receivers are generally greater than 2 kilometres from the solar plant, noise from the substation is considered to be inaudible.

Noise from maintenance works

During operations, 2-3 staff will be required on site to operate and maintain the solar plant. Noise from the maintenance works will mostly be due to infrequent maintenance works conducted inside the prefabricated steel maintenance building located in the southwest corner of the site. As such, noise from any maintenance works will be intermittent and occur during the day period only. Given the large distance from the site to the surrounding receivers, noise from most scheduled maintenance works will be well below the NSW Industrial Noise Policy (INP) criteria.

To provide an indicative assessment example of a worst case maintenance activity, noise from a concrete saw (with a sound power level of 117 dBA) would result in a level of 32 dBA at the nearest residential receptor. This is 5 dBA below the INP criteria of 37 dBA.

Transmission line

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. Aeolian noise is the sound produced by wind when it encounters an obstacle, such as building and wires, causing a humming or other constant sound (*Encyclopædia Britannica 2012*). In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest sensitive receiver (2.3 kilometres), aeolian noise impacts are expected to be negligible.

Corona is the breakdown of air into charged particles caused by the electrical field at the surface conductors. The weather and voltage of the line causes variation in corona noise, most often occurring during heavy rainfall and high humidity. Given the distance (2.3 kilometres) to the closest non-involved sensitive receiver, corona noise impacts are expected to be negligible. A minimum line potential of 70 kV or higher is required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components, a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing' and is generally only a feature during foggy or raining conditions.

SLR Consulting have previously measured corona noise (reference GEHA Report 045-109/2 dated 9 November 2004, pers. comm. I. Fricker December 2012) at a site near Officer in outer Melbourne, Victoria. SLR found it possible to measure corona noise at close distances, at high frequencies only, as

other noise sources, namely traffic and birds, caused some interference at times. A 500 kV line was measured during damp foggy conditions.

At a distance of 30 metres along the ground from the line an L_{eq} noise level of approximately 44 dBA was measured. At a distance of 100 metres the corona noise was calculated to be approximately 39 dBA. Assuming a minimum night time RBL value of 30 dBA, the minimum intrusive criteria as determined by the NSW Industrial Noise Policy (INP) would be 35 dBA. SLR therefore conservatively estimates that the minimum criteria level of 35 dBA would be complied with at a distance of 240 metres. The proposed transmission route is further than this distance from any receptor and hence any occasional corona noise would comply with the NSW INP minimum limit at all residential receivers.

3.3 OPERATIONAL NOISE MITIGATION MEASURES

Operational noise associated with the project would be minor. No specific operational mitigation measures are considered to be warranted.

4 CONCLUSION

Three (non-involved) noise sensitive receivers were identified in the vicinity of the proposed solar plant. These receivers were investigated for their potential to be impacted by construction noise, both during the construction of the solar plant and construction of the transmission line required by the project.

Noise modelling based on background noise logging and policy criteria was undertaken to predict construction noise levels during solar plant and transmission line construction activities (Section 2.2). Once correction factors were applied to account for atmospheric and ground absorption (Section 2.3) predicted noise levels were found to be compliant with NSW ICNG [NSW Interim Construction Noise Guidelines] at all receivers, including the project-involved receiver.

For the construction of the solar plant, construction noise at the closest dwelling (Tikkara, Residence 1) complies with the 42 dBA NML by 4 dBA. For the other properties located to the west and south, the margin of compliance ranges from 8 to 14 dBA. For construction of the transmission line and main access road, predicted noise levels can be seen to comply by 3 dBA at the Tikkara property. For the other three dwellings, the level of compliance is 8 dBA.

It should be noted that these predictions allow for a worst case scenario as:

- The likelihood of the ten loudest items of plant operating concurrently at the closest point to a single receiver is incredibly small. In reality, the equipment will be spread across the area of works.
- The adjustments for ground and air absorption have been conservatively based on the acoustic wave travelling a distance of 1 kilometre. However, receivers are between 1.8 and 4.6 kilometres from the construction works. For these distances, the combined losses range from 13 to 20 dBA.

It is anticipated that during typical construction works the level of noise at any receiver will actually be less than that reported, with a larger margin of compliance than stated in this report.

Whilst noise from construction impacts are found to comply with all criteria, it is recommended that mitigation measures be implemented to minimise the potential for short term adverse impacts. The

provided mitigation strategies (Section 2.4) range from engineering controls, construction scheduling, and community consultation.

Operational noise associated with the project would be minor. No specific operational mitigation measures are considered to be warranted.

5 REFERENCES

Department of Environment & Climate Change (DECC) (2009) *Interim Construction Noise Guideline*, Sydney.

Department of Lands (2012) SIX Viewer website, http://imagery.maps.nsw.gov.au, accessed August 2012.

Environment Protection Authority (EPA) (2000). NSW Industrial Noise Policy, Environment Protection Authority, Sydney South.

