

Report VA2987.191024.NIA

The Laurels, Dappers Lane, Angmering

Noise Impact Assessment

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**Oceanview Developments Ltd
Timberley
North Drive
Ossemsley
BH25 5TJ**

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1. Introduction

It is proposed to develop the land adjacent to The Laurels, Dappers Lane, Angmering for residential use.

Venta Acoustics has been commissioned by Oceanview Developments Ltd to undertake an assessment of the current environmental noise impact on the site and provide recommendations of acoustic mitigation where required to address condition 4 of the planning consent.

An environmental noise survey has been undertaken to determine the noise levels incident on the site. These levels are then used to undertake an assessment of the likely impact in accordance with the National Planning Policy Framework with reference to relevant standards, guidance and the planning requirements of Arun District Council.

Outline mitigation measures are considered and an appraisal of the requirements of external building fabric elements are provided where appropriate.

All staff at Venta Acoustics are fully qualified and members of the Institute of Acoustics, the recognised UK professional body for acoustics, noise and vibration professionals and are fully competent to undertake noise impact assessments.

2. Guidance and Legislation

2.1 Arun District Council Requirements

Condition 4 of the consent for the scheme, ref A/74/18/OUT states:

Following approval of this application and before the reserved matters applications are determined, the applicant shall submit an acoustic report to demonstrate that the internal and external noise levels of the proposed residential units bordering these sites, including access thereto/from, will conform to the indoor ambient noise levels for dwellings and external noise levels for amenity spaces ie. gardens, as specified within BS8233:2014, Guidance on Sound Insulation and Noise Reduction for Buildings and World Health Organisation:2009. The applicant should also demonstrate application of guiding principles from ProPG: Planning & Noise May 2017 as well as from the Planning Noise Advice Document, Sussex, July 2015. Any mitigation measures which may prove necessary are to be specified and such a scheme to be approved in writing by the Local Planning Authority. Any works specified in the approved scheme shall then be carried out in accordance with the approved details prior to occupation of the premises and retained thereafter. Post construction validation testing to be carried out within 8 weeks of completion of those residential units closest to the noise sources to demonstrate to the satisfaction of the Local Planning Authority that the above standards are met.

The details agreed shall be adhered to at all times thereafter.

2.2 Planning Noise Advice Document, Sussex, July 2015

In addition to the condition, which is based upon the Sussex Planning Noise Advice Document, section 5.6 of the document provides further advice regarding industrial/commercial noise affecting new residential sites.

- 5.6.1 *Careful consideration will need to be given to proposals that are likely to site new noise sensitive developments near to existing industrial, commercial, entertainment premises ports and airports.*
- 5.6.2 *There is no protection offered in law to existing premises, from nuisance complaints made by new residents. This may result in formal action being taken against these premises if a statutory nuisance is established.*
- 5.6.3 *Therefore, in general, where it is apparent to the LPA that existing noise from an existing industrial, commercial, entertainment premises, ports and air ports is likely to cause disturbance or a statutory nuisance to new residents, the development is unlikely to be supported unless clear evidence can be shown that adequate noise attenuation to the existing noise sources can and will be provided.*
- 5.6.4 *In some circumstances, legal agreements can be entered into, whereby the developers provide the necessary measures to attenuate the existing noise through adequate sound proofing or re-locating of the noise source*

2.3 The National Planning Policy Framework (2019)

The revised *National Planning Policy Framework (NPPF)*, adopted in 2019, sets out the Government's planning policies for England, superseding all previous planning policy statements and guidance.

In respect of noise, the NPPF states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing developments from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

Hence, Paragraph 180 states that *planning policies and decisions should also ensure new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- a) *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*

- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*

In regards to the term adverse impact, reference is made to the Noise Policy for England:

2.4 Noise Policy Statement for England (2010)

The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy: to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

This vision is supported by the following aims:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*

The terms “significant adverse” and “adverse” are related to the following concepts:

- No Observed Effect Level (NOEL) - the level below which no effect on health and quality of life can be detected.
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The guidance acknowledges that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations, but will be different for different noise sources, receptors and times.

In order to enable assessment of impacts in line with these requirements, reference should be made to other currently available guidance.

2.5 Planning Practice Guidance

This document advises on how planning can be used to manage potential noise impacts on communities.

The document has some overlap with the NPSE in its guidance although it does introduce new concepts regarding amenity.

Local planning authorities’ plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*

- *whether or not a good standard of amenity can be achieved.*

The document includes a table, reproduced in Table 2.1, regarding perception of noise in relation to the effect on residents, which is summarised below. This provides a qualitative description of noise and how it affects people and their behaviour.

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 2.1 – Noise exposure hierarchy

2.6 WHO Guidelines for Community Noise (1999)

The guidance in this document details suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this document are shown in Table 2.2.

Criterion	Environment	Design range $L_{Aeq,T}$ dB
Maintain speech intelligibility and avoid moderate annoyance, daytime and evening	Living Room	35 dB
Prevent sleep disturbance, night time	Bedrooms	30 dB

Table 2.2 – Excerpt from WHO

[dB ref. 20µPa]

This guidance also states:

For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times a night (Vallet & Vernet 1991).

For outdoor living areas, it is stated that:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.

For sleep disturbance, i.e. in bedrooms at night, the NOEL can, therefore, be taken as anything below 30dB(A), whilst the onset of the LOAEL occurs at 30dB(A) and above. The SOAEL cannot be inferred from this information.

During daytime periods, for avoidance of annoyance, the NOEL relates to anything up to 50dB(A) (typically applied to external areas, such as gardens), whilst the onset of the LOAEL occurs at 50dB(A) and above.

2.7 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to desirable internal ambient noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.3.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$

Table 2.3 – Excerpt from BS8233:2014 - Indoor ambient noise levels for dwellings

[dB ref. 20µPa]

For external areas the standard states the following:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

2.8 BS4142:2014

British Standard BS4142:2014 *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and;
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

The Standard is therefore suited to this assessment.

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation in terms of a L_{Aeq} value over a one-hour period during daytime operation (07:00-23:00 hours) and a fifteen-minute period during night-time operation (23:00-07:00 hours).

A correction factor is added to this level to account for the acoustic character of the sound. This is determined as follows when using the subjective assessment methodology:

Tonality - For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be allocated as a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity - A correction of up to +9dB can be applied for sound that is highly impulsive considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be allocated as a penalty of 3 dB for impulsivity which is just perceptible at the receiver, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics - Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3 dB can be applied.

Intermittency - When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.

An initial estimate of the impact of the source is then obtained by subtracting the typical background noise level, in terms of a LA90 value over the relevant period of operation, from the corrected Specific Sound Level.

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB could be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

2.9 ProPG: Planning & Noise (2017)

ProPG (Professional Practice Guidance: Planning and Noise) 2017 has been jointly developed by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH) to guide Local Planning Authorities (LPA's) and Practitioners in assessing the suitability for residential development on sites predominantly exposed to airborne transport noise.

The guidance advocates a proportionate and risk based 2-stage assessment approach.

