Acoustic assessment of proposed new mechanical services equipment

18 Lendal Street, York

Client: Giggling Squid

Report Reference: 231210-R001

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CONTENTS

0. SUMMARY

0.1. ACA Acoustics Limited has been commissioned to assess the acoustic impact of proposed new mechanical services equipment associated with a new restaurant to be installed at 18 Lendal Street, York.

0.2. The assessment is required to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby noise-sensitive properties and complies with the Local Authority's requirements.

0.3. A survey has been carried out in the vicinity to establish existing background sound levels. The background sound levels during the most sensitive time of the proposed operating hours are LA90 54dB to the front overlooking the nearest noise sensitive receptor. Background sound levels overnight are LA90 37dB. Based on the York City Council's criteria, noise from the new plant should not exceed a rating level 5dB below the measured background sound level outside the closest noise-sensitive windows.

0.4. The most noise-sensitive residential receptor (NSR) has been assessed as top floor windows of The Judges Lodging on Lendal Street to the front of the development.

0.5. Calculations using manufacturer's sound level data for the new equipment, allowing for the recommendations as set out in this report, confirm that the sound level from the new equipment at the receptor is LAr 38dB during the daytime and LAr 21dB overnight at the receptor.

0.6. Noise from the proposed equipment will not be disturbing or detrimental to the amenity of any nearby residential or other noise-sensitive receptors and complies with the planning requirements of York City Council.

1. INTRODUCTION

New mechanical services equipment associated with a proposed Giggling Squid restaurant is to be installed at 18 Lendal Street, York.

ACA Acoustics Limited has been commissioned by Giggling Squid to carry out an assessment of noise emissions from the proposed mechanical plant and, where necessary, to make recommendations for a mitigation scheme to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the sound level survey, computer modelling, and assessment.

2. ACOUSTIC CRITERIA

2.1. York City Council

Based on similar developments in the city, ACA Acoustics Limited understands that York City Council typically require the rated plant sound level to not exceed a level 5dB below the background LA90 at the closest noise-sensitive receptor, when assessed in accordance with BS 4142:2014+A1:2019.

York City Council's criterion is somewhat more stringent than required by the standard to ensure low impact. Therefore, even further protection of amenity will be ensured.

2.2. BS 4142:2014+A1:2019

The current version of the standard is BS 4142:2014+A1:2019, and the scope advises that "*this British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature … to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*". BS 4142:2014+A1:2019 is commonly used to assess the potential for loss of amenity due to noise from mechanical services equipment and is considered appropriate for this application.

The assessment method of BS 4142:2014+A1:2019 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more intrusive to obtain a rating level. This rating level is compared against the prevailing background noise outside the noise-sensitive property. Section 11 of BS 4142:2014+A1:2019 provides a commentary of the assessment result and advises that:

a) The greater the difference between the rating level and the background sound level, the greater the magnitude of the impact.
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is 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.

York City's requirement to design the rating level of the new plant to be at least 5dBA below the background sound level is more stringent than the requirements of the Standard and will therefore ensure a good standard of amenity for nearby residents.

3. REVIEW OF SITE LOCATION

New mechanical equipment, comprising of new supply and extract fans, and catering and air conditioning condensers, are being installed at flat roof level of the proposed restaurant at 18 Lendal Street, York.

The most noise-sensitive residential receptor (NSR) has been assessed as the top floor residential windows of The Judges Lodging to the north. There are no identifiable residential windows to the rear façade in the vicinity of the development site.

A marked-up aerial image is included in Figure 1, identifying the location of the proposed equipment and sound level survey measurement positions.

