

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Nightingale Centre Extension, Wythenshawe Hospital

Noise survey and plant noise egress limits

London, Manchester, Edinburgh, Birmingham, Belfast, Stevenage

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Summary

Sandy Brown has been commissioned by AFL Architects to provide acoustic advice in relation to the proposed two storey extension to the existing Nightingale Centre, Wythenshawe Hospital.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 15:30 on 6 December 2019 and 15:45 on 9 December 2019.

The representative background sound levels measured during the survey were $L_{A90,15\text{ min}}$ 50 dB during the daytime and $L_{A90,15\text{ min}}$ 44 dB at night.

Based on the requirements of the Manchester City Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15\text{ min}}$ 45 dB during the daytime, and $L_{Aeq,15\text{ min}}$ 39 dB during the night. These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set.

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1 Introduction

Sandy Brown has been commissioned by AFL Architects to provide acoustic advice in relation to the proposed two storey extension to the existing Nightingale Centre, Wythenshawe Hospital.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and to set appropriate limits for noise egress from building services plant.

This report presents the survey method and results, and a discussion of acceptable limits for noise emissions from building services plant.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1.

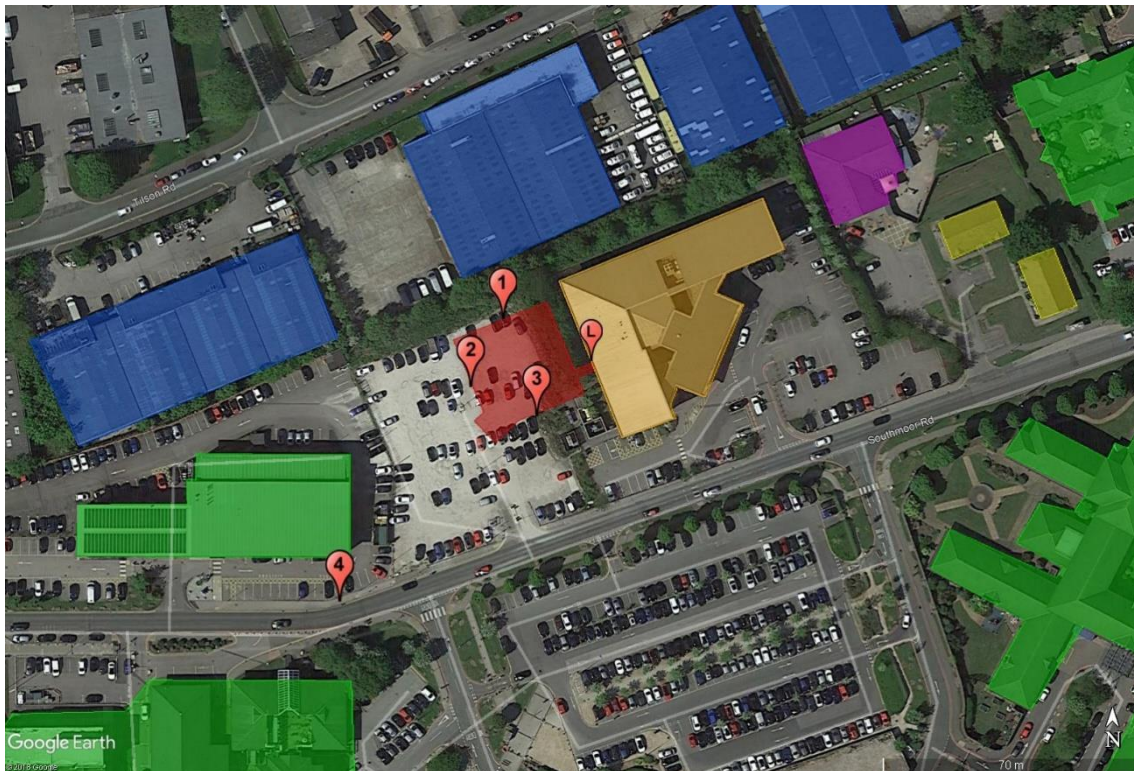


Figure 1 Aerial view of site (courtesy of Google Earth Pro)

The site itself is highlighted in red and is proposed to form an extension to the Nightingale Centre highlighted in orange. The site is located off Southmoor Road, Wythenshawe which runs to the south. Tilson Road runs to the north with other internal hospital roads to the south.

2.2 Adjacent premises

The surrounding premises is mostly commercial with the site being part of Wythenshawe Hospital. Nearby hospital buildings are highlighted in green in Figure 1. To the north of the site are offices and industrial units located on Tilson Road, highlighted in blue in Figure 1. To the north west of the site highlighted in pink is a nurse's, Kids Allowed. Also to the north west are two buildings highlighted in yellow which are understood not to be residential, however the use is unknown.