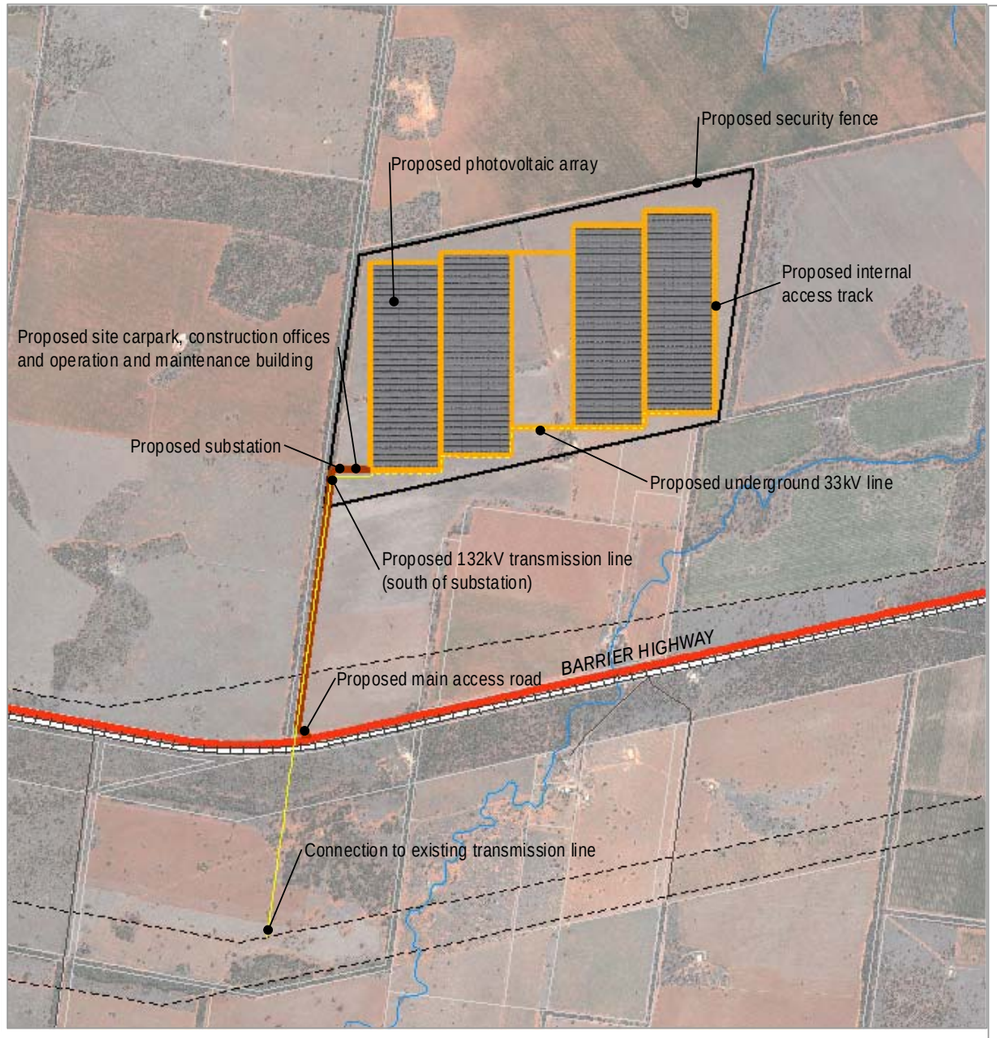
APPENDIX A LOCATION MAP

SITE LOCATION RELATIVE TO NYNGAN

0 5 10 20 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Bing (ESRI Online) accessed 2012

SITE LAYOUT



0 0.5 1 2 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Microsoft Virtual Earth accessed 2012

Proposed transmission line
- 132 kV
- Underground 33 kV

Proposed roads and tracks
- Internal access track
- Main access road
- Development site (fenced)
- Rail
- Highway
- Built up area (Nyngan)
- Road
- Existing transmission line

Ref: 4554v1.4 VIA
Author: SP

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APPENDIX B DECIBEL CALCULATOR

Tontechnik-Rechner - sengpielaudio

Deutsche Version

• Adding acoustic levels of sound sources •

• Combining decibels - adding up to 10 incoherent levels •

Addition of SPL − Sum of levels (voltage, sound, and noise)

Summing up to ten incoherent or uncorrelated noise sources

For beginners: incoherent means the signals of the overdubbed channels are irrelative like a violin and a trumpet, that means having no correlative relationship. Sometimes we say uncorrelated when we mean incoherent.

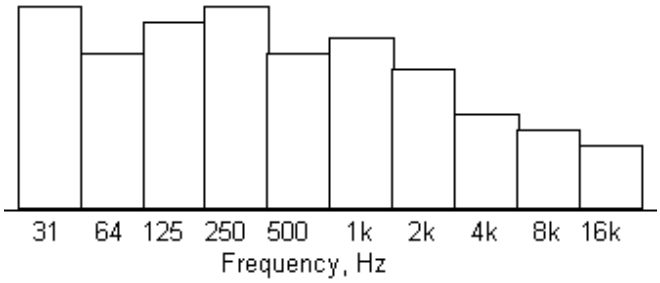
The decibel calculator can be used to combine the levels of up to ten incoherent electric or acoustic sources when the level of each source is known in decibels (dB).

Level 1	112	**dB**
Level 2	123	**dB**
Level 3	111	**dB**
Level 4	113	**dB**
Level 5	110	**dB**
Level 6	109	**dB**
Level 7	109	**dB**
Level 8	109	**dB**
Level 9	109	**dB**
Level 10	108	**dB**
reset	calculate	
Total Level	124.707	**dB**

Fill in as many sound level boxes as necessary (max 10) and then click the calculate bar, to get the calculated sum. Provided, that each sound source has its own random phasing.

A program to combine as much as thirty (30) noise sources

Conversion of sound pressure level to sound pressure and sound intensity



The ten octave bands of our hearing range

The formula for the sum level of sound pressures of n incoherent radiating sources is

$$L_\Sigma = 10 \cdot \log_{10} \left(\frac{p_1^2 + p_2^2 + \cdots + p_n^2}{p_0^2} \right) = 10 \cdot \log_{10} \left(\left(\frac{p_1}{p_0} \right)^2 + \left(\frac{p_2}{p_0} \right)^2 + \cdots + \left(\frac{p_n}{p_0} \right)^2 \right)$$

The reference sound pressure p_0 is 20 µPa = 0.00002 Pa = 2 × 10^{-5} Pa (RMS) ≡ 0 dB.

From the formula of the sound pressure level we find

$$\left(\frac{p_i}{p_0} \right)^2 = 10^{\frac{L_i}{10}}, \qquad i = 1, 2, \cdots, n$$

This inserted in the formula for the sound pressure level to calculate the sum level shows

$$L_\Sigma = 10 \cdot \log_{10} \left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \cdots + 10^{\frac{L_n}{10}} \right) \text{ dB}$$

L_Σ = Total level and L_1, L_2, ... L_n = sound pressure level of the separate sources in dBSPL.
Incoherent means: lacking cohesion, connection, or harmony. It is not coherent.

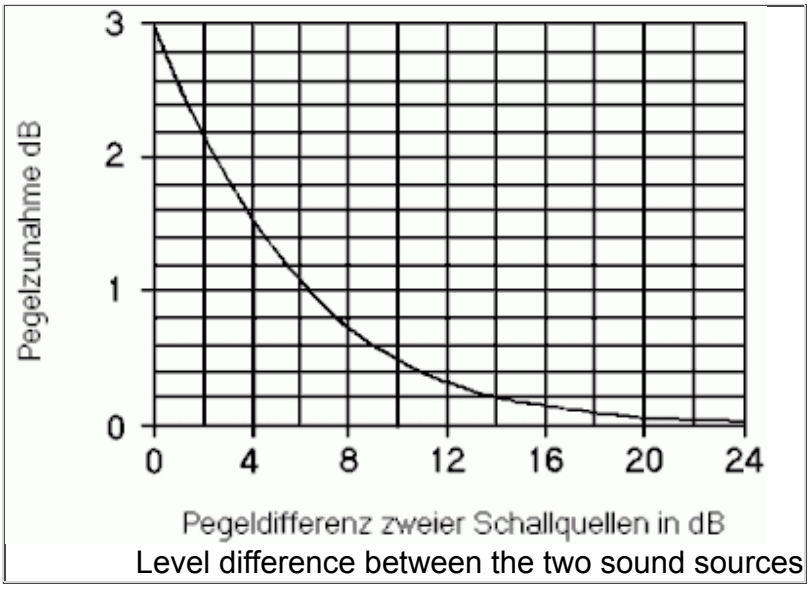
For example, adding three levels 94.0 + 96.0 + 98.0:
$L = 10 \log_{10} (10^{9.4} + 10^{9.6} + 10^{9.8}) = 101.1$ dB

