MACH TESTING

115 FROGNAL, LONDON

Noise Assessment – BS 4142: 2014

Will Potter

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1.0 INTRODUCTION

MACH Testing has been appointed by Will Potter to undertake an environmental noise assessment for the proposed air conditioning units at 115 Frognal in London. Proposals are for four air conditioning units to be installed above the garage on the site.

The purpose of the assessment is to determine the existing ambient background noise level representative of the worst affected dwellings. Based on this level, the likelihood of complaints, as a result of the proposed plant units, can be assessed. Where non-compliance is indicated, appropriate noise mitigation can be specified.

In order to assess noise emissions from the proposed air conditioning units, an assessment has been carried out to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound*". This assessment has been benchmarked against a noise survey carried out between the 28th and 30th of April 2017.

2.0 SITE DESCRIPTION

The proposed air conditioning units are to be located at "ac" in Figure 2.1. The nearest residential receptors are indicated in Figure 2.1 by green (113 Frognal) and blue (the garage of 113 Frogal) boxes.

Figure 2.1: Site location, with the position of the fixed microphone (F) and the nearest receptors (in green and blue) and the position of the air conditioning units (ac)

2.1 Environmental Noise Sources

Road traffic noise from Frognal and Oak Hill Way is relatively low. Noise from these roads constitute the primary contributors to background noise levels on site.

There are a number of large trees and hedges around the property. Wind blowing leaves in trees can be heard. Bird calls are also evident within the vicinity as many small birds live in these trees.

2.2 Noise Sensitive Receptors

The nearest noise sensitive windows are located at the main house of 113 Frognal, as indicated by the green square in Figure 2.1 and the garage of 113 Frognal, as indicated by the blue square in Figure 2.1.

The window at the main house of 113 Frognal is approximately 15 meters from the proposed air conditioning units. The garage of 113 Frognal is approximately 8 meters from the proposed air conditioning units. However, it should be noted, there is no direct line of sight from the air conditioning units and the window on the garage of 113 Frognal.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Methodology

In order to establish the existing environmental noise levels on site, a noise survey was conducted between 11:30 on 28/04/17 and 01:50 on 30/04/17.

A fixed microphone position was used to determine the change in noise levels during typical operating hours of the noise source, with the fixed long term meter set to measure consecutive 'A' weighted 5-minute time samples. Measurements have been taken in free-field conditions.

The fixed measurement location (F) is shown in Figure 2.1. The location is comparable to the receptor location in terms of background noise, which has been verified on site. The results of the environmental noise survey are provided within Section 4.0 of this report.

3.2 Measurement Equipment

The measurement equipment illustrated in Table 3.1 was used during the survey, all equipment complies with BS EN 60942:2003 i.e. a class 1 device.

Name	Serial Number	Last Calibrated	Certificate Number	Calibration Due
Norsonic Precision Sound Analyser Type 131	1313109	Mar-16	15588	Mar-18
Norsonic Type 1207 Pre-amplifier	12303	Mar-16	15588	Mar-18
Norsonic Type 1228 Microphone	170603	Mar-16	15587	Mar-18
Norsonic Sound Calibrator Type 1251	32090	Jun-16	1606317	Jun-17

Table 3.1: Measurement equipment calibration.

3.3 Weather Conditions

The following climate conditions were recorded for the site:

	Temperature (°C)	Humidity (%)	Precipitation (mm)	Wind Speed (m/s)
Average Values Over Noise Assessment	11	62	0	4

Table 3.2: Shows the overview of the weather over the duration of the noise assessment.

The above weather conditions are suitable for the measurement of environmental noise in accordance with BS7445 *Description and Measurement of Environmental Noise.*

A summary of the climate over the two days has been shown in Appendix A.

4.0 RESULTS

4.1 Fixed Measurement Results

The following graph presents the background noise levels recorded over the measurement period at the fixed location (F). The complete set of measurement data is available on request.

