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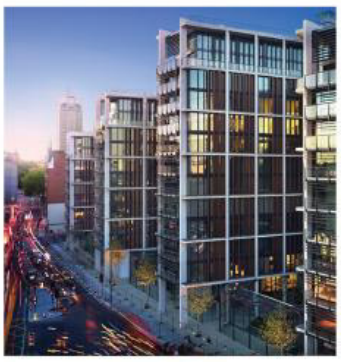

REPORT AS9808.170725.NIA1.1

FORTESS GROVE
28-34 FORTESS ROAD
LONDON

NOISE IMPACT ASSESSMENT

Prepared: 20 October 2017

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1.0 INTRODUCTION

Planning approval is being sought for the installation of new plant at Fortess Grove, 28-34 Fortess Road, London.

Clarke Saunders Associates has been commissioned by WPP on behalf of Fortess 2016 Limited to undertake an environmental noise survey in order to measure the prevailing background noise climate at the site.

The background noise levels measured will be used to determine daytime and night-time noise emission limits and, subsequently, to assess the noise impact of proposed building services plant, in accordance with the planning requirements of Camden Council.

2.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at 1st floor level of the existing building at the location shown in site plan AS9808/SP1. A suitable monitoring location was not available on the eastern elevation of the building. The inspection of the site and relative proximity of dominant noise sources suggest that the lowest night-time background noise levels at the monitoring position would be consistent with those in Railey Mews to the east of the proposed plant area.

Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 15:00 hours on Tuesday 13th June and 12:00 hours on Thursday 17th June 2017.

These measurements will allow suitable noise criteria to be set for the new building services plant, dependent on hours of operation.

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

- Rion data logging sound level meter type NA28;
- Rion sound level calibrator type NC-74.

The calibration of the sound level meter was verified before and after use. No significant calibration drift was detected.

The weather during the survey was dry with light winds, which made the conditions suitable for the measurement of environmental noise.

Measurements were made following procedures in BS 7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2- Acquisition of data pertinent to land use*.

Please refer to Appendix A for details of the acoustic terminology used throughout this report.

3.0 RESULTS & ANALYSIS

Figures AS9808/TH1-TH2 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position.

The background noise climate at the property is determined by road traffic noise in the surrounding streets.

Measured minimum background and average noise levels are shown in Table 3.1 below.

Monitoring period	Minimum $L_{A90,5mins}$
07:00 - 23:00 hours	40 dB 15/06/2017 07:55
23:00 - 07:00 hours	31 dB 15/06/2017 03:25
24 hours	31 dB

Table 3.1 - Minimum measured background and average noise levels **[dB ref. 20µPa]**

Measured spectral noise levels for these periods are shown in Table 4.2 below.

Freq (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime L_{A90}	53	46	39	37	35	29	24	16
Night time L_{A90}	43	37	33	29	26	20	13	12

Table 3.2 – Minimum L_{90} linear spectral levels **[dB ref. 20µPa]**

4.0 DESIGN CRITERIA

4.1 Local Authority Requirements

Camden Council typically requires new plant to be 5dB below the background level. In addition, the background level must not be exceeded by more than 1dB in any octave band between 63Hz and 8kHz[1].

[1] NB The Camden Local Plan was adopted 3/7/17. This appears to suggest at 'Appendix 3: Noise Thresholds' that a BS4142:2014 *Rating Level* 10dB below background is required, with a more onerous criterion required for situations where plant may have tonal content.

Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the L_{A90}, expressed in dB(A).

Cooling plant is not expected to have any of these characteristics at the noise sensitive receptor and on this basis, the plant noise emissions criteria that should not be exceeded at the nearest noise sensitive receiver should be set to the proposed levels detailed in Table 4.1 and Table 4.2.

Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)	24 hours
L_{Aeq} 35 dB	L_{Aeq} 26 dB	L_{Aeq} 26 dB

Table 4.1 - Proposed design noise criteria **[dB ref. 20µPa]**

Freq (Hz)	63	125	250	500	1k	2k	4k	8k
24-hour spectral Criterion	44	38	34	30	27	21	14	13

Table 4.2 - Spectral design criterion **[dB ref. 20µPa]**

4.2 BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

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

The relevant sections of this standard are shown in the following table:

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

Table 4.3 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

5.0 PREDICTED NOISE IMPACT

5.1 Proposed plant

The selected plant has been confirmed as:

- 14 no. Daikin Condensing Units Type RXYSQ4TV1
- 5 no. Daikin Condensing Units Type 20HP Single (REYQ20T)
- 1 no. Daikin Condensing Units Type 32HP Multi (REYQ16T / REYQ16T)
- 1 no. Daikin Condensing Units Type 34HP Multi (REYQ16T / REYQ18T)
- 1 no. Daikin Condensing Units Type 36HP Multi (REYQ16T / REYQ20T)

The approximate location of the plant to be installed is shown in site plan AS9808/SP1. The plant has been arranged in order to minimise noise impact on nearby noise sensitive-receptors.