Table for combining decibel levels

Difference between the two levels to be added in dB

0	1	2	3	4	5	6	7	8	9	10
3.0	2.5	2.1	1.8	1.5	1.2	1.0	0.8	0.6	0.5	0.4

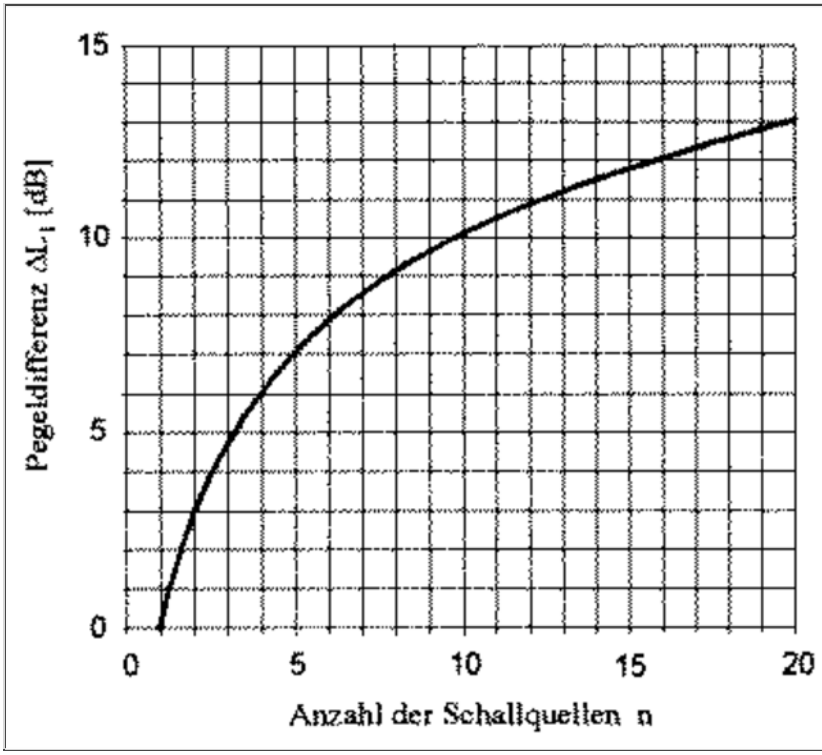
Amount to be added to the higher level in order to get the total level in dB



Level difference between the two sound sources

source 1	80	dB
source 2	74	dB
source 3		dB
source 4		dB
reset	calculate	
total		dB

Adding equal loud sound sources



Level increase ΔL for n equal loud sound sources	
Number of n equal loud sound sources	Level increase ΔL in dB
1	0
2	3.0
3	4.8
4	6.0
5	7.0
6	7.8
7	8.5
8	9.0
9	9.5
10	10.0
12	10.8
16	12.0
20	13.0

Formulas: $\Delta L = 10 \times \log n$ or $n = 10^{\Delta L/10}$

ΔL = level difference; n = number of equal loud sound sources.

n = **2** equally loud incoherent sound sources result in a higher level of

$10 \times \log_{10} 2$ = **+3.01 dB** compared to the case that only one source is available.

n = **3** equally loud incoherent sound sources result in a higher level of
$10 \times \log_{10} 3$ = **+4.77 dB** compared to the case that only one source is available.

n = **4** equally loud incoherent sound sources result in a higher level of
$10 \times \log_{10} 4$ = **+6.02 dB** compared to the case that only one source is available.

Adding (combining) levels of equal loud sound sources

Simply enter the value to the left or the right side.
The calculator works in both directions of the ↔ sign.

Number of sound sources n:	↔	**Increase of level ΔL:**
4		6 dB
$n = 10^{\frac{\Delta L \, in \, dB}{10}}$		$\Delta L \, in \, dB = 10 \log_{10}(n)$

The total level in dB is the level of one sound source plus the increase of level in dB.

See also:
Adding decibels of one-third octave bands to level of octave band
Combining decibels - adding up to thirty acoustic sound levels

Example: The measurable noise of a motorcycle is at a certain distance 60 dB (A). How big is the total level of 4 motorcycles with the same volume?
Solution: 60 dB (A) + 10 log 4 = 60 + 6 = 66 dB (A).
If you are doing noise measurements of motorcycles you should at least consider the "honesty" of the dBA-readings without low frequencies.

You can easily add up coherent and incoherent sound level and sound pressure values. It is often desired to add the psychoacoustic perceived loudness or volume. See:

How many decibels (dB) level change is double, half, or four times as loud?

How many dB to appear twice as loud (two times)? Here are all the different ratios. Ratio means "how many times" or "how much" ... Doubling of loudness.

Level change	Volume Loudness	Voltage Sound pressure	Acoustic Power Sound Intensity
+40 dB	16	100	10000
+30 dB	8	31.6	1000
+20 dB	4	10	100
+10 dB	2.0 = double	3.16 = √10	**10**
+6 dB	1.52 times	2.0 = double	4.0
+3 dB	1.23 times	1.414 times = √2	2.0 = double
- - - - ±0 dB - - - -	- - - - 1.0 - - - - - - -	- - - - 1.0 - - - - - - -	- - - - 1.0 - - - - -
−3 dB	0.816 times	0.707 times	0.5 = half
−6 dB	0.660 times	0.5 = half	0.25
−10 dB	0.5 = half	0.316	0.1
−20 dB	0.25	0.100	0.01

−30 dB	0.125	0.0316	0.001
−40 dB	0.0625	0.0100	0.0001
Log. quantity	**Psycho quantity**	**Field quantity**	**Energy quantity**
dB change	**Loudness multipl.**	**Amplitude multiplier**	**Power multiplier**