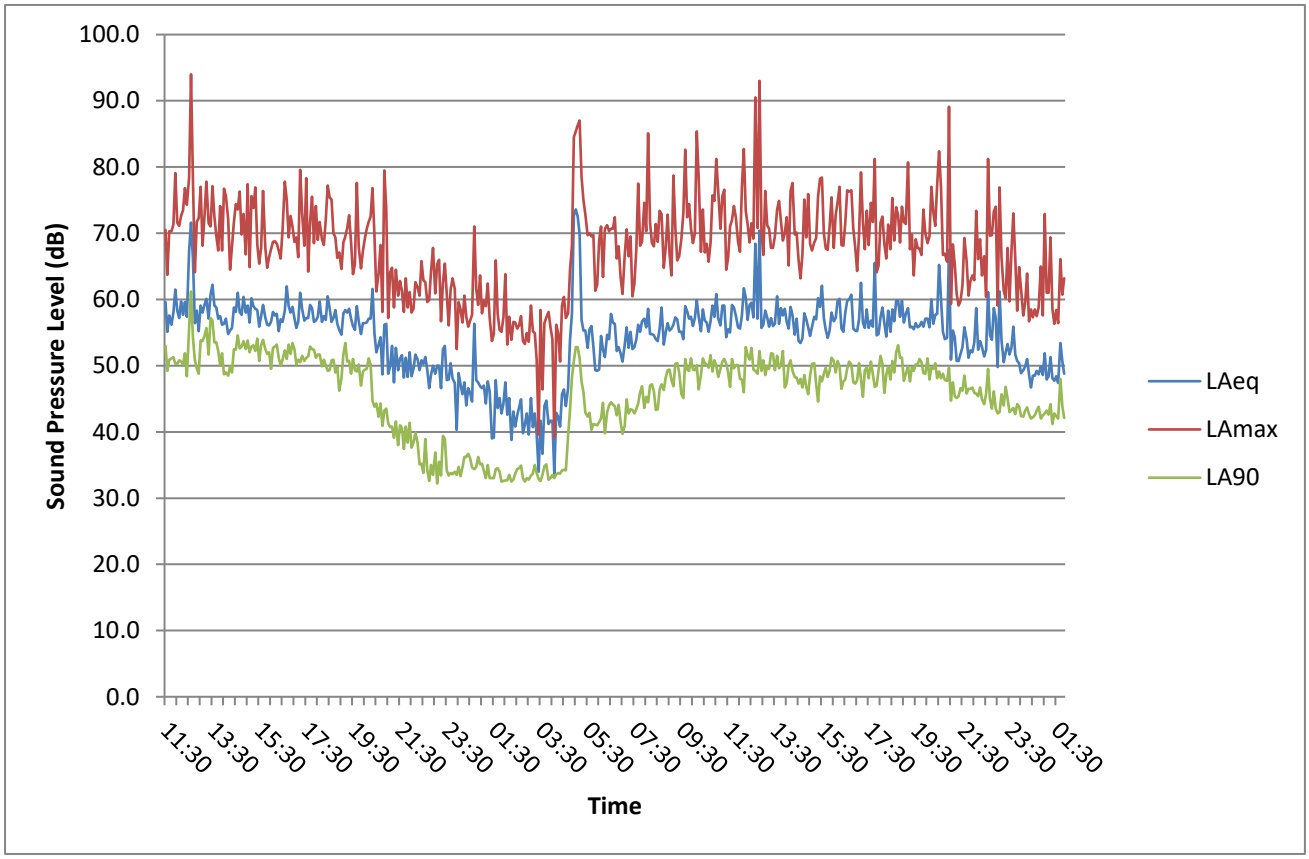

Figure 4.1: Shows the results of the noise assessment at position F1.

4.1.1 Summary of Fixed Location Measurements – Background Noise

BS4142: 2014 states that '*in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'* BS4142 further states that '*a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value'.* Hence BS4142 does not provide a black and white method of obtaining the assessment level for background noise.

For the purposes of assessment, MACH Acoustics have derived the modal L_{A90} occurring during the operational hours of the noise source. Table 4.1 provides the background noise levels which will form the basis of assessment.

Position	Time Period	L_{A90}, dB
F	Day (07:00 – 23:00)	50
F	Night (23:00-07:00)	33

Table 4.1: Assessment background noise levels.

5.0 PLANT NOISE ASSESSMENT

5.1 Specific Noise Source

The following noise levels have formed the basis of assessment. The levels are associated with the proposed noise source. The sound power levels of the air conditioning units have been taken from manufacturer data, this data has been provided by Daikin and is shown in Appendix B.

Source	Sound Power Level, dBA
RXYAQ5 (full power)	67
RXYAQ5 (night mode)	58

Table 5.1: Shows the sound power levels of a single air conditioning unit on full power, and in night mode.

5.2 BS 4142: 2014 Assessment

Table 5.3 provides the calculated rating level at the nearest noise sensitive receptor. The specific noise level has been established through calculation as provided in Appendix C. The nearest noise sensitive receptors are indicated in Figure 2.1 by the green and blue boxes.