Stage 1 is an initial noise risk assessment of the site, based on measurements or predictions, in the absence of mitigation or consideration of the proposed layout. A risk category is assigned to the site as follows:

Risk Category	Indicative Daytime Noise Levels $L_{Aeq,16hr}$	Indicative Night Time Noise Levels $L_{Aeq,8hr}$	Pre-Planning Application Advice
Negligible Risk	< 50 dB	< 40 dB	Indication that the development site is likely to be acceptable from a noise perspective and application need not normally be delayed on noise grounds.
Low Risk	50 - 60 dB	40 - 50 dB	Indication that the development site is likely to be acceptable provided a good acoustic design process is followed and is confirmed in a detailed Acoustic Design Statement confirming how noise will be mitigated
Medium Risk	60 - 70 dB	50 - 60 dB	
High Risk	> 70dB	> 60dB	Indication that the development site may be refused on noise grounds unless a good acoustic design process and detailed Acoustic Design statement can demonstrate the significant noise risk can be mitigated.

Notes

- Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.
- Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is “not dominant”.
- $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.
- An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F} > 60$ dB means the site should not be regarded as negligible risk.

The table suggests hard boundaries between risk categories based on values. The intent is a more considered and progressive increase in risk level as noise levels increase.

Table 2.4 – ProPG Stage 1 Site Noise Risk Assessment

Stage 2 is a detailed assessment of the proposals with consideration of four key elements:

- Element 1 – demonstrating a “Good Acoustic Design Process”
- Element 2 – observing internal “Noise Level Guidelines”
- Element 3 – undertaking an “External Amenity Area Noise Assessment”
- Element 4 – consideration of “Other Relevant Issues”

3. Site Description

As illustrated on attached site plan VA2987/SP1, the site is currently by a small light industrial estate to the north and south bounded, with the Laurels to the west.

The noise sources expected to affect the site are from distant roads, namely the A27, and the nearby commercial premises.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Monday 14th and Thursday 17th October 2019 at the locations shown in site plan VA2987/SP1. These locations were chosen to be representative of the ambient and background noise level at the new affected noise sensitive receivers.

Continuous 5-minute samples of the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels were undertaken at each of the measurement locations.

The weather during the survey period was generally dry with light winds, although there were periods of heavy rain, which has been excluded from the analysis. The ambient and background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-11586-E0	UCRT18/1582	7/6/18
NTi Class 1 Integrating SLM	XL2	A2A-12202-E0	UCRT19/1017	4/1/19
Larson Davis calibrator	CAL200	13049	UCRT19/1501	18/4/19

Table 4.1 – Equipment used for the survey

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA2987/TH1-3 for position 1 and VA2987/TH4-6 for position 2.

The average noise levels for the Daytime and Night-time periods, as well as the noise levels during the opening hours of the adjacent businesses on the light industrial premise, as measured at the automated monitoring positions are shown in Table 4.2.

Monitoring Period	Position 1		Position 2	
	L _{Aeq,T}	Typical ¹ L _{A90}	L _{Aeq,T}	Typical ¹ L _{A90}
07:00 – 23:00 hours	51 dB	38 dB	52 dB	40 dB
23:00 – 07:00 hours	45 dB	28 dB	47 dB	31 dB
Commerical hours – 07:00 – 18:00 hours)	51 dB	40 dB	53 dB	42 dB

Table 4.2 – Ambient and background noise levels at measurement locations**[dB ref. 20µPa]**¹ The typical L_{A90} value is taken as the 90th percentile of all L_{A90} values measured during the relevant period

The typical night time L_{Amax} events in the area, with the periods of rain excluded were recorded to be in the order of 59dB L_{Amax,fast}.

5. ProPG Stage- 1 Risk Assessment

The noise levels shown in Table 4.2 both lie within the ‘low risk’ category.

As this is the case a stage 2 assessment will be required to evaluate the detailed exposure of the site, and the relevant mitigation measures that will be required.

As part of the Good Acoustic Design Process, the internal layout of the new dwellings has been considered, with mainly blank, gable walls to the bordering commercial premises, with windows to bathrooms or hallways facing these areas. Habitable spaces are oriented at 90° to the industrial estate, reducing the angle of vie. The gardens are proposed to be enclosed by a 2m high boundary fence to the industrial estates.

6. ProPG Stage- 2 Detailed Assessment

BS8233 suggests that a loss of around 15dB can be expected from a partially open window. The document also includes a note that states ‘...the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved’. It is considered that where occupants have a choice, the desirable aspect of an open window offsets the slight increase in internal noise levels and the 5dB relaxation is generally acceptable.

The following table summarises the implications of external levels on the requirement for windows to be able to remain open. Where windows are required to be closed to achieve acceptable internal noise levels, an alternative means of ventilation will be required. This does not preclude the windows from being openable under occupant preference.

Period	External Noise Level			
	<L _{Aeq} 45dB	L _{Aeq} 45dB – 50dB	L _{Aeq} 50dB – 55dB	≥L _{Aeq} 55
Internal Levels Daytime (07:00-23:00 hours)	L _{Aeq,16hr} <35dB 'Desirable' Internal noise level with open windows		L _{Aeq,16hr} <40dB 'Reasonable' Internal noise level with open windows	≥L _{Aeq,16hr} 40dB Windows should be closed to control internal levels
Internal Levels Night Time (23:00-07:00 hours)	L _{Aeq,8hr} <30dB 'Desirable' Internal noise level with open windows	L _{Aeq,8hr} <35dB 'Reasonable' Internal noise level with open windows	L _{Aeq,8hr} ≥35dB Windows should be closed to control internal levels	

Table 6.1 – Summary of implication of external noise levels on the requirements for windows to able to remain open (applicable to bedrooms)

The above relates to continuous traffic noise only. L_{Amax} levels from individual events must also be considered.

With the levels measured on site, 'reasonable' internal noise levels would be achieved in rooms during both day and night-time with the windows partially open, with maximum internal events being below L_{Amax} 45dB.

The assessment of ambient noise in the area shows that the new buildings can be ventilated using open windows whilst still achieving the desired internal noise levels recommended under ProPG, BS8233:2014 and the WHO Guidance.

7. BS4142 Noise Impact Assessment

The adjacent light industrial premises contain various businesses. To the north there are SG Tanks. WCAW cladding, Sussex Mouldings, Alley Cats Cattery, Delta Signs and Thatcher Motors. Delta Signs, WCAW cladding and Thatcher Motors both border the residential site, with the rears of the buildings facing the residential site.

To the south, the businesses noted on site were WD Engineering Solutions, Reed between the Rust, MR Autobody Restorations, PK Autos.

Observations on site confirmed that noise from the car restoration premises to the south would have the greatest potential to cause impact on the new houses. Whilst the works appear to be mainly undertaken within the warehouse units, there is hardstanding outside, so it is not unreasonable to expect that works may also take place in front of the units.

A selection of the louder noise sources expected to occur associated with the adjacent car restoration premises are shown below which are to be assessed.