Ratio	Change in Sound Loudness Level	Change in Sound Pressure Level	Change in Sound Power Level
20	+43.22 dB	+26.02 dB	+13.01 dB
15	+39.07 dB	+23.52 dB	+11.76 dB
10	+33.22 dB	+20 dB	+10 dB
5	+23.22 dB	+13.98 dB	+6.99 dB
4	+20 dB	+12.04 dB	+6.02 dB
3	+15.58 dB	+9.54 dB	+4.77 dB
2	+10 dB	+6.02 dB	+3.01 dB
- - - - - 1 - - - - -	- - - - ±0 dB - - -- -	- - - - ±0 dB - - - --	- - - ±0 dB - - -- -
1/2 = 0.5	−10 dB	−6.02 dB	−3.01 dB
1/3 = 0.3333	−15.58 dB	−9.54 dB	−4.77 dB
1/4 = 0.25	−20 dB	−12.04 dB	−6.02 dB
1/5 = 0.2	−23.22 dB	−13.98 dB	−6.99 dB
1/10 = 0.1	−33.22 dB	−20 dB	−10 dB
1/15 = 0.0667	−39.07 dB	−23.52 dB	−11.76 dB
1/20 = 0.05	−43.22 dB	−26.02 dB	−13.01 dB

Noise

Noise is annoying, harassing and unwanted sound. It is not a physical phenomenon, but only mental processes change a sound to noise.
There are a number of definitions of noise. Important ones are:
1 - the *acoustic ratio* that characterize the noise and by measurable physical quantities, such as the amplitude or the sound pressure level, frequency, and the time behavior of the sound, can be described.
2 - *the situational ratio*, i.e. location, time and situation in which the person is situate during the occurrence of the noise, and the relation to the activities, intentions and the current being of the person who is exposed to the noise.
3 - the *personal ratio* of the person who is exposed to the noise, with their acquired cognitive and emotional implications for the sound source. The fact that noise is not only dependant on physically measurable quantities, but "of more", makes the derivation of methods and calculation methods for the objective description to a problem and explains the problems of noise control, which are often found between the measured noise values and the perceived harassment.

Pro audio equipment often lists an A-weighted noise spec – not because it correlates well with our hearing – but because it can "hide" nasty hum components that make for bad noise specs.

Words to bright minds: Always wonder what a manufacturer
is hiding when they use A-weighting. *)

***) http://www.google.com/search?q=Always+wonder+what+a+manufacturer+Rane&filter=0**

Formulas for working with sound

1 pascal (Pa) = 1 newton/m^2
= 10 dyne/cm^2
= 10 microbar
≡ 94 dB SPL (Sound Pressure Level)

Sound Pressure Level (SPL)

Sound Pressure Level L_p = 20 × lg (p / p_0) in decibels (dB), where

p is the measured pressure as sound field quantity and
p_0 is a reference pressure in the same system of units:

p_0 = 20 micropascals or micronewtons/m^2 = 0.00002 Pa

= 0.0002 microbar or dyne/cm^2.

This reference pressure
p_0 = 0.00002 Pa as a sound field quantity corresponds to a sound wave in free air with an acoustic intensity (energy) of I_0 = 10^{-12} Watt/m^2 as a sound energy quantity.

Sound Intensity Level (SIL) or Acoustic Intensity Level

Sound Intensity Level L_I = 10 × lg (I / I_0) in decibels (dB), where

I is the measured intensity as sound energy quantity and
I_0 is the reference sound intensity in the same system of units:

I_0 = 10^{-12} Watt per m^2.

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APPENDIX C NOISE MONITORING DATA

Session Report

23/05/2012

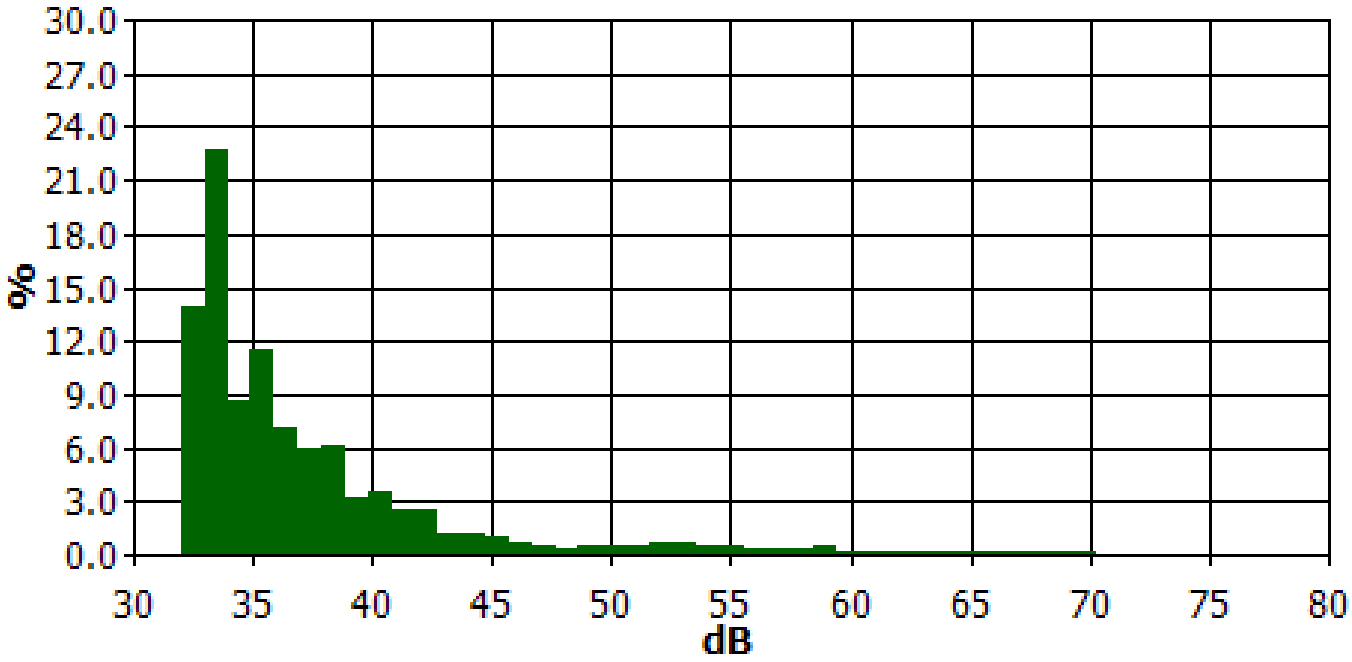
Information Panel

Name	S499_BJH070015_21052012_130044
Start Time	Thursday, 17 May 2012 08:34:15
Stop Time	Thursday, 17 May 2012 08:50:43
Device Model Type	SoundPro DL
Comments	

General Data Panel

Description	Meter	Value	Description	Meter	Value
Leq	1	50.2 dB	Exchange Rate	1	3 dB
Weighting	1	A	Response	1	SLOW
Bandwidth	1	OFF	Exchange Rate	2	3 dB
Weighting	2	C	Response	2	SLOW