Time Period	Receptor Location	Background Noise Level (L_{A90}, dB)	Specific Noise Level ($L_{Aeq\ 60\ min}$, dB)	Acoustic Feature Correction	Rating Level	Assessment Outcome
Day (07:00 – 23:00)	Garage of 113 Frognal	50	37	+0	37	-13
Night (23:00 – 07:00)	Garage of 113 Frognal	33	28	+0	28	-5
Day (07:00 – 23:00)	House of 113 Frognal	50	42	+0	42	-8
Night (23:00 – 07:00)	House of 113 Frognal	33	33	+0	33	-0

Table 5.3: Shows the outcome of the BS4142: 2014 assessment

As can been seen in Table 5.3, the rating level of the proposed noise source is 13 dB below the background level during the day at the garage of 113 Frognal.

As can been seen in Table 5.3, the rating level of the proposed noise source is 5 dB below the background level during the night at the garage of 113 Frognal.

As can been seen in Table 5.3, the rating level of the proposed noise source is 8 dB below the background level during the day at the house of 113 Frognal.

As can been seen in Table 5.3, the rating level of the proposed noise source is equal to the background level during the night at the garage of 113 Frognal. Therefore, the air conditioning units are compliant with BS4142:2014.

The Daikin air conditioning units have a "night mode" which, according to the manufacturer specifications, can reduce the sound power level of the unit by 9 dB, using step 3 (see Appendix B). This has been taken into account within the assessment. Therefore, it is essential that this is mode is activated between the hours of 23:00 and 07:00 for the air conditioning units to be compliant with BS4142:2014.

It should be noted that there is no direct line of sight from the air conditioning units to the nearest noise sensitive window on the garage of 113 Frognal. Therefore, 10 dB of attenuation has been added. This is generally considered to be a conservative estimate of the level attenuation due to no line of sight. Therefore, the assessment is a worst-case scenario, and robust.

6.0 CONCLUSION

MACH Testing has been appointed by Will Potter to undertake an environmental noise assessment for the proposed air conditioning units at 115 Frognal, London. Proposals are for four air conditioning units to be placed on the site.

As can been seen in Table 5.3, the rating level of the proposed noise source at the nearest noise sensitive receptors is below the background level in each case. Therefore, the air conditioning units are compliant with BS4142:2014.

So that the air conditioning units are compliant with BS4142:2014, it is essential that night mode is activated between the hours of 23:00 and 07:00.