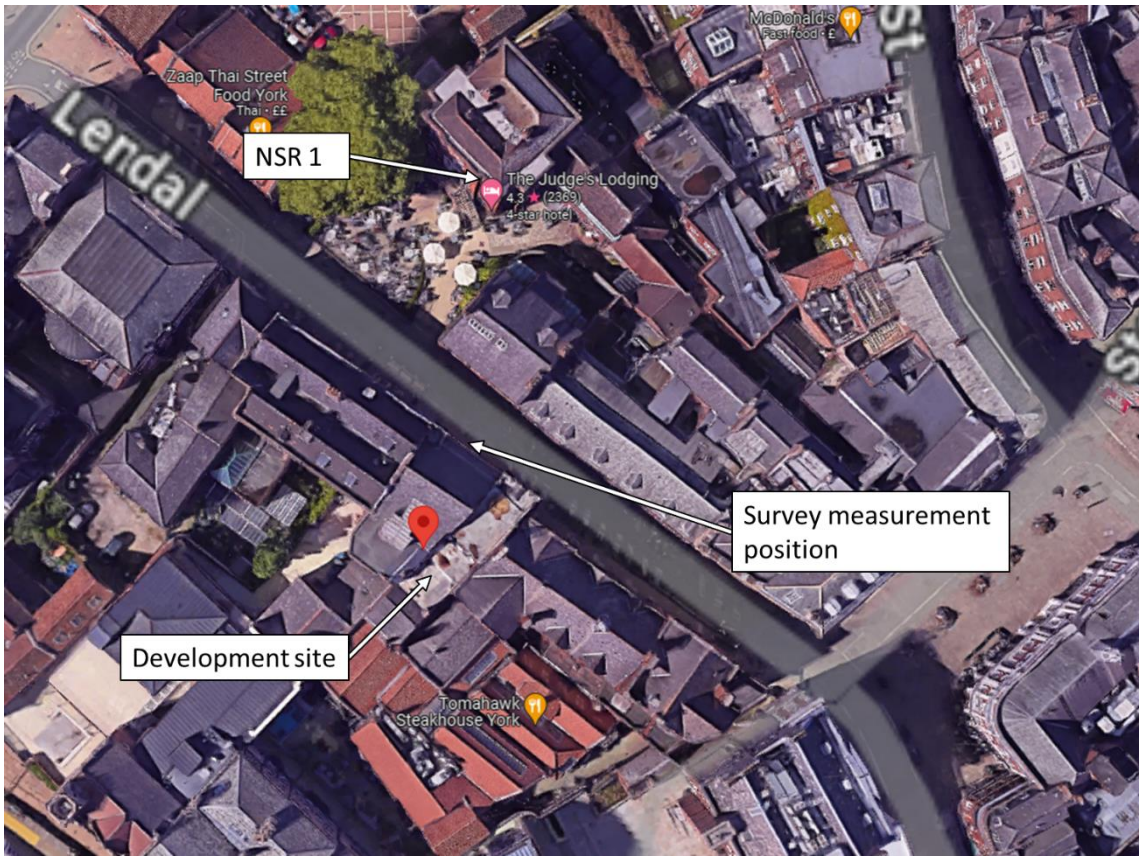


Figure 1: Measurement position and closest receptor (available at google.com/maps)

Proposed operating times of the equipment are to 23:00 hours, and the catering condensers will operate over a potential 24-hour period.

4. SOUND LEVEL SURVEY

To assess sound levels from the new mechanical equipment, it is necessary to establish representative background sound levels in the vicinity during the proposed plant operating times.

An unmanned sound level survey was undertaken to the front facade of the development site between the 10th to the 11th January 2024.

During the survey, the soundscape to the front façade was influenced predominantly by traffic on nearby roads, pedestrian activity, and nearby mechanical plant noise. To the rear mechanical plant serving a nearby restaurant was significantly dominant over the full survey period. The existing condensers to the rear of the site were not operating at the time of the survey.

The following equipment was used during the survey. An on-site calibration check was conducted on the sound level meter prior to the survey and repeated after with no deviation noted.

Equipment	Serial Number
Rion NL-42 sound level meter, complete with weatherproof outdoor environmental kit	320635
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003	122245

Table 1: Equipment used for the sound level survey

Weather conditions at the time of the survey were cold with partial cloud cover and calm wind conditions. Meteorological conditions are considered acceptable and will not have adversely impacted the survey results.

Results of the survey are shown in graphical form in Figure 2 below.