Statistics Chart



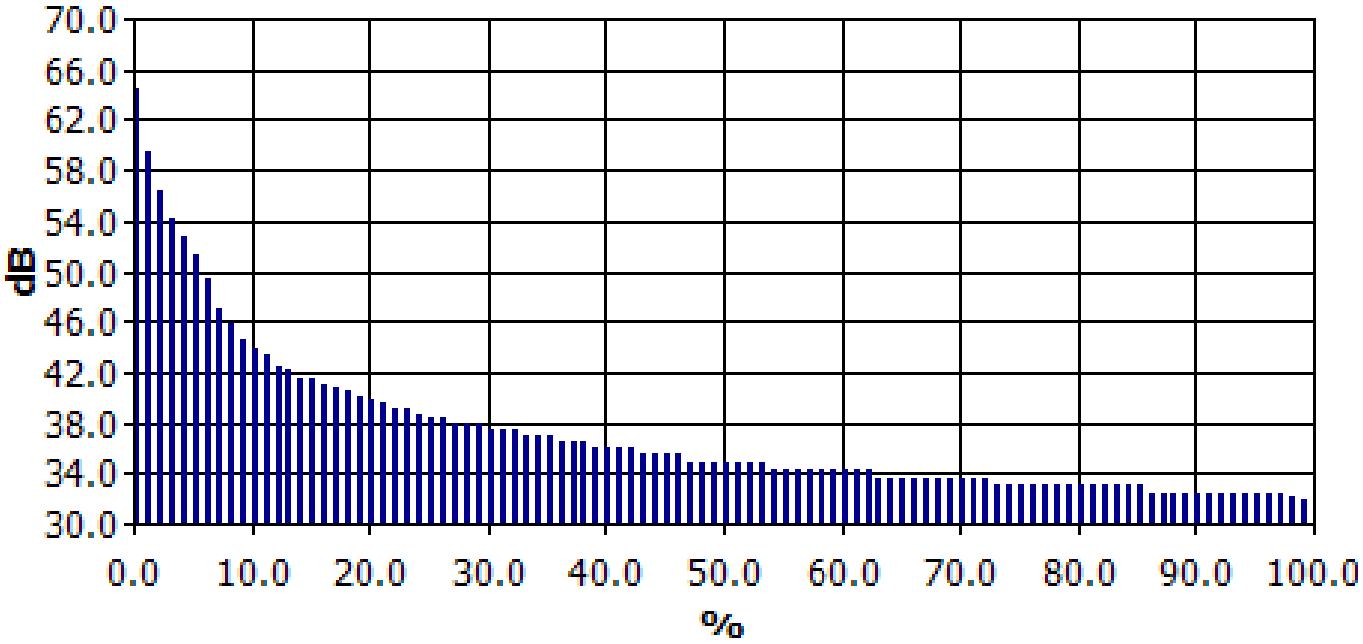
Statistics Table

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.0	0.0	0.0	0.1	1.6	4.8	7.4	0.0	0.0	0.0	0.0	14.0
33.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	10.2	0.0	22.7
34.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0	0.0	8.7
35.0	6.7	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	11.4
36.0	0.0	3.9	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	7.0
37.0	0.0	2.9	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	5.9
38.0	2.3	0.0	0.0	0.0	2.1	0.0	0.0	0.0	1.8	0.0	6.2
39.0	0.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	1.0	3.3
40.0	0.0	0.0	1.2	0.0	0.0	0.0	1.2	0.0	0.0	1.1	3.5
41.0	0.0	0.0	1.0	0.0	0.0	0.9	0.0	0.7	0.0	0.0	2.5
42.0	0.7	0.0	0.8	0.0	0.0	0.4	0.0	0.4	0.0	0.3	2.6
43.0	0.0	0.0	0.2	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.1
44.0	0.3	0.0	0.3	0.2	0.0	0.1	0.0	0.1	0.2	0.0	1.2
45.0	0.2	0.0	0.1	0.2	0.0	0.1	0.2	0.0	0.1	0.1	1.1
46.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.7
47.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.6
48.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4
49.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.5
50.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.4
51.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.6
52.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.7
53.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.6
54.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.5
55.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.6
56.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4

Statistics Table (cont'd)

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3
58.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.4
59.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.5
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
61.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
62.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
63.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
69.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
71.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
73.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
79.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Exceedance Chart



Exceedance Table

	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%
0%		64.4	59.5	56.3	54.3	52.7	51.3	49.3	47.1	45.8
10%	44.7	43.9	43.3	42.4	42.1	41.6	41.4	41.1	40.8	40.5
20%	40.1	39.8	39.5	39.1	39.1	38.7	38.3	38.3	37.9	37.9
30%	37.9	37.5	37.5	37.5	37.0	37.0	37.0	36.5	36.5	36.5
40%	36.0	36.0	36.0	36.0	35.5	35.5	35.5	35.5	34.9	34.9
50%	34.9	34.9	34.9	34.9	34.9	34.3	34.3	34.3	34.3	34.3
60%	34.3	34.3	34.3	34.3	33.7	33.7	33.7	33.7	33.7	33.7
70%	33.7	33.7	33.7	33.7	33.1	33.1	33.1	33.1	33.1	33.1
80%	33.1	33.1	33.1	33.1	33.1	33.1	33.1	32.4	32.4	32.4
90%	32.4	32.4	32.4	32.4	32.3	32.3	32.3	32.3	32.3	32.2
100%	32.0									

General Data Panel

Description	Meter	Value	Description	Meter	Value
Dose	1	0 %	Pdose	1	0 %
Lmin	1	32.1 dB	Lmax	1	71.2 dB
Lpk	1	88.1 dB	Leq	1	50.2 dB
TWA	1	35.2 dB	OL%	1	0 %
ULtime	1	00:00:00	Takt	1	52.6 dB
SEL	1	79.8 dB	ExpSec	1	0 Pa2-Sec
UR%	1	93.4 %	L1	1	64.4 dB
L10	1	44.7 dB	L50	1	34.9 dB
L90	1	32.4 dB	Mntime	1	17/05/2012 8:34:36 AM
Mxtime	1	17/05/2012 8:42:11 AM	PKtime	1	17/05/2012 8:42:11 AM