APPENDIX A – Weather Overview

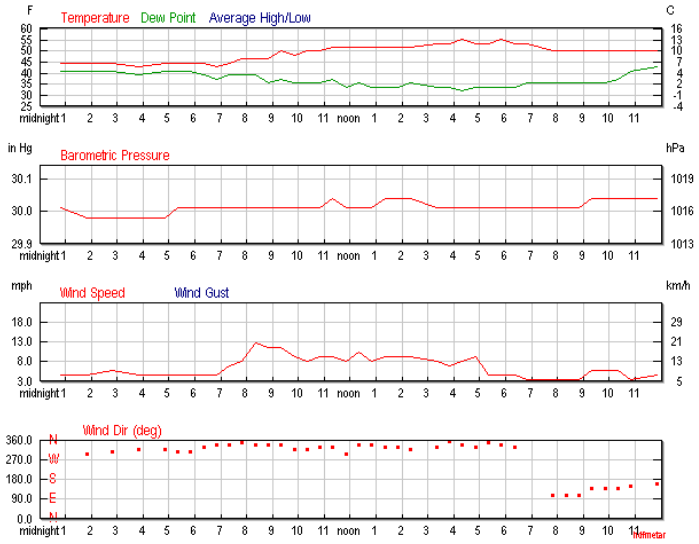

Figure 6.1: Shows the weather data for 28th April

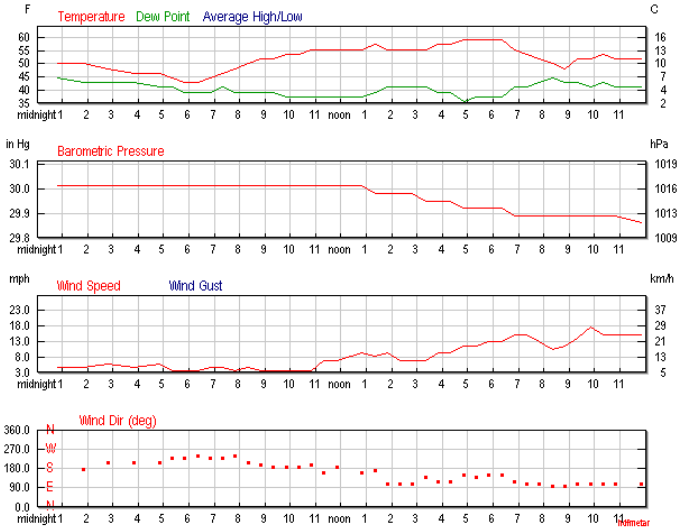

Figure 6.2: Shows the weather data for 29th April

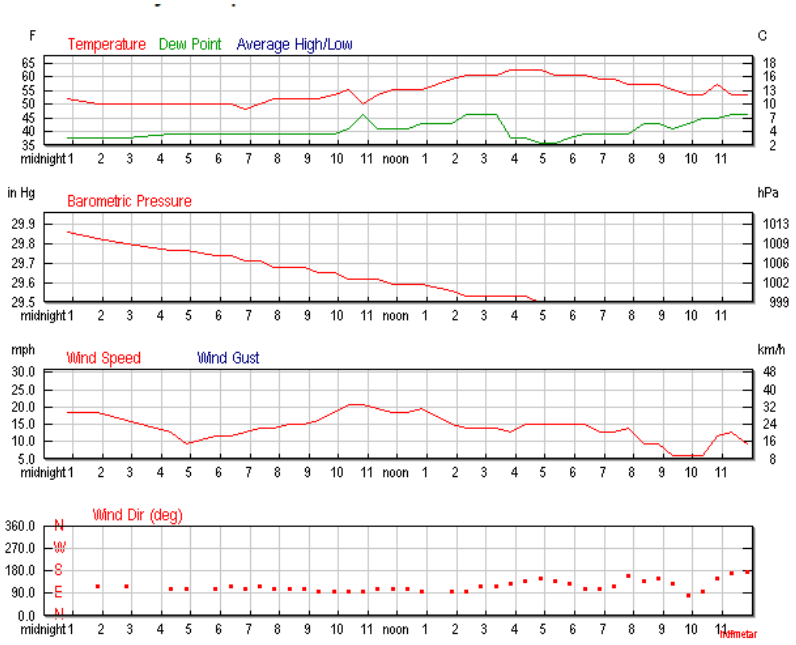

Figure 6.3: Shows the weather data for 30th April

APPENDIX C – Plant Data

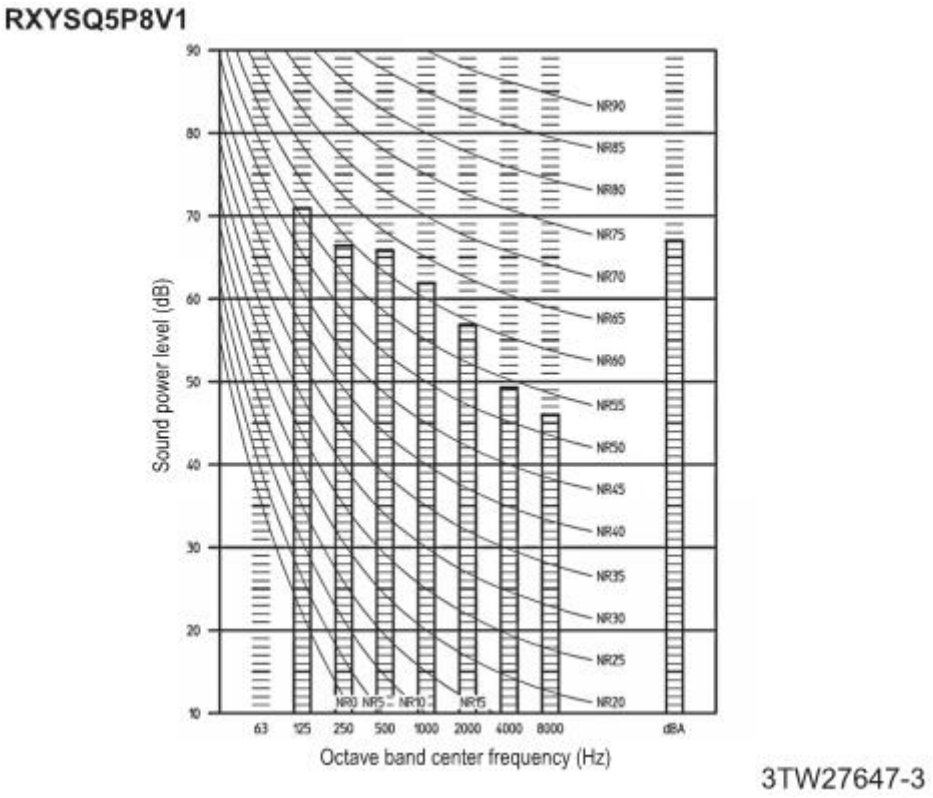

Figure 6.4: Shows the sound power level of one of the proposed air conditioning units.