3 Development proposals

The development proposed is a two storey extension to the existing Nightingale Centre. It will comprise of mainly consulting and examination rooms on the ground floor with a plant room to the north of the building and office/seminar type spaces on the first floor. The extension will be joined to the existing building via a link bridge at both ground and first floor level.

Due to the uses of the building, it is assumed that it will operate during normal working hours and not during the night time.

Screenshots of the proposed development from AFL Architects are provided in Figure 2 and Figure 3 for reference.

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Figure 2 Excerpt of proposed ground floor layout drawing 193153-AFL-00-XX-SK-A-30003



Figure 3 Excerpt of proposed first floor layout drawing 193153-AFL-00-XX-SK-A-30004

4 Noise survey method

The survey included unattended and attended noise measurements.

4.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 4 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods between 6 December 2019 and 9 December 2019. The equipment was installed and collected by Kane Mitchell.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 4. This location was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.

The logging location was 1 m from the facade of the building and as such can be considered to be a facade level. It was protruding out of a first floor window approximately 5.5 m above ground level.



Figure 4 Photograph of noise monitoring location, facade measurement

4.2 Attended measurements

Attended sample measurements were taken by Kane Mitchell at 4 locations around the site. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out on 9 December 2019, over 5 minute periods.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 3.5 m from any other reflective surface. Photographs of the attended measurement locations are presented in Figure 5. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.



Figure 5 Photographs of attended locations 1-4, free field measurements (L-R)

4.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

5 Noise survey results

5.1 Observations

The dominant noise source observed at the site during the survey was road traffic noise from vehicles passing along Southmoor Road.

Less significant noise sources included intermittent noise from the industrial units to the north of the site, air traffic and pedestrians.

5.2 Noise measurement results

5.2.1 Unattended measurement results

A graph showing the results of the unattended measurements is provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 1.

Table 1 Ambient noise levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 6 Dec 2019	56 ^[1]	51
Saturday 7 Dec 2019	56	53
Sunday 8 Dec 2019	56	52
Monday 9 Dec 2019	55 ^[1]	-
Average	56	52

^[1] Measurement not made over full period due to monitoring start and end time (the measurement on 6 December 2019 was over 8 hours, and on 9 December 2019 over 15 hours); not included in the average.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 6 and Figure 7.

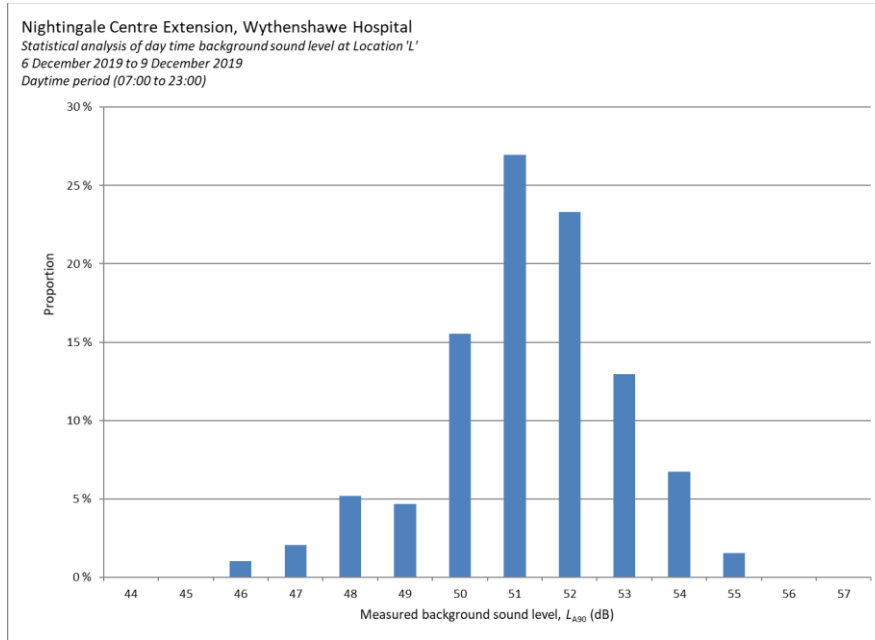


Figure 6 Statistical analysis of daytime background sound levels at Location 'L'