Projected TWA	1	50.2 dB	Dose8	1	0 %
ExpHrs	1	0.00 Pa2-Hours			

Session Report

23/05/2012

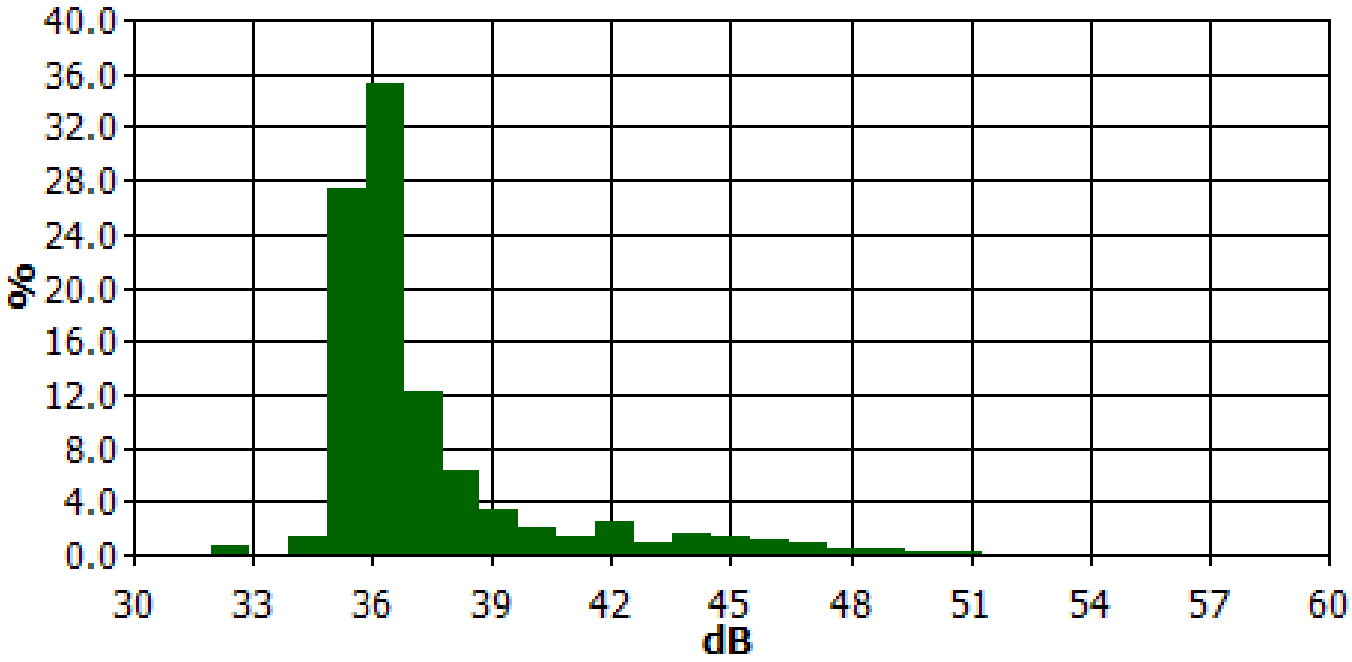
Information Panel

Name	S500_BJH070015_21052012_130045
Start Time	Thursday, 17 May 2012 15:29:11
Stop Time	Thursday, 17 May 2012 15:44:12
Device Model Type	SoundPro DL
Comments	

General Data Panel

Description	Meter	Value	Description	Meter	Value
Leq	1	39.2 dB	Exchange Rate	1	3 dB
Weighting	1	A	Response	1	SLOW
Bandwidth	1	OFF	Exchange Rate	2	3 dB
Weighting	2	C	Response	2	SLOW