Noise levels generated by the type REYQ16T condenser to be installed have been confirmed by the manufacturer as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
Lp @ 1m (dB)	69	67	66	62	57	53	47	42	64

Table 5.1 - Source noise data for the type REYQ16T condenser **[dB ref. 20µPa]**

Noise levels generated by the type REYQ18T condenser to be installed have been confirmed by the manufacturer as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
Lp @ 1m (dB)	66	65	67	64	59	55	50	44	65

Table 5.2 - Source noise data for the type REYQ18T condenser **[dB ref. 20µPa]**

Noise levels generated by the type REYQ20T condenser to be installed have been confirmed by the manufacturer as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
Lp @ 1m (dB)	65	65	66	65	60	56	52	45	66

Table 5.3 - Source noise data for the type REYQ20T condenser **[dB ref. 20µPa]**

Noise levels generated by the type RXYSQ4TV1 condenser to be installed have been confirmed by the manufacturer as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
Lp @ 1m (dB)	59	52	51	49	45	38	31	23	50

Table 5.4 - Source noise data for the type RXYSQ4TV1 condenser **[dB ref. 20µPa]**

5.2 Predicted noise levels

Following an inspection of the site, the nearest noise sensitive receiver is situated on Railey Mews at 2nd floor level, as shown on the indicative site plan AS9808/SP1. This window is at least 6 metres away from the proposed plant location.

The cumulative noise level at the nearest noise sensitive receiver has been assessed using the noise data above. Screening losses afforded by the parapet upstand which surrounds the plant area have been included in the prediction of the cumulative plant noise level at the nearest receiver. The plant will be located behind a new acoustically rated louvre over the top of the plan enclosure.

The insertion losses for the Proposed Caice CS600 louvre used in the calculations are as follows;

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Insertion (Caice CS600)	6	8	13	23	38	32	32	32

Table 5.5 - Insertion Losses of Louvred Enclosure **[dB ref. 20 µPa]**

The cumulative plant noise level predictions, shown against the corresponding spectral and overall design criteria are shown in Table 5.6 below.

Freq (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Criterion	44	38	34	30	27	21	14	13	26
Predicted level at 1m from receiver	41	35	28	14	0	0	0	0	23

Table 5.6 - Predicted noise level and criteria at nearest noise sensitive location **[dB ref. 20 µPa]**

The assessment shows that cumulative plant noise emissions would comply with the requirements of Camden Council[2].

A summary of the calculations is shown in Appendix B.

Any other air handling and extract plant will be fitted with acoustically specified splitter silencers in order that the cumulative noise level does not exceed the 24-hour design noise criterion.

[2] With the mitigation measures in place, compliance is achieved relatively comfortably, and the more onerous BS4142 rating level objective intimated in the new Camden Local Plan would also be achieved.

5.3 Comparison to BS8233:2014 Criteria

Depending on window type, and frequency content/orientation of incident sound, Appendix G.2.1 of BS8233:2014 indicates that a loss of approximately 15dB is appropriate for external noise ingressing through a partially open window.

Even disregarding any such loss, the overall predicted level shown in Table 6.6 indicates that internal noise levels due to ingressing plant noise would be significantly lower than the level recommended in Table 4.3 for sleeping in bedrooms at night.

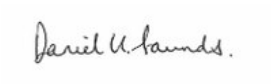
6.0 CONCLUSION

An environmental noise survey has been undertaken at Fortess Grove, 28-34 Fortess Road, London by Clarke Saunders Associates between Tuesday 13th June and Thursday 17th June 2017.

Measurements have been made to establish the current background noise climate. This has enabled a 24-hour design criterion to be set for the control of plant noise emissions to noise sensitive properties, in accordance with Camden Council's requirements.

Data for the new Daikin condensing units have been used to predict the noise impact of the new plant on neighbouring residential properties, both in spectral terms and in overall dB(A).

Compliance with the noise emission design criterion has been demonstrated including insertion losses provided by a proprietary acoustically louvred enclosure. No further mitigation measures are required for control of external plant noise emissions.