Noise Source	Measurement Distance	L_{Aeq}	Notes
Paint Spray	7m	60 dB	Fairly broadband
Buffer	7m	54 dB	Tonal
Hammering	Library data, 1m	69 dB	Impulsive
Grinder	Library data, 10m	81 dB	Intermittent

Table 7.1 – Measured and library data noise sources used for assessment

7.2 Acoustic Character Correction

The subjective method of allocating corrections to the sound source has been used following the methodology provided in BS4142:2014 and summarised in section 2.8.

Noise Source	Subjective Description	Allocated Corrections
Spray Paint	Generally broadband with identifiable on-off conditions	Tonality: 0dB Impulsivity: 0dB Intermittency: +3dB
Buffer	Clear tonal character, although located within workshop and not highly perceptible	Tonality: +4dB Impulsivity: 0dB Intermittency: +3dB
Hammering	Occasional use and impulsive in use.	Tonality: 0dB Impulsivity: +3dB Intermittency: +6dB
Angle Grinder	Expected to be slightly perceptible above background and intermittent and impulsive in use.	Tonality: 0dB Impulsivity: 0dB Intermittency: +3dB

Table 7.2 – Acoustic character corrections

These penalties are applied to the specific noise level in section 7.3 to obtain the rating noise level.

7.3 Rating Noise Level and Assessment

The rating noise levels at the assessment locations are compared against the relevant background noise levels to assess the notional significance of the noise impact as follows. Operations are adjusted to the appropriate on times.

Table 7.3 shows the assessments for on the most affected façade of the new development.

Noise Source	Specific Sound Level	On time per hour (Correction)	Character penalties			Rating Level	Difference from Background
			Tonality	Impulsivity	Intermittency		
Paint Spray	39 dB	30 mins (-3)	0	0	3	39 dB	-1 dB
Buffer	36 dB	30 mins (-3)	4	0	3	40 dB	0 dB
Hammering	52 dB	3 mins (-13)	0	3	6	48 dB	+8 dB
Angle Grinder	62 dB	5 mins (-11)	0	0	3	54 dB	+14 dB

Table 7.3 – Specific and Rating Sound Levels

7.4 Context

The site is located within a generally residential area.

At a greater distance, there is the A27 to the north which is audible across the site, albeit at a low level.

Review of the opening hours of the surrounding businesses are between 07:00 and 18:00, which has been used for the typical background noise level.

The assessment has been undertaken using a highly robust methodology, assuming works would be undertaken externally to the workshops. This was not witnessed on site, and where works are undertaken internally, even with the roller doors open, noise levels would be expected to be reduced by at least 10dB due to the angle of view and attenuation provided by the building.

Within this context, the estimated impact of the sound sources is expected to remain valid or be slightly reduced.

The BS4142 standard aims to cover a wide variety of situations under the same base assessment methodology and so has some inherent shortcomings. To allow for this, the guidance encourages consideration of the site context as a means of adapting the base assessment to specific scenarios.

The base assessment methodology is considered to be weighted towards the more sensitive case of assessing industrial noise upon an existing residential receiver. The introduction of a new residential use to an area with existing sources of commercial noise provides an opportunity to provide appropriate mitigation against the noise sources.

Mitigation at the source or along the propagation path for some of the noise sources outside of the industrial estate would be achievable in this situation, with the option of the installation of a taller, 3m boundary fence to the southern façade facing the industrial estate.

Should such a fence be installed, the following assessment levels would be expected at the most affected new dwelling.

Noise Source	Specific Sound Level	On time per hour (Correction)	Character penalties			Rating Level	Difference from Background
			Tonality	Impulsivity	Intermittency		
Paint Spray	33 dB	30 mins (-3)	0	0	3	33 dB	-7 dB
Buffer	32 dB	30 mins (-3)	4	0	3	36 dB	-4 dB
Hammering	46 dB	3 mins (-13)	0	3	6	42 dB	+2 dB
Angle Grinder	55 dB	5 mins (-11)	0	0	3	47 dB	+7 dB

Table 7.4 - Specific and Rating Sound Levels – 3m southern boundary

Considering the working day opening hours, and the likelihood that works are normally undertaken internally inside the building, it is expected that the impact to future residents would be reduced to acceptable levels where the level of impact would be low. There is not expected to be an impact in the evening or during the night-time.

Occasional noise events may be audible but the overall level is generally low, and is considered unlikely to cause negative impact.

7.5 Uncertainty

This section considers the variable in the assessment that may cause variations within the final results and describes how these have been addressed.

- Use of Class 1 sound level meters is considered to reduce instrument error to insignificant levels as compared with environmental variations. The calibration of the instrumentation was confirmed before and after the noise surveys.
- The background measurements were undertaken under suitable weather conditions over a period designed to include reasonable temporal variations in background noise levels, including a weekend period. Two monitoring locations were selected to minimise local acoustic phenomenon that may affect a single measurement location, including the noise from the nearby road site. These measurement locations were selected to be representative of the background noise levels expected to be experienced by the proposed dwellings without being unduly influenced by extraneous noise sources.
- Where library data has been used, propagation calculations have been used to correct noise levels to the relevant distance at the receiver.
- A pessimistic assessment of external works has been used. It is likely that noise levels will be much lower in reality as works would generally be carried out internally.

Overall, the uncertainty is considered to have been minimised to a suitable range so as not to risk significant variations in the impact assessment of typical operations.

8. Internal Noise Assessment

As previously highlighted, BS8233 suggests that a loss of around 15dB can be expected from a partially open window. On this basis the recommended internal ambient noise levels are expected to be achieved within the dwellings across the site with windows partly open.

With the above recommendations implemented, the noise levels within the proposed dwellings would be expected to be in line with recommendations given in the WHO 1999 and BS8233:2014 guidance. Internal noise levels can therefore be considered to be between the NOEL the LOAEL levels.

However, as highlighted, some noise from external areas of the industrial premises could be notable against the background noise profile. The construction of the new dwellings provides an opportunity to provide mitigation in the form of appropriately specified external building fabric elements. This would allow appropriate internal noise levels to be achieved such that the commercial noise source would be considerably mitigated to a level that would be unlikely to cause impact.

The monitoring data and predicted commercial noise levels have been used to calculate the required sound insulation performance for the windowsets (glazing and frame combination) and open ventilators for the building. These are summarised in Table 8.1 below.

Glazing Reference	Required Glazing SRI, dB	Ventilator Performance, dB
Type A	R_w 30	$D_{n,e,w}$ 30

Table 8.1 – Required minimum sound reduction indices for glazing and ventilators

In order that windows may remain closed to maintain the internal noise levels, it is expected that attenuated means of background ventilation will be required. If trickle vents are used the performance shown in Table 8.1 will be required. The figures stated are for a single vent per room. If multiple vents are required, then the performance requirement shown in **Error! Reference source not found.** will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room.

The glazing performances shown in Table 8.1 would be expected to be achieved by standard thermal double glazing.

With the above recommendations implemented, the noise levels within the proposed dwellings would be expected to be in line with recommendations given in the WHO 1999 and BS8233:2014 guidance. Internal noise levels can therefore be considered to be between the NOEL the LOAEL levels.