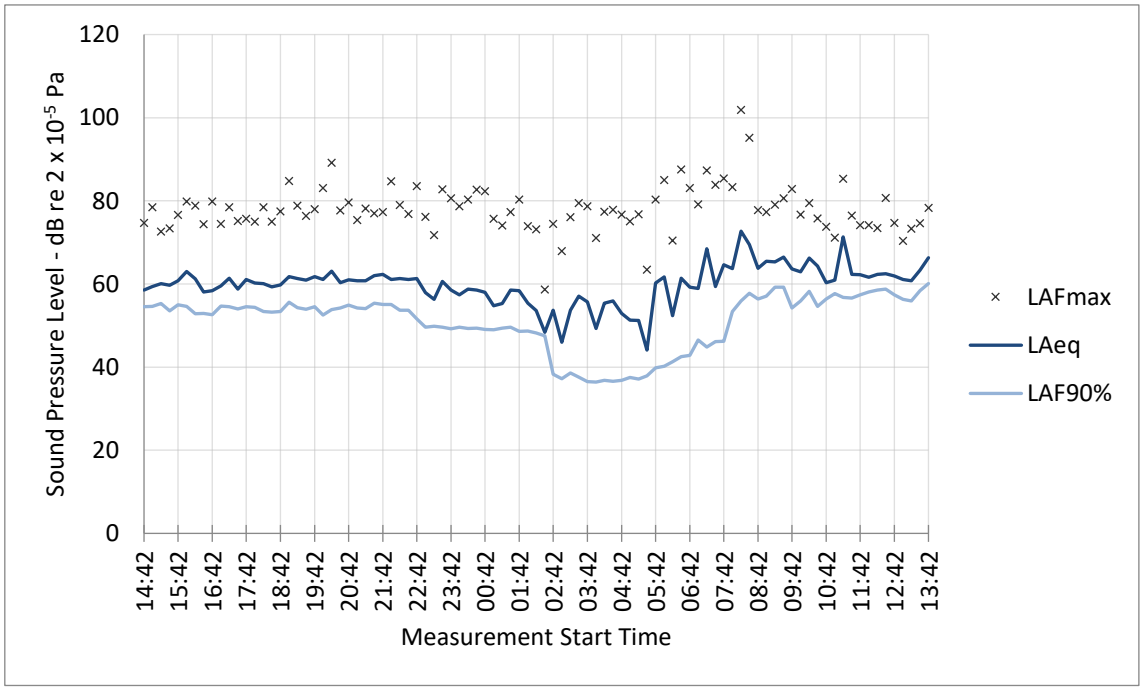


Figure 2: Sound level survey results overlooking front façade

In accordance with the methodology set out in BS 4142:2014+A1:2019, the background sound level is not necessarily the lowest recorded value. Instead, the background sound level should be a level which is representative of the underlying soundscape at the receptor location. A histogram of measured background sound levels to the front façade, considered representative of the nearest noise sensitive receptor is shown in Figure 3 below.