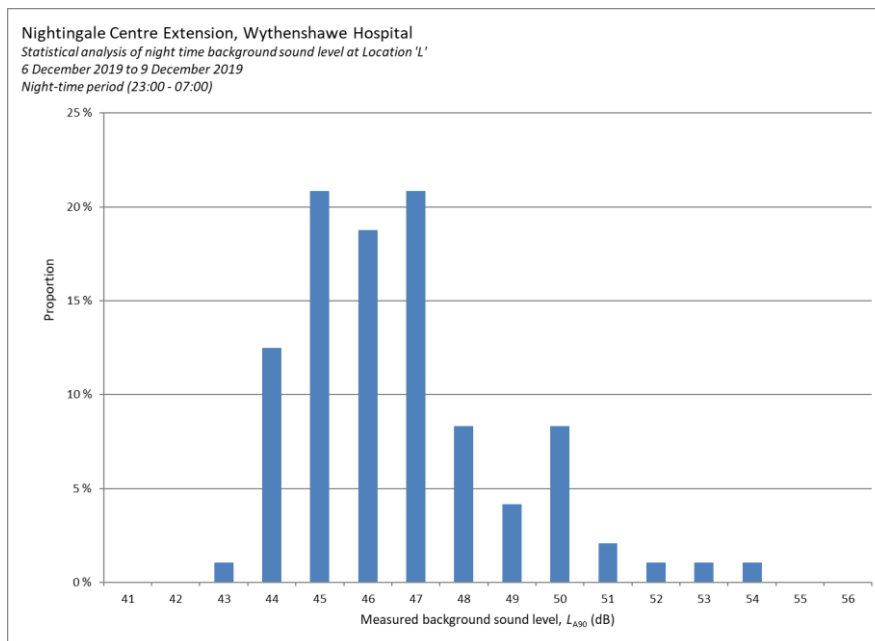


Figure 7 Statistical analysis of night time background sound levels at Location 'L'

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

5.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 2. All measurements can be considered free field.

Table 2 Noise levels and key noise sources from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	13:30	50	69	48	Traffic along Southmoor Road, vehicles within Hospital car park and intermittent noise from industrial units to the north
1	13:35	53	75	48	As above
1	13:40	50	63	47	As above
1	14:45	51	69	48	As above
1	14:50	51	69	48	As above
1	14:55	49	60	47	As above
2	13:45	52	70	48	Traffic along Southmoor Road, vehicles within Hospital car park and intermittent noise from industrial units to the north
2	13:50	52	70	48	As above
2	13:55	51	72	48	As above
2	15:00	52	69	50	As above
2	15:05	53	72	49	As above
2	15:10	55	73	49	As above
3	14:00	51	71	48	Traffic along Southmoor Road and vehicles within Hospital car park
3	14:05	53	71	49	As above

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
3	14:10	53	73	49	As above
3	15:15	51	65	48	As above
3	15:20	51	63	49	As above
3	15:25	57	80	49	As above
4	14:15	67	83	56	Constant traffic along Southmoor road
4	14:20	66	82	58	As above
4	14:25	68	83	58	As above
4	15:30	68	81	52	As above
4	15:35	69	84	56	As above
4	15:40	68	80	53	As above

6 Building services noise egress limits

6.1 Standard guidance

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

6.2 Local Authority criteria

Manchester City Council (MCC) typically states for plant noise limits that limits should be set 5 dB (L_{Aeq}) below the existing background noise level (L_{A90}) in accordance with BS 4142:2014 methodology.

6.3 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 3.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. In this case these limits would apply at the following locations:

- Other hospital buildings
- Office units located on Tilson Road
- Nursery, Kids Allowed
- Other nearby noise sensitive buildings.

Table 3 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	45
Night-time (23:00-07:00)	39

^[1] The limits set out in Table 3 do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses. This is discussed in Appendix C.

6.4 Assessment

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features. At this stage, no information is available in relation to the proposed plant. This will need to be assessed as the design progresses.

7 Conclusion

The representative background sound levels from the noise survey were $L_{A90,15min}$ 50 dB during the day, and $L_{A90,15min}$ 44 dB during the night.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises are L_{Aeq} 45 dB during the day, and L_{Aeq} 39 dB during the night.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied.