9. Areas of External Amenity

External noise levels comply with the World Health Organisation guideline value for external amenity of $L_{Aeq,16hour}$ 55dB. No mitigation measures are deemed necessary in relation to external noise levels.

The outdoor noise levels across the site can therefore be considered to fall between the LOAEL and SOAEL levels, generally being below the level that is expected to cause significant annoyance.

10. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the prevailing noise climate in the locality of The Laurels, Dappers Lane, Angmering in support of a planning application for the proposed development of new residential dwellings.

The measured levels have been assessed against the National Planning Policy Framework and currently available standards and guidance documents including World Health Organisation *Guidelines for Community Noise* (1999), BS8233:2014 *Guidance on sound Insulation and noise*, ProPG (Professional Practice Guidance: Planning and Noise) 2017, Planning Noise Advice Document, Sussex, July 2015 and BS4142: 2014 *Methods for rating and assessing industrial and commercial sound*.

The measured noise levels have been assessed against BS4142:2014 *Methods for rating and assessing industrial and commercial sound*, BS8233: 2014 *Guidance on sound insulation and noise*

reduction for buildings and the World Health Organisation *Guidelines for Community Noise* (1999) to assess potential noise impacts on the new residences.

When assessed using BS4142, noise from most activities on site have been shown to have a low impact. A discussion of potential mitigation in the form of building envelope performance has been included and through the use of this, it is considered that external noise levels can be mitigated to acceptable noise levels.

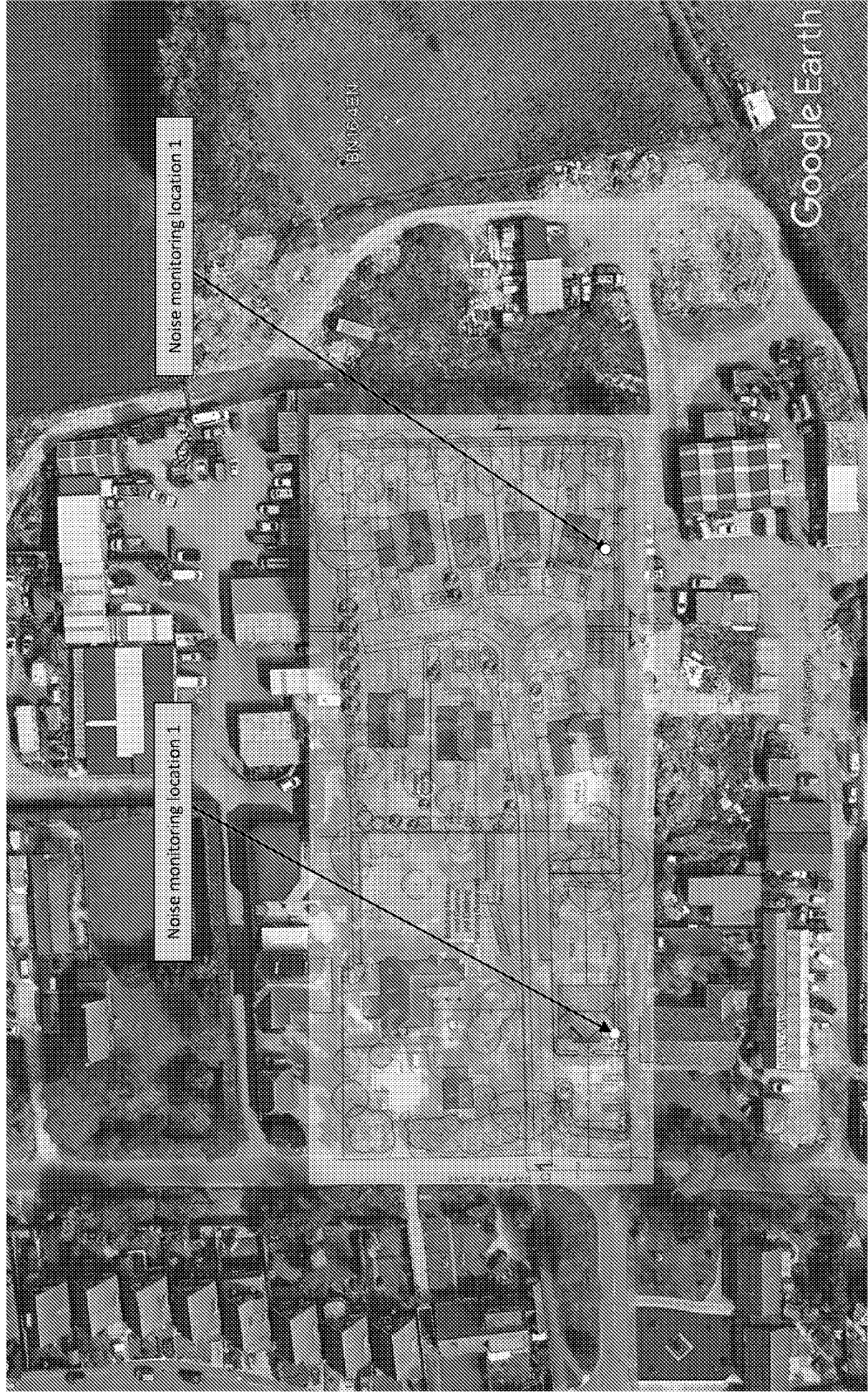
When considered against the guidance provide in the NPPF, NPSE, PPG and WHO, noise levels are audible at the nearby residences, although at a level which would be considered of low impact.

Assessment of average and maximum daytime and night-time noise levels have been calculated and show that internal noise levels would be below those stated in BS8233: 2014 *Guidance on sound Insulation and noise reduction for buildings*, with partially open windows

Although not required for average noise levels, appropriate mitigation measures to control the loudest events from the commercial uses have been outlined, including proprietary thermal double-glazing and trickle vents.

The proposed scheme is not expected to experience a significant adverse noise impact and the site is considered acceptable for the proposed residential use.