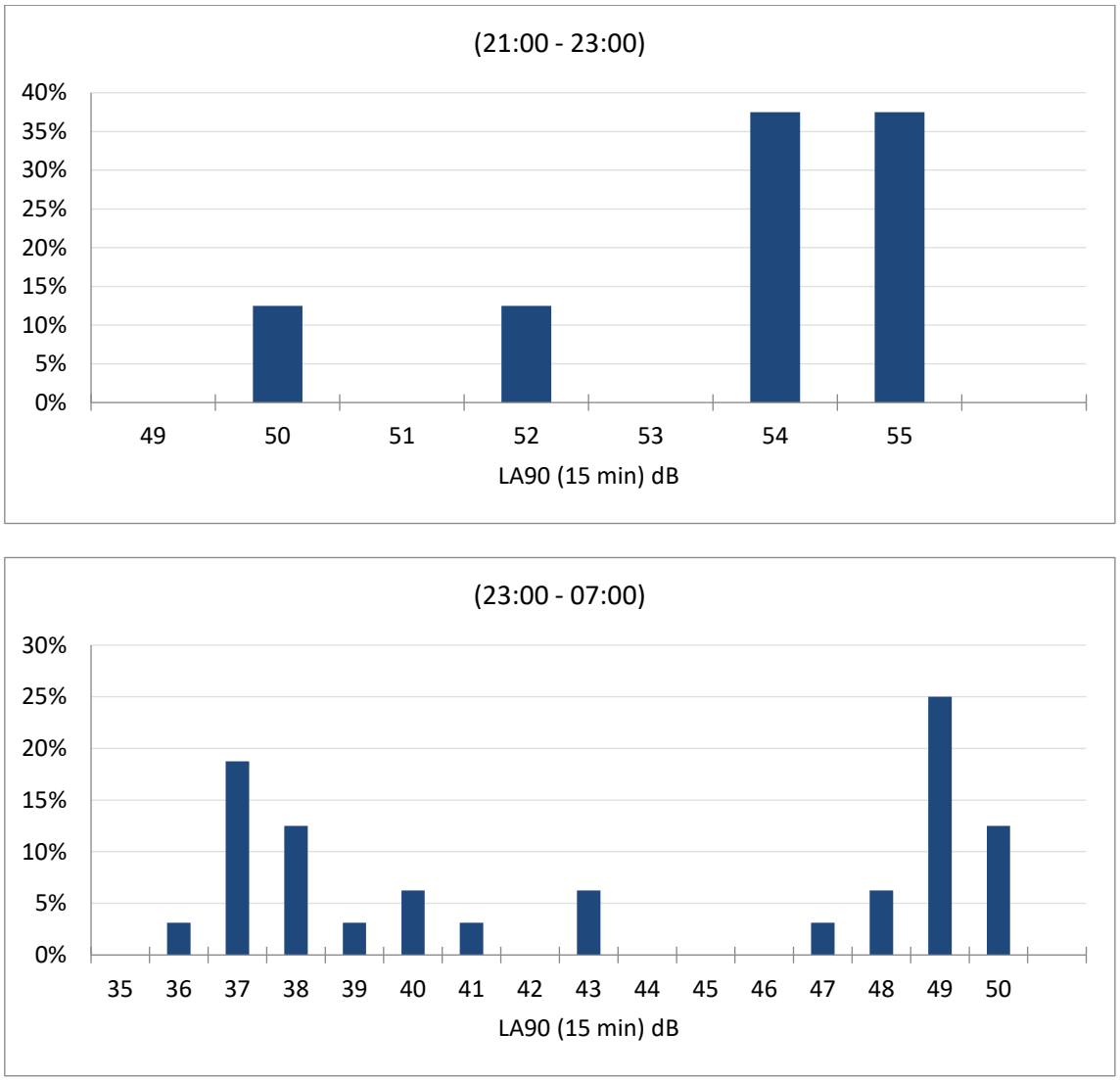


Figure 3: Histogram of measured L90 sound levels during the latest opening hours of the restaurant and overnight

Sound levels from other mechanical equipment in the area are dominant up until 02:30 hours, and then the sound level drops significantly. As a result, the second-most representative sound level of LA90 37dB has been used over the night-time period in order to ensure a robust assessment.

Summary results of the survey are provided in Table 2 below.

Receptor	Period	Representative Background Sound Level LA90
NSR1	Latest opening hours of the restaurant to 23:00 hours	54dB
	Overnight	37dB

Table 2: Summary sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of new extract and supply fans and condensing units. Confirmation of the equipment models used in the assessment is provided in Table 3 below.

Description	Equipment Model	Airflow (m3/s)	Sound Level (LwA)	Quantity
EF1	MUB 100 630D4-L	4.25	95dB	1
SF1	MUB 100 630D4-L	3.68	91dB	1
AC 1-4	AOYG36KRTA	N/A	70dB	4
CCU1 Freezer	OP-LPQM048NT	N/A	70dB	1
CCU2 Fridge	OP-MPBM018AJP00G	N/A	69dB	1

Table 3: Proposed new mechanical equipment used in the assessment

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows, using manufacturer's published sound data for the proposed new plant. Ductwork system losses have been calculated in accordance with CIBSE Guide B4 *Noise and vibration control for HVAC*. Environmental corrections have been calculated in accordance with ISO 9613-2. Note that the assessment considers noise to external receptors only.

The assessment has been undertaken using drawings reference 1897/04, and 1897/07 as provided by the client.

Mitigation recommendations outlined in Section 6 of this report are included in the computer model.

The cumulative calculated specific sound level to outside the most sensitive receptors with all equipment operating is shown in Table 4 below. Summary printouts from the calculation models are included in Appendix A.