Appendix A

Survey details

Equipment

The unattended and attended noise measurements were taken using a Rion NL-52 sound level meter and a B&K Type 2250 sound level meter, respectively.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
<i>B&K Type 2250</i>				
Sound level meter	2250/3011964	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Microphone	4189/3100176	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Pre-amp	ZC0032/26376	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Calibrator	4231/3019123	Brüel & Kjær	3 Sep 21	UCRT19/1969
<i>NL-52C</i>				
Sound level meter	NL-52/00932326	Rion	13 Mar 21	TCRT19/1179
Microphone	UC-59/05549	Rion	13 Mar 21	TCRT19/1179
Pre-amp	NH-25/32354	Rion	13 Mar 21	TCRT19/1179
Calibrator	NC-74/34125432	Rion	13 Mar 21	TCRT19/1178

^[1] Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

Weather conditions

During the attended noise measurements, the weather was generally clear and dry and no rain occurred. Wind speeds were measured at each position and varied between 0 m/s and 5 m/s.

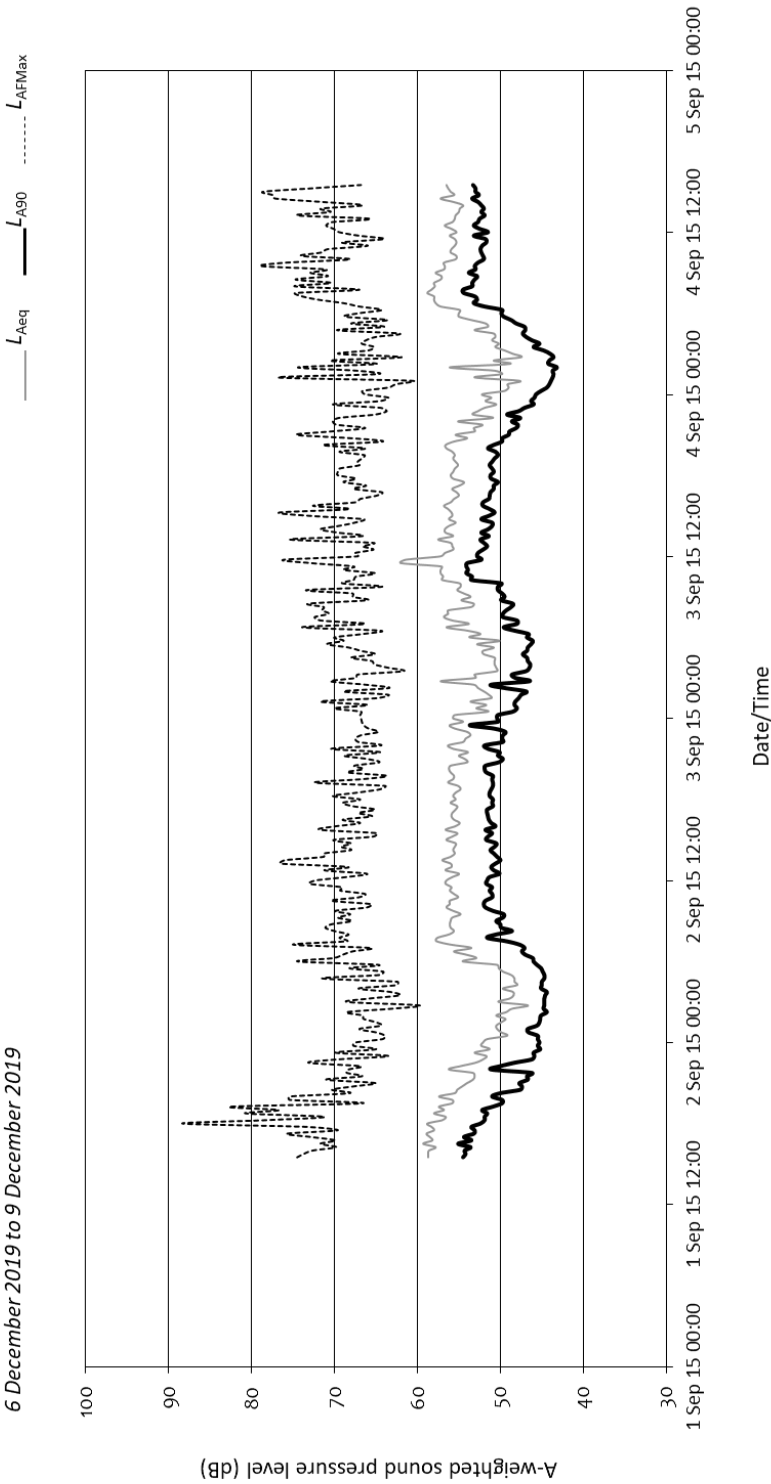
During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 6°C at night and 12°C during the day, and the wind speed was less than 5 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location L

Nightingale Centre Extension, Wythenshawe Hospital
Results of noise logging survey at Location 'L'
6 December 2019 to 9 December 2019



Appendix C

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.