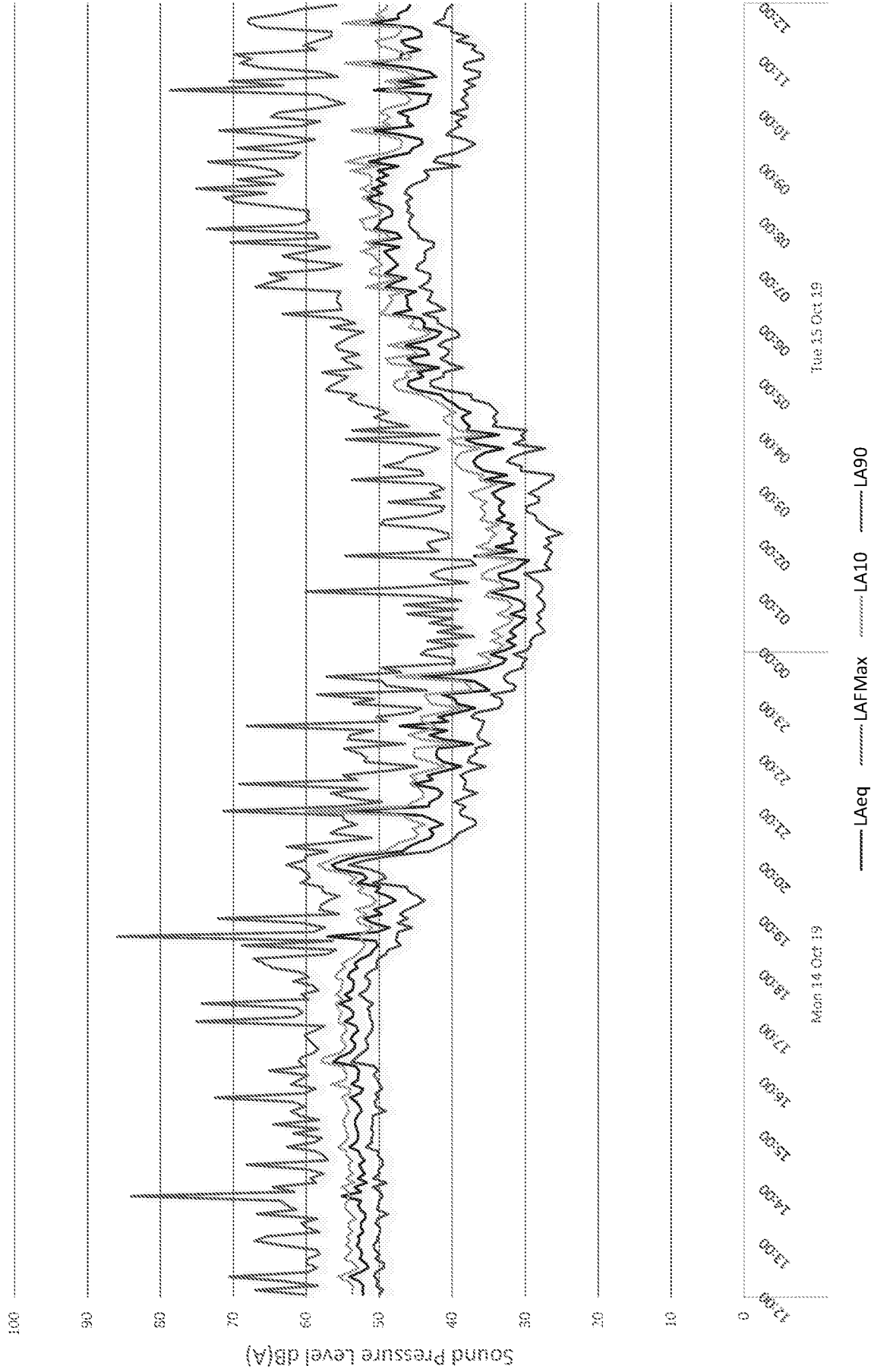
Jamie Duncan MIOA



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 1
Position 1



Figure VA2987/TH1



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 2

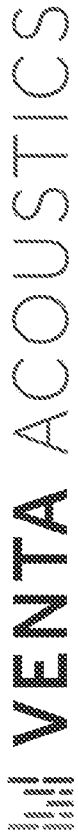
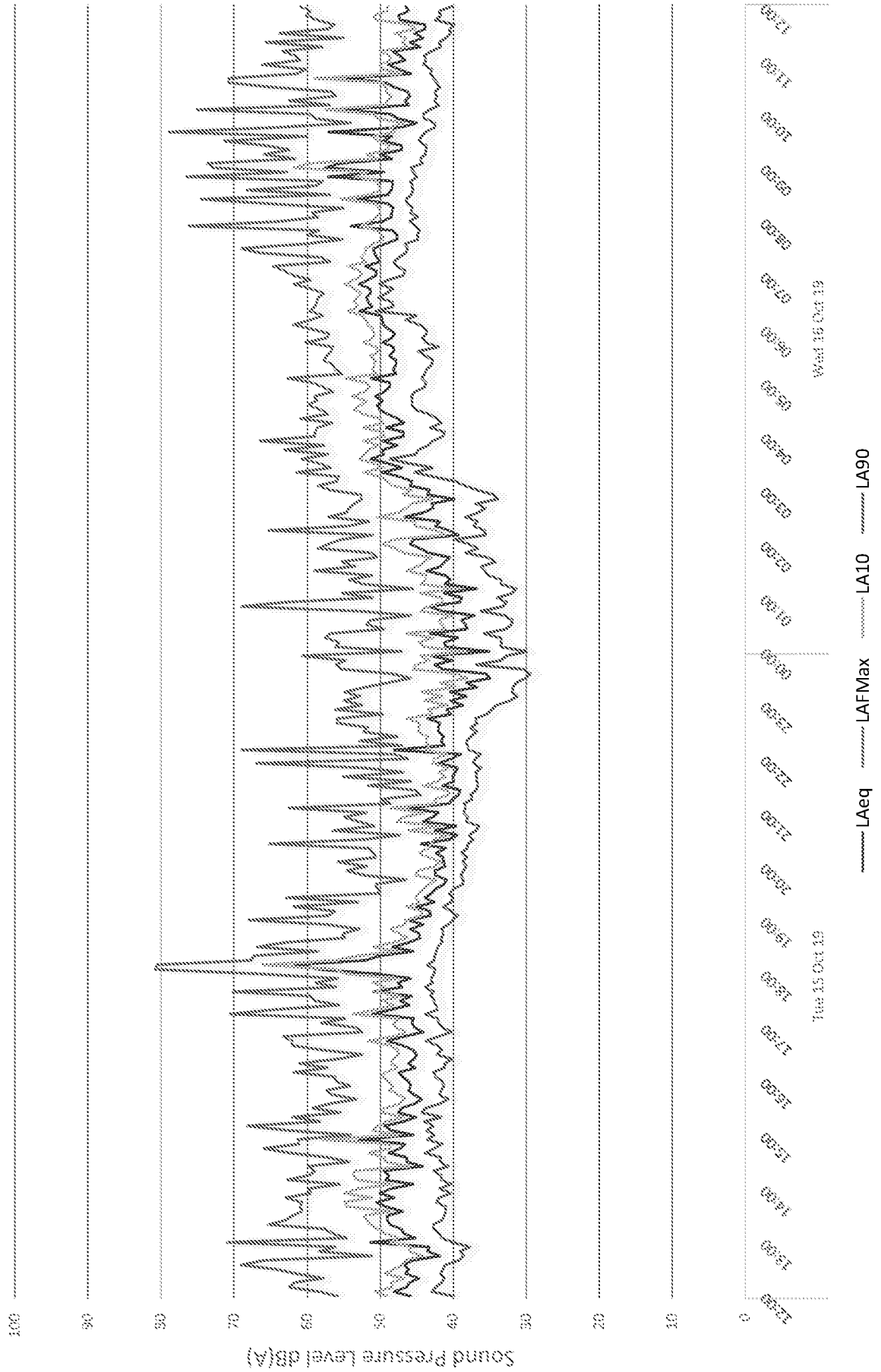