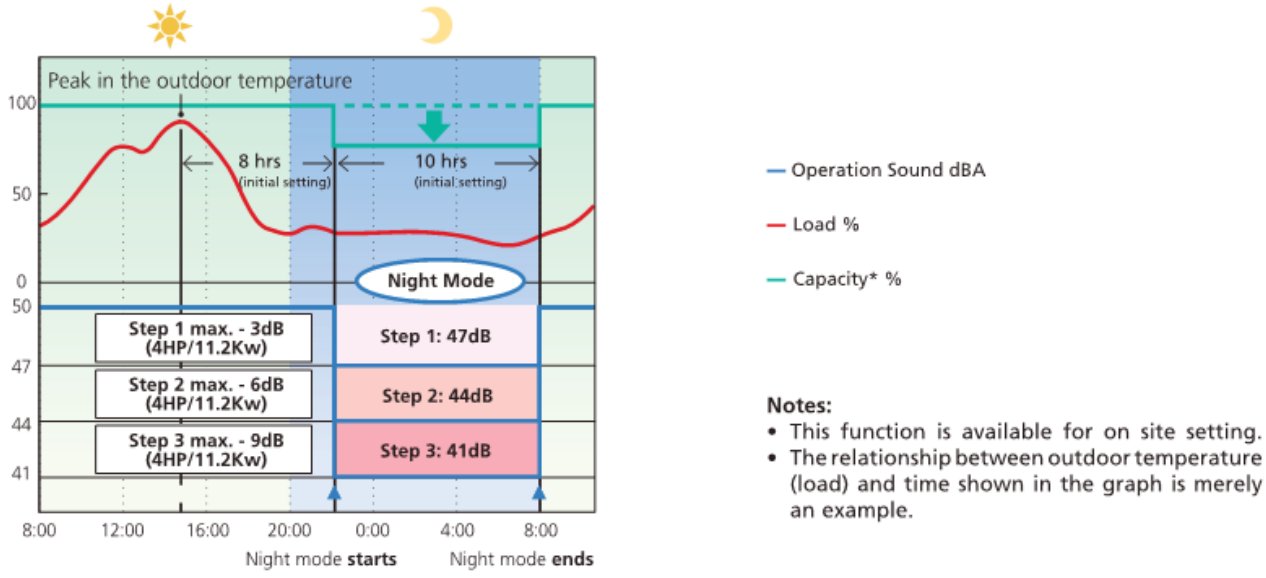

Figure 6.5: Shows the night mode specifications which can be used on each air conditioning unit.

APPENDIX D – Calculations

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
Measured SWL **RXYSQ5P8V1 Full Power**	71	66	65	63	57	49	67.1
Number of Units	4						
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*					
Distance (m)	8						
Attenuation	10	10	10	10	10	10	
SPL @ Distance	41	36	35	33	27	19	37

Figure 6.6: Shows the calculation of specific the noise level at nearest receiver, during the day (full power mode) to the garage of 113 Frognal.

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
Measured SWL **RXYSQ5P8V1 Night Mode**	62	57	56	54	48	40	58.1
Number of Units	4						
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*					
Distance (m)	8						
Attenuation due to no line of sight	10	10	10	10	10	10	
SPL @ Distance	32	27	26	24	18	10	28

Table 6.1: Shows the calculation of specific the noise level at nearest receiver, during the night (with night mode on) to the garage of 113 Frognal.

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
Measured SWL **RXYSQ5P8V1 Full Power**	71	66	65	63	57	49	67.1
Number of Units	4						
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*					
Distance (m)	15						
Attenuation	0	0	0	0	0	0	
SPL @ Distance	46	41	40	38	32	24	42

Figure 6.7: Shows the calculation of specific the noise level at nearest receiver, during the day (full power mode) to the house of 113 Frognal.

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
Measured SWL **RXYSQ5P8V1 Night Mode**	62	57	56	54	48	40	58.1
Number of Units	4						
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*					
Distance (m)	15						
Attenuation	0	0	0	0	0	0	
SPL @ Distance	37	32	31	29	23	15	33

Table 6.2: Shows the calculation of specific the noise level at nearest receiver, during the night (with night mode on) to the house of 113 Frognal.

APPENDIX B – BS4142 Criteria

BS 4142:2014 "Methods for rating and assessing industrial and commercial sound" describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level.

BS 4142 states that one should *'obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:*

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

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if *'a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.* To summarise, BS4142 section 9.2 advises the following in regards to corrections for acoustic characteristics:

- 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 converted to 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 +9 dB 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 converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*
- Other sound characteristics – *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against 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.*