Receptor Location	Calculated Equipment Sound Level (All plant operating)	Calculated Equipment Sound Level (Catering condensers overnight)
NSR1	38dBA	21dBA

Table 4: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Assessment of the calculated rating levels in accordance with BS 4142:2014+A1:2019 is provided in Table 5 below.

Description	R1 Receptor (All Plant)	R1 Receptor (Overnight)	Relevant Clause	Commentary
Calculated specific sound level to receptor	LAeq 38dB	LAeq 21dB	7.1 7.3.6	New equipment operating. Refer to calculation sheets in Appendix A.
Background sound level	LA90 54dB	LA90 37dB	8.1.3 8.3	Measured representative background sound level.
Acoustic feature correction	+0dB	+0dB	9.2	The calculated specific sound levels do not indicate any distinctive component and the plant is significantly below the background sound level and therefore no rating correction is applicable.
Rating level	LAr 38dB	LAr 21dB	9.2	
Excess of rating level over background sound level	-16dB	-16dB	11	Assessment indicates negligible likelihood of adverse impact

Table 5: Assessment of results in accordance with BS 4142:2014+A1:2019

Table 5 shows the rating level of the proposed new equipment will be at least 16dB below the background LA90 sound level to outside the closest noise-sensitive properties.

Sound levels from the new mechanical equipment should not be detrimental to the amenity of any residential occupiers in the vicinity and comply with the requirements of York City Council.

6. ACOUSTIC MITIGATION TREATMENTS

As discussed in Section 5, noise control treatments have been included in the calculation model. Acoustic specification for the mitigation scheme is provided below.

6.1. Duct Mounted Attenuators

The calculation model includes benefit of duct-mounted attenuators to the fans. Schedule of minimum dynamic insertion loss performance for the attenuators along with description of typical silencer to comply with the specified performance is provided in Appendix B. Note that the

dimensions and free-area shown are nominal and the successful supplier should confirm their own selections to meet the minimum specified insertion loss performance.

Any transformation sections between the fan and attenuator should be formed with double-skinned casings.

It is important airflow generated noise from the atmospheric terminal does not increase the cumulative sound level at nearby noise-sensitive properties. Suitable airflow velocity is dependent on the profile of the terminal used and should be verified with the manufacturer accordingly.

6.2. Vibration Isolators

To control the potential for structure-borne noise and vibration from the mechanical equipment affecting adjoining residential and commercial occupants, it is recommended that the plant is installed on vibration isolators.

Vibration isolators for the fans would typically be steel spring type mounts. The isolator supplier would be able to select a suitable model to provide minimum 98% isolation efficiency at the working load and operating speed. Flexible connections should be fitted between the fans and adjoining ductwork both sides.

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical plant and equipment associated with a proposed Giggling Squid restaurant at 18 Lendal Street, York.

ACA Acoustics have undertaken an assessment of noise from the proposed equipment using manufacturer's published acoustic data. Calculated rating levels for the plant are at least 5dB below the background sound level during proposed operating times of the equipment when assessed at 1m from the closest noise-sensitive windows of residential receptors.

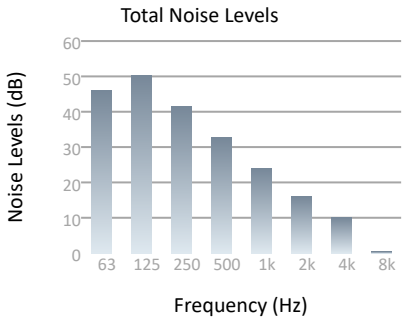
The author considers that allowing for the proposed mitigation scheme in this report, the proposed equipment achieves the Local Authority's planning requirements for this development and will not be detrimental to the amenity of nearby noise-sensitive occupants.