Figure VA2987/TH2

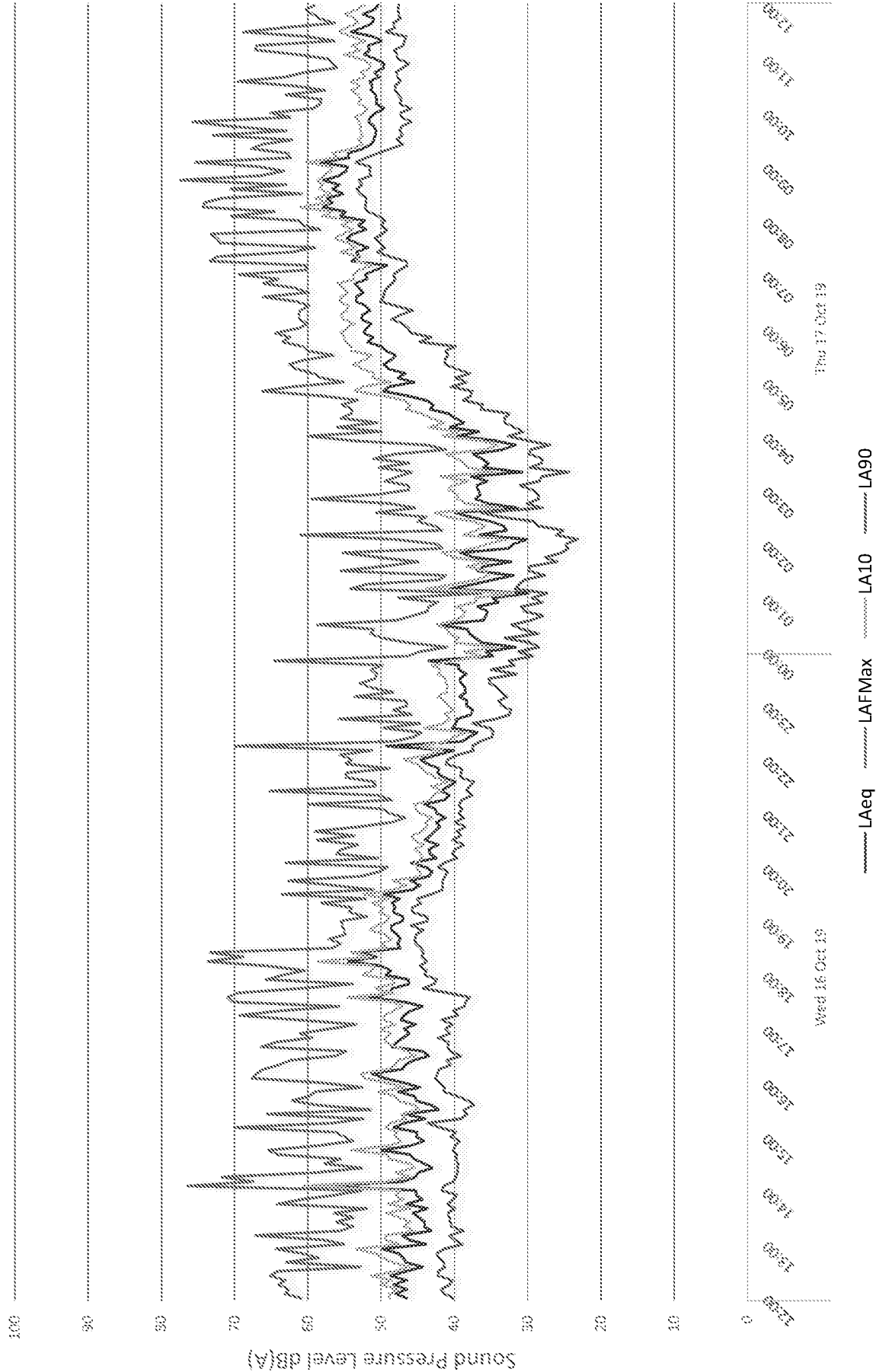
Position 1



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 3
Position 1



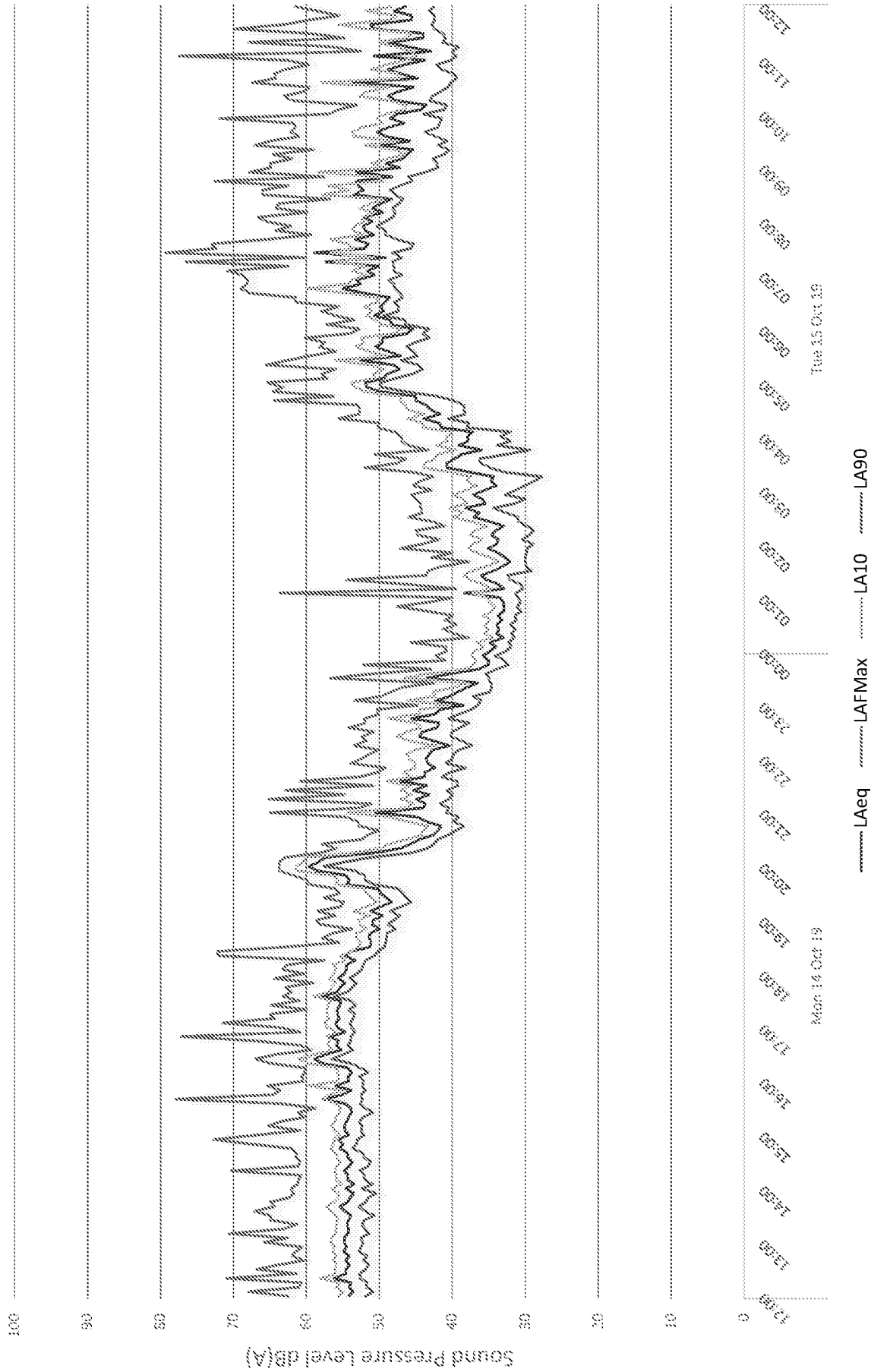
Figure VA2987/TH3



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 4
Position 2



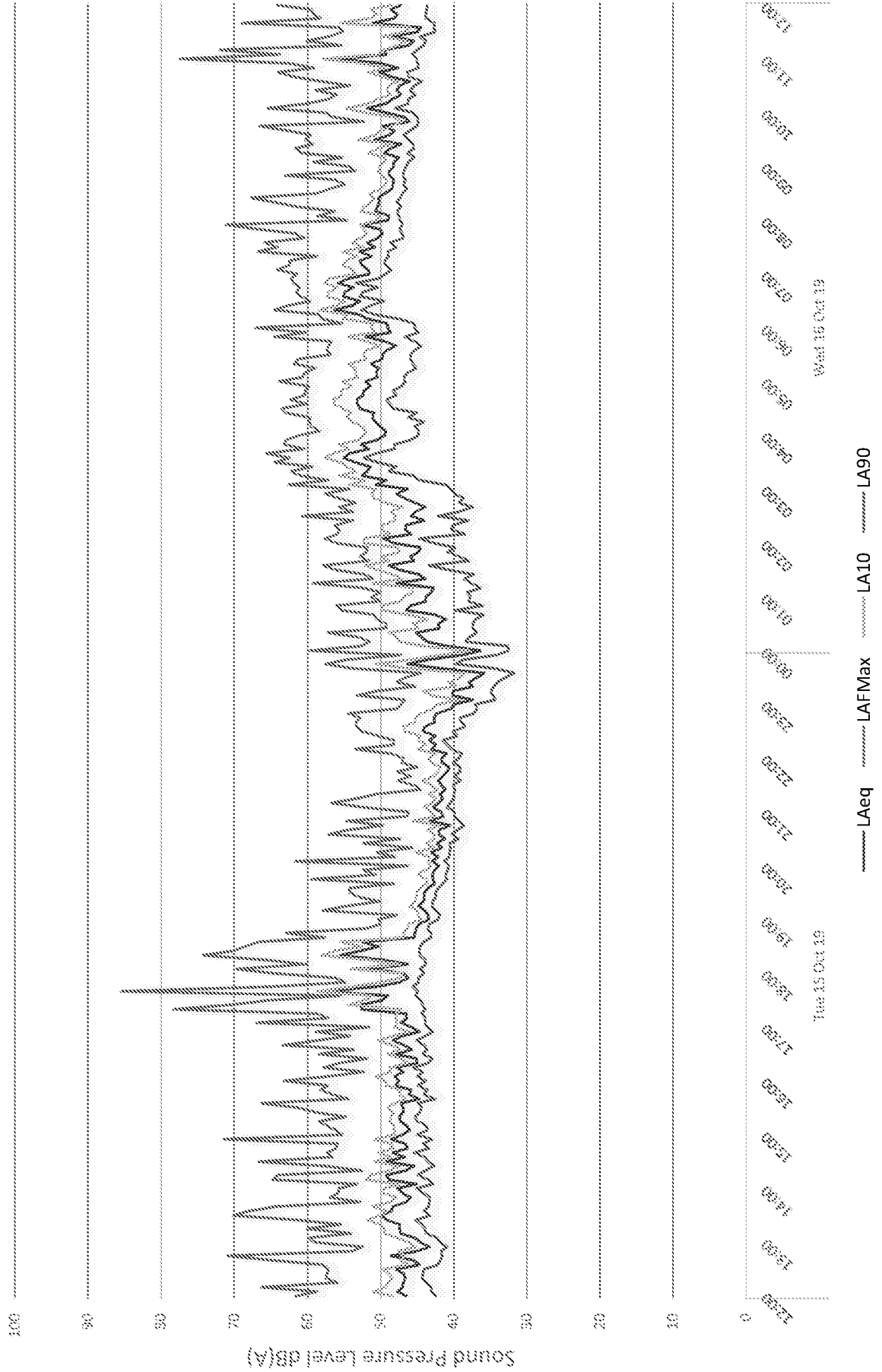
Figure VA2987/TH4



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 5
Position 2



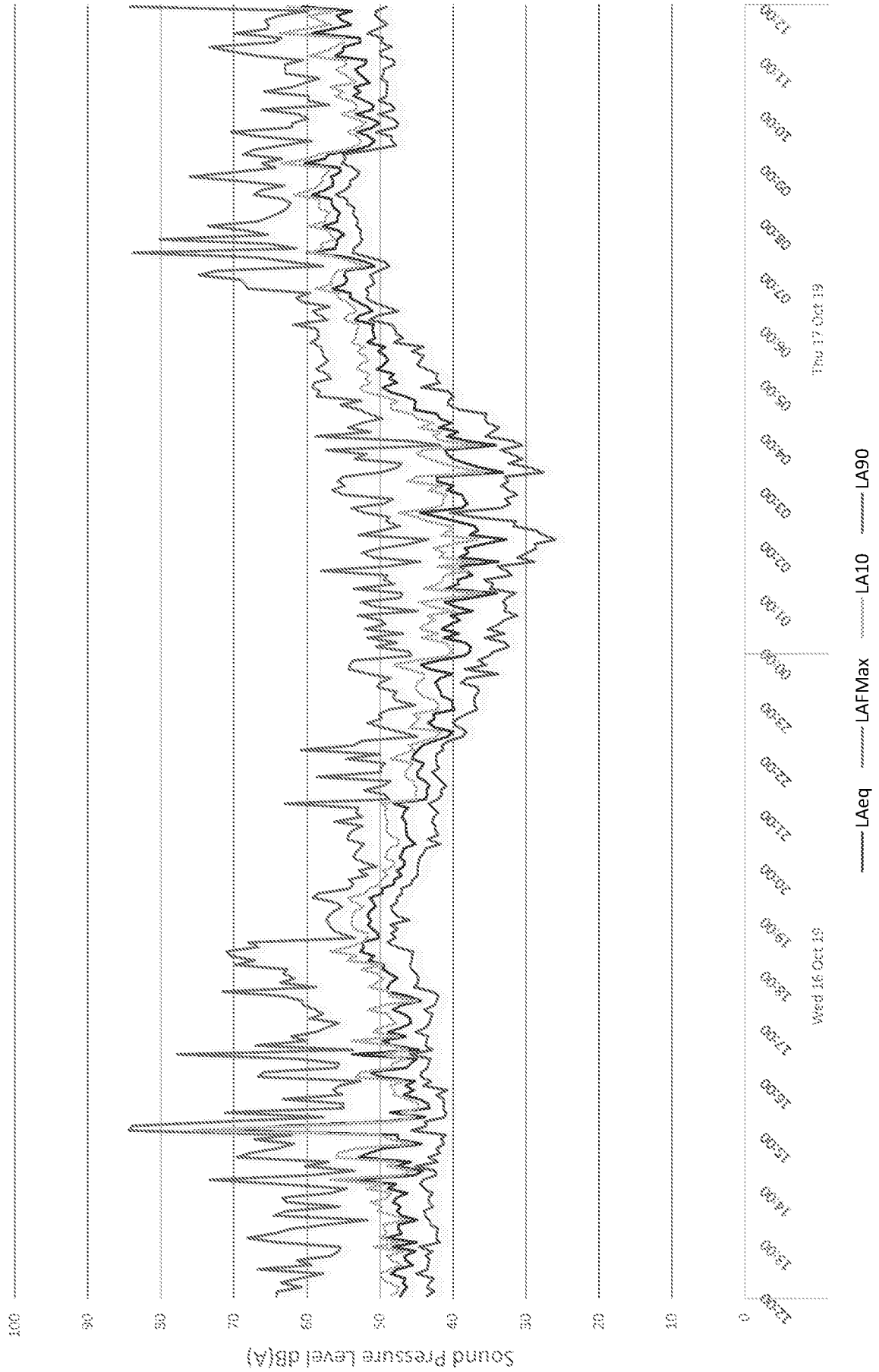
Figure VA2987/TH5



The Laurels, Dappers Lane, Angmering
Environmental Noise Time History: 6
Position 2



Figure VA2987/TH6



APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A . A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).
L_{eq} :	The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
R	<i>Sound Reduction Index</i> . Effectively the <i>Level Difference</i> of a building element when measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010 and corrected for its size and the reverberant characteristics of the receive room.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz		63		125		250		500		1000		2000		4000		8000
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1.3 Human Perception of Broadband Noise

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX B

VA2987 - The Laurels, Dappers Lane, Angmering

Noise Impact Assessment

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Paint Spraying	Lp @ 7m	59	59	50	49	53	52	54	55	60
Distance Loss	To 20m	-9	-9	-9	-9	-9	-9	-9	-9	
Line of sight screening		-5	-6	-7	-8	-10	-12	-14	-17	
Level at receiver (specific sound level)		45	44	34	31	34	30	31	28	39
Corrected to 30 mins / hour		-3	-3	-3	-3	-3	-3	-3	-3	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		45	44	34	31	34	30	31	28	39