Statistics Chart



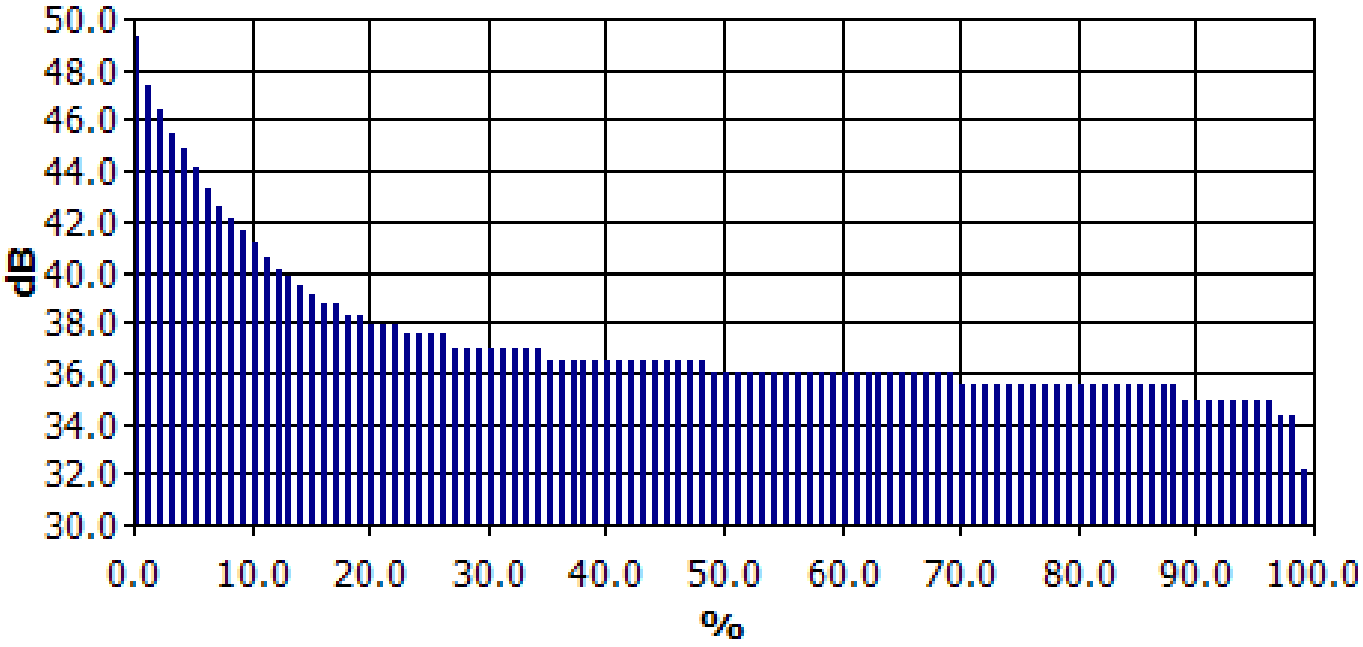
Statistics Table

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.0	0.0	0.0	0.0	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.7
33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
34.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3
35.0	8.5	0.0	0.0	0.0	0.0	0.0	18.8	0.0	0.0	0.0	27.3
36.0	0.0	20.6	0.0	0.0	0.0	0.0	14.7	0.0	0.0	0.0	35.3
37.0	0.0	8.1	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	12.2
38.0	2.7	0.0	0.0	0.0	2.0	0.0	0.0	0.0	1.7	0.0	6.3
39.0	0.0	0.0	1.5	0.0	0.0	0.0	1.1	0.0	0.0	0.8	3.4
40.0	0.0	0.0	0.8	0.0	0.0	0.0	0.6	0.0	0.0	0.6	2.0
41.0	0.0	0.0	0.5	0.0	0.0	0.4	0.0	0.4	0.0	0.0	1.4
42.0	0.5	0.0	0.5	0.0	0.0	0.6	0.0	0.6	0.0	0.4	2.5
43.0	0.0	0.0	0.2	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.9
44.0	0.2	0.0	0.3	0.2	0.0	0.3	0.0	0.2	0.2	0.0	1.5
45.0	0.3	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.2	1.4
46.0	0.0	0.1	0.2	0.0	0.2	0.2	0.2	0.0	0.1	0.1	1.1
47.0	0.0	0.2	0.2	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.9
48.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.5
49.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.5
50.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.3
51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
52.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Statistics Table (cont'd)

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Exceedance Chart



Exceedance Table

	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%
0%		49.3	47.4	46.4	45.5	44.9	44.1	43.3	42.6	42.1
10%	41.6	41.1	40.5	40.1	39.8	39.5	39.1	38.7	38.7	38.3
20%	38.3	37.9	37.9	37.9	37.5	37.5	37.5	37.5	37.0	37.0
30%	37.0	37.0	37.0	37.0	37.0	37.0	36.5	36.5	36.5	36.5
40%	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
50%	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
60%	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
70%	36.0	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
80%	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
90%	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.3	34.3
100%	32.1									

General Data Panel

Description	Meter	Value	Description	Meter	Value
Dose	1	0 %	Pdose	1	0 %
Lmin	1	32.2 dB	Lmax	1	53.3 dB
Lpk	1	80.7 dB	Leq	1	39.2 dB
TWA	1	24.2 dB	OL%	1	0 %
ULtime	1	00:00:00	Takt	1	42 dB
SEL	1	68.8 dB	ExpSec	1	0 Pa2-Sec
UR%	1	99.3 %	L1	1	49.1 dB
L10	1	41.6 dB	L50	1	36 dB
L90	1	34.9 dB	Mntime	1	17/05/2012 3:35:33 PM
Mxtime	1	17/05/2012 3:41:56 PM	PKtime	1	17/05/2012 3:41:56 PM
Projected TWA	1	39.2 dB	Dose8	1	0 %
ExpHrs	1	0.00 Pa2-Hours			

Session Report

23/05/2012

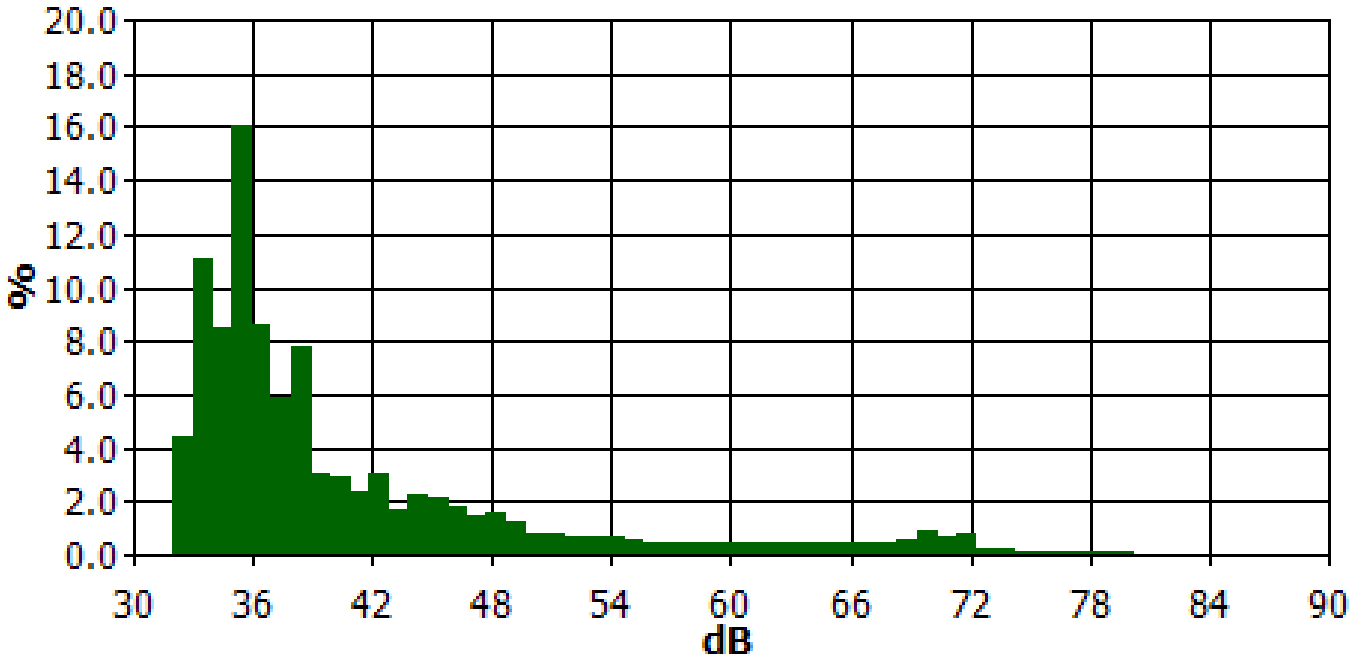
Information Panel

Name	S501_BJH070015_21052012_130045
Start Time	Thursday, 17 May 2012 15:58:00
Stop Time	Thursday, 17 May 2012 16:13:04
Device Model Type	SoundPro DL
Comments	

General Data Panel

Description	Meter	Value	Description	Meter	Value
Leq	1	60.2 dB	Exchange Rate	1	3 dB
Weighting	1	A	Response	1	SLOW
Bandwidth	1	OFF	Exchange Rate	2	3 dB
Weighting	2	C	Response	2	SLOW