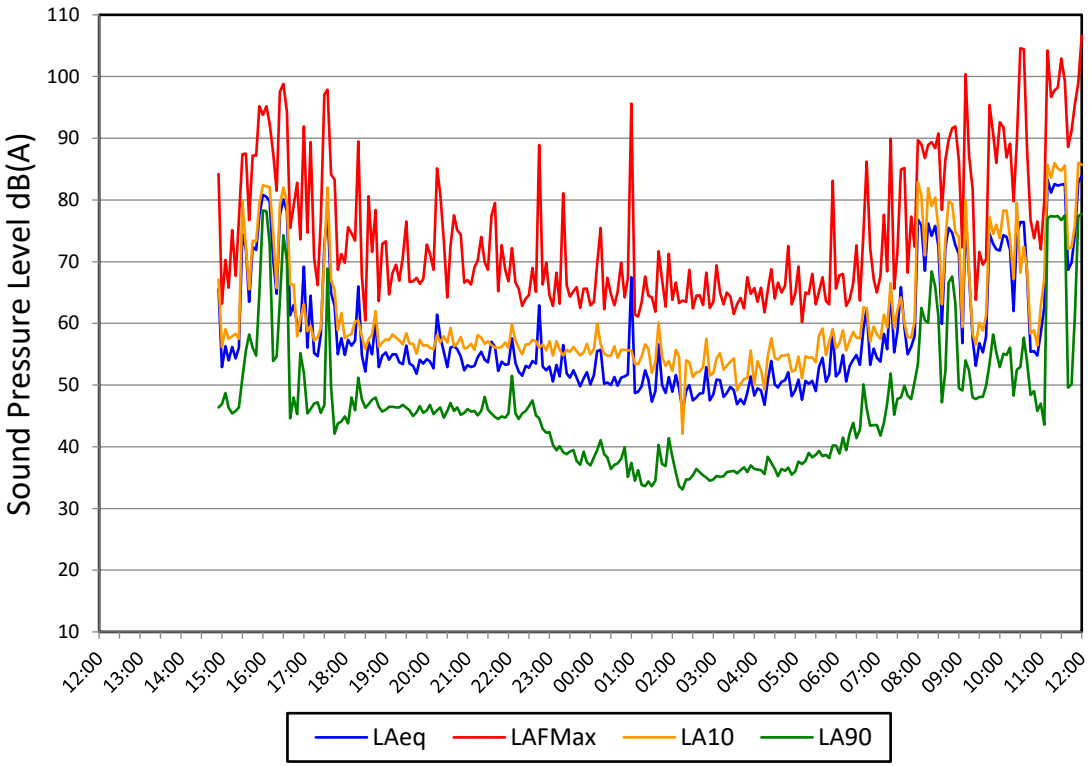
Daniel Saunders MIOA

CLARKE SAUNDERS ASSOCIATES

Figure AS9808/SP1

Fortess Grove, 28-34 Fortess Road, London

Environmental Noise Time History: Inner Courtyard

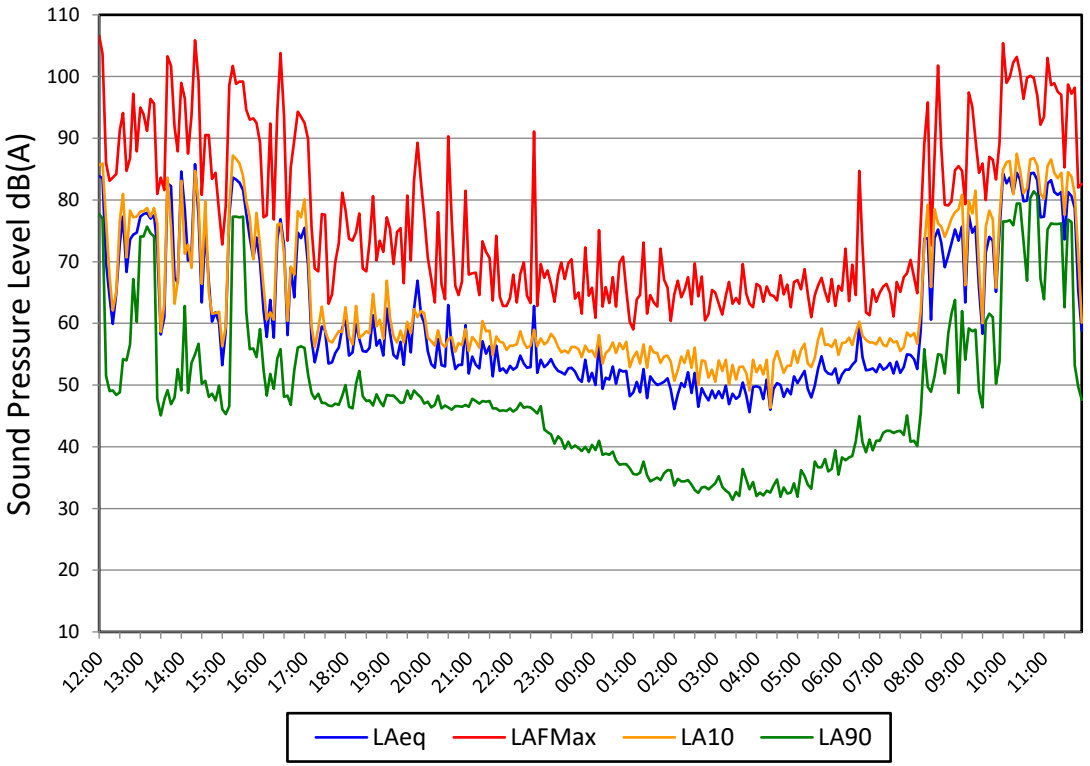


Tuesday 13 June to Wednesday 14 June 2017

Figure AS9808/TH1

Fortess Grove, 28-34 Fortess Road, London

Environmental Noise Time History: Inner Courtyard



Wednesday 14 June to Thursday 15 June 2017

Figure AS9808/TH2

APPENDIX A

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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.
L_{eq} :	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). 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.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

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

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.

INTERPRETATION

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

APPENDIX B
AS9808 - Fortess Grove, 28-34 Fortess Road, London
Noise Impact Assessment

To Railey Mews

REYQ16T	Group E	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	69	67	66	62	57	53	47	42	**64**
Number of Plant	4	6	6	6	6	6	6	6	6	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 10m	-20	-20	-20	-20	-20	-20	-20	-20	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-8	-10	-13	-15	-18	-18	-18	-18	
Level at receiver		**38**	**32**	**24**	**7**	**-16**	**-14**	**-20**	**-25**	**19**

REYQ18T	Group E	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	66	65	67	64	59	55	50	44	**65**
Number of Plant	1	0	0	0	0	0	0	0	0	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 10m	-20	-20	-20	-20	-20	-20	-20	-20	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-8	-10	-12	-15	-18	-18	-18	-18	
Level at receiver		**29**	**24**	**19**	**3**	**-20**	**-18**	**-23**	**-29**	**13**