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Buffing	Lp @ 7m	58	63	49	50	47	44	44	37	54
Distance Loss	To 20m	-9	-9	-9	-9	-9	-9	-9	-9	
Line of sight screening		-5	-6	-7	-8	-10	-12	-14	-17	
Level at receiver (specific sound level)		44	48	33	33	28	23	21	11	36
Corrected to 30 mins / hour		-3	-3	-3	-3	-3	-3	-3	-3	
Tonality penalty		4	4	4	4	4	4	4	4	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		48	52	37	37	32	27	25	15	40

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Hammering (BS5228)	Lp @ 1m	69	75	77	86	82	80	72	66	87
Distance Loss	To 20m	-26	-26	-26	-26	-26	-26	-26	-26	
Line of sight screening		-5	-6	-7	-8	-10	-12	-14	-17	
Level at receiver (specific sound level)		38	43	44	52	46	42	32	23	52
Corrected to 3 mins / hour	180 strikes	-13	-13	-13	-13	-13	-13	-13	-13	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		3	3	3	3	3	3	3	3	
Intermittency penalty		6	6	6	6	6	6	6	6	
Level at receiver		34	39	40	48	42	38	28	19	48

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Angle Grinder (BS5228)	Lp @ 10m	57	51	52	60	70	77	73	73	81
Distance Loss	To 20m	-6	-6	-6	-6	-6	-6	-6	-6	
Line of sight screening		-5	-6	-7	-8	-10	-12	-14	-17	
Level at receiver (specific sound level)		46	39	39	46	54	59	53	50	62
Corrected to 5 mins / hour		-11	-11	-11	-11	-11	-11	-11	-11	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		38	31	31	38	46	51	45	42	54

APPENDIX B

VA2987 - The Laurels, Dappers Lane, Angmering

Noise Impact Assessment - 3m high boundary

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Paint Spraying	Lp @ 7m	59	59	50	49	53	52	54	55	60
Distance Loss	To 20m	-9	-9	-9	-9	-9	-9	-9	-9	