Statistics Chart



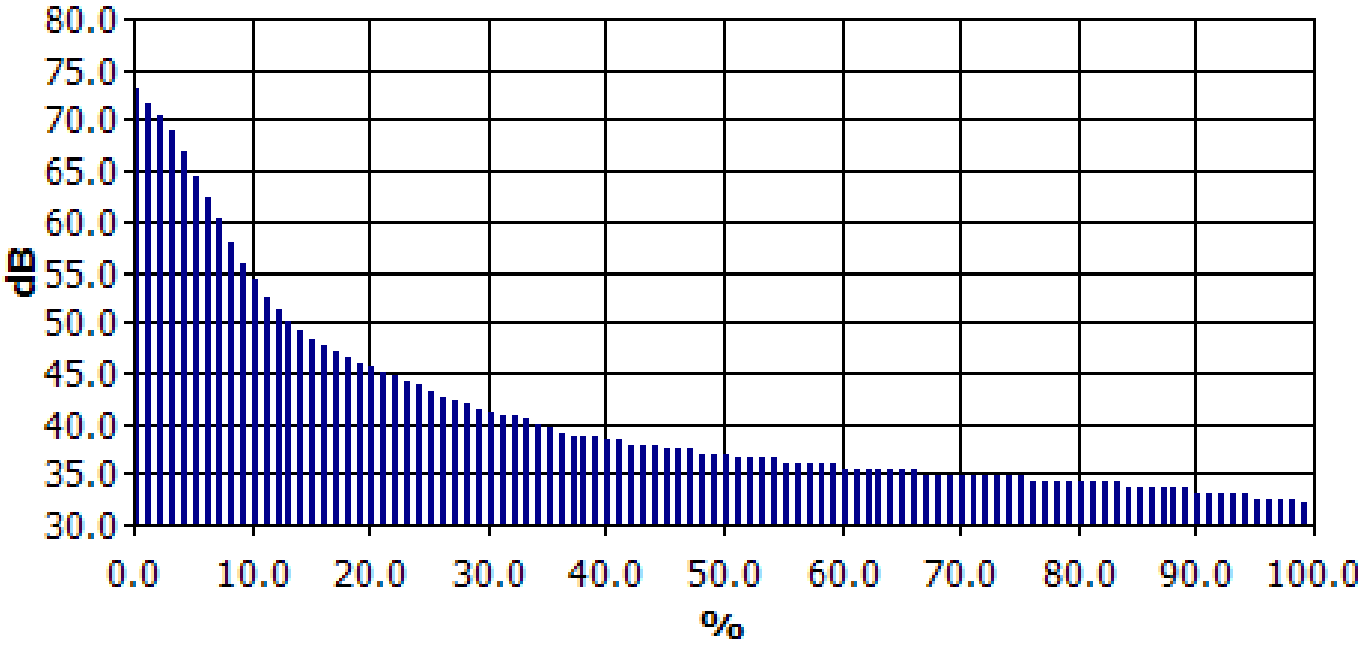
Statistics Table

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.0	0.0	0.0	0.0	0.1	0.9	3.4	0.0	0.0	0.0	0.0	4.4
33.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	6.3	0.0	11.1
34.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	8.4
35.0	8.3	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0	0.0	16.0
36.0	0.0	4.8	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	8.6
37.0	0.0	3.1	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	5.9
38.0	2.8	0.0	0.0	0.0	2.8	0.0	0.0	0.0	2.2	0.0	7.8
39.0	0.0	0.0	1.2	0.0	0.0	0.0	1.0	0.0	0.0	0.8	3.1
40.0	0.0	0.0	0.7	0.0	0.0	0.0	1.0	0.0	0.0	1.3	3.0
41.0	0.0	0.0	1.2	0.0	0.0	0.7	0.0	0.5	0.0	0.0	2.4
42.0	0.5	0.0	0.7	0.0	0.0	0.6	0.0	0.7	0.0	0.5	3.0
43.0	0.0	0.0	0.3	0.0	0.4	0.0	0.4	0.0	0.6	0.0	1.7
44.0	0.4	0.0	0.5	0.3	0.0	0.3	0.0	0.3	0.4	0.0	2.3
45.0	0.3	0.0	0.2	0.3	0.0	0.3	0.4	0.0	0.3	0.4	2.2
46.0	0.0	0.3	0.3	0.0	0.3	0.3	0.2	0.0	0.2	0.2	1.8
47.0	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.2	0.1	1.4
48.0	0.0	0.3	0.3	0.3	0.0	0.3	0.2	0.2	0.0	0.1	1.6
49.0	0.2	0.2	0.2	0.0	0.2	0.1	0.1	0.1	0.1	0.1	1.3
50.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.8
51.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.8
52.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.7
53.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6
54.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.7
55.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.5
56.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5

Statistics Table (cont'd)

dB	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	%
57.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.5
58.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
59.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.4
60.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.5
61.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.5
62.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
63.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.5
64.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4
65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4
66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.5
67.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4
68.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.5
69.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6
70.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9
71.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
72.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.7
73.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
74.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2
75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
76.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
77.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
79.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
81.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
84.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
89.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Exceedance Chart



Exceedance Table

	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%
0%		73.1	71.7	70.3	68.9	66.7	64.5	62.3	60.2	57.9
10%	55.7	54.2	52.5	51.2	50.0	49.1	48.4	47.8	47.1	46.5
20%	46.0	45.5	45.1	44.6	44.1	43.7	43.3	42.6	42.4	41.9
30%	41.4	41.1	40.8	40.8	40.5	39.8	39.5	39.1	38.7	38.7
40%	38.7	38.3	38.3	37.9	37.9	37.9	37.5	37.5	37.5	37.0
50%	37.0	37.0	36.5	36.5	36.5	36.5	36.0	36.0	36.0	36.0
60%	36.0	35.5	35.5	35.5	35.5	35.5	35.5	35.5	34.9	34.9
70%	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.3	34.3	34.3
80%	34.3	34.3	34.3	34.3	34.3	33.7	33.7	33.7	33.7	33.7
90%	33.7	33.1	33.1	33.1	33.1	33.1	32.4	32.4	32.4	32.4
100%	32.2									

General Data Panel

Description	Meter	Value	Description	Meter	Value
Dose	1	0 %	Pdose	1	0.3 %
Lmin	1	32.3 dB	Lmax	1	80.4 dB
Lpk	1	94.5 dB	Leq	1	60.2 dB
TWA	1	45.2 dB	OL%	1	0 %

ULtime	1	00:00:00	Takt	1	63.4 dB
SEL	1	89.8 dB	ExpSec	1	0.3 Pa2-Sec
UR%	1	85.9 %	L1	1	73.1 dB
L10	1	55.7 dB	L50	1	37 dB
L90	1	33.7 dB	Mntime	1	17/05/2012 4:08:11 PM
Mxtime	1	17/05/2012 4:10:27 PM	PKtime	1	17/05/2012 4:10:27 PM
Projected TWA	1	60.2 dB	Dose8	1	0.3 %
ExpHrs	1	0.00 Pa2-Hours			