REYQ20T	Group D / E	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	65	65	66	65	60	56	52	45	**66**
Number of Plant	6	8	8	8	8	8	8	8	8	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 10m	-20	-20	-20	-20	-20	-20	-20	-20	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-8	-10	-12	-15	-18	-18	-18	-18	
Level at receiver		**35**	**31**	**25**	**12**	**-11**	**-9**	**-13**	**-20**	**20**

RXYSQ4TV1	Group A	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	59	52	51	49	45	38	31	23	**50**
Number of Plant	6	8	8	8	8	8	8	8	8	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 8m	-18	-18	-18	-18	-18	-18	-18	-18	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-9	-11	-14	-16	-18	-18	-18	-18	
Level at receiver		**30**	**19**	**11**	**-4**	**-24**	**-25**	**-32**	**-40**	**8**

RXYSQ4TV1	Group B	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	59	52	51	49	45	38	31	23	**50**
Number of Plant	6	8	8	8	8	8	8	8	8	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 6m	-16	-16	-16	-16	-16	-16	-16	-16	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-10	-13	-15	-18	-18	-18	-18	-18	
Level at receiver		**31**	**19**	**11**	**-3**	**-22**	**-23**	**-30**	**-38**	**8**

RXYSQ4TV1	Group C	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Level measured	Lp @ 1m	59	52	51	49	45	38	31	23	**50**
Number of Plant	2	3	3	3	3	3	3	3	3	
Night time duty setback		-3	-3	-3	-3	-3	-3	-3	-3	
Distance Loss	To 11m	-21	-21	-21	-21	-21	-21	-21	-21	
Louvre Insertion Loss		-6	-8	-13	-23	-38	-32	-32	-32	
Screening loss		-8	-10	-12	-15	-18	-18	-18	-18	
Level at receiver		**24**	**13**	**5**	**-10**	**-31**	**-33**	**-40**	**-48**	**2**

Specific Noise Level	**$L_{eq\ 15min}$**	**41**	**35**	**28**	**14**	**-9**	**-7**	**-12**	**-18**	**23**

** Screening loss limited to 18dB*

Night Time Design Criterion **26 dB(A)**