Screening		-7	-9	-11	-13	-16	-19	-22	-25	
Level at receiver (specific sound level)		43	41	30	26	28	23	23	20	33
Corrected to 30 mins / hour		-3	-3	-3	-3	-3	-3	-3	-3	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		43	41	30	26	28	23	23	20	33

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Buffing	Lp @ 7m	58	63	49	50	47	44	44	37	54
Distance Loss	To 20m	-9	-9	-9	-9	-9	-9	-9	-9	
Screening		-7	-9	-11	-13	-16	-19	-22	-25	
Level at receiver (specific sound level)		42	45	29	28	22	16	13	3	32
Corrected to 30 mins / hour		-3	-3	-3	-3	-3	-3	-3	-3	
Tonality penalty		4	4	4	4	4	4	4	4	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		46	49	33	32	26	20	17	7	36

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Hammering (BS5228)	Lp @ 1m	69	75	77	86	82	80	72	66	87
Distance Loss	To 20m	-26	-26	-26	-26	-26	-26	-26	-26	
Screening		-7	-9	-11	-13	-16	-19	-22	-25	
Level at receiver (specific sound level)		36	40	40	47	40	35	24	15	46
Corrected to 3 mins / hour	180 strikes	-13	-13	-13	-13	-13	-13	-13	-13	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		3	3	3	3	3	3	3	3	
Intermittency penalty		6	6	6	6	6	6	6	6	
Level at receiver		32	36	36	43	36	31	20	11	42

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Angle Grinder (BS5228)	Lp @ 10m	57	51	52	60	70	77	73	73	81
Distance Loss	To 20m	-6	-6	-6	-6	-6	-6	-6	-6	
Screening		-7	-9	-11	-13	-16	-19	-22	-25	
Level at receiver (specific sound level)		44	36	35	41	48	52	45	42	55
Corrected to 5 mins / hour		-11	-11	-11	-11	-11	-11	-11	-11	
Tonality penalty		0	0	0	0	0	0	0	0	
Impulsivity penalty		0	0	0	0	0	0	0	0	
Intermittency penalty		3	3	3	3	3	3	3	3	
Level at receiver		36	28	27	33	40	44	37	34	47