Appendix A

Acoustic Calculations

18 Lendal Street, York

Project Name	18 Lendal Street, York
Project Reference	231210
Reference	The Judges Lodging Daytime
Description	
Noise Limit	-
dBA	37.7



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
KEF1 Discharge	1	32.3	43.6	36.5	28.3	18.4	8.7	4.3	-5.0
KEF1 Inlet	1	36.8	40.8	28.4	16.7	8.8	-0.5	-11.4	-24.8
KEF1 Breakout	1	21.1	33.0	15.6	4.8	-1.1	-4.4	-13.4	-25.7
KEF1 Discharge	1	41.1	47.0	37.5	27.8	17.9	7.5	-2.4	-15.8
SF1 Breakout	1	19.1	31.0	12.6	1.8	-0.1	-4.4	-12.4	-23.7
SF1 Inlet	1	31.7	41.0	33.5	25.2	17.1	9.6	5.7	-3.7
SF1 Inlet	1	32.3	37.3	27.8	19.1	11.2	1.8	-8.1	-21.5
AC 4	1	34.1	23.0	18.6	13.8	9.9	2.6	-2.4	-11.7
AC 3	1	34.1	23.0	18.6	13.8	9.9	2.6	-2.4	-11.7
AC 2	1	34.1	23.0	18.6	13.8	9.9	2.6	-2.4	-11.7
AC 1	1	34.1	23.0	18.6	13.8	9.9	2.6	-2.4	-11.7
CCU 1 Freezer	1	36.1	29.0	21.6	11.8	5.9	6.6	-5.4	-14.7
CCU 2 Fridge	1	35.1	28.0	20.6	10.8	4.9	5.6	-6.4	-15.7

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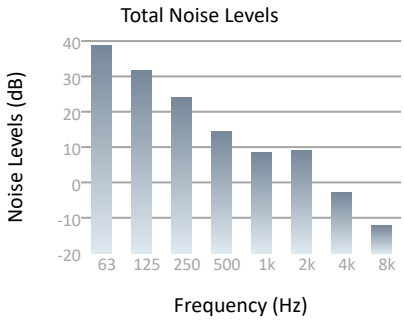
18 Lendal Street, York

Project Name	18 Lendal Street, York
Project Reference	231210
Reference	The Judges Lodging Nightime
Description	
Noise Limit	-
dBA	20.8



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
CCU 2 Fridge	1	35.1	28.0	20.6	10.8	4.9	5.6	-6.4	-15.7
CCU 1 Freezer	1	36.1	29.0	21.6	11.8	5.9	6.6	-5.4	-14.7

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Calculation Sheet

KEF1 Breakout to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - KEF1 Breakout								
Noise Levels	**67.0**	**81.0**	**66.0**	**58.0**	**55.0**	**53.0**	**45.0**	**36.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Directivity								
DI Index - 6dB								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**21.1**	**33.0**	**15.6**	**4.8**	**-1.1**	**-4.4**	**-13.4**	**-25.7**

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Calculation Sheet

SF1 Breakout to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Breakout								
Noise Levels	**65.0**	**79.0**	**63.0**	**55.0**	**56.0**	**53.0**	**46.0**	**38.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Directivity								
DI Index - 6dB								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**19.1**	**31.0**	**12.6**	**1.8**	**-0.1**	**-4.4**	**-12.4**	**-23.7**

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Calculation Sheet

AC 1 to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AC 1								
Noise Levels	**80.0**	**71.0**	**69.0**	**67.0**	**66.0**	**60.0**	**56.0**	**50.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**34.1**	**23.0**	**18.6**	**13.8**	**9.9**	**2.6**	**-2.4**	**-11.7**

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Calculation Sheet

AC 2 to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AC 2								
Noise Levels	**80.0**	**71.0**	**69.0**	**67.0**	**66.0**	**60.0**	**56.0**	**50.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**34.1**	**23.0**	**18.6**	**13.8**	**9.9**	**2.6**	**-2.4**	**-11.7**

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Calculation Sheet

AC 3 to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AC 3								
Noise Levels	**80.0**	**71.0**	**69.0**	**67.0**	**66.0**	**60.0**	**56.0**	**50.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**34.1**	**23.0**	**18.6**	**13.8**	**9.9**	**2.6**	**-2.4**	**-11.7**

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Calculation Sheet

AC 4 to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AC 4								
Noise Levels	**80.0**	**71.0**	**69.0**	**67.0**	**66.0**	**60.0**	**56.0**	**50.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**34.1**	**23.0**	**18.6**	**13.8**	**9.9**	**2.6**	**-2.4**	**-11.7**

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Calculation Sheet

CCU 2 Fridge to The Judges Lodging Nightime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CCU 2 Fridge								
Noise Levels	**81.0**	**76.0**	**71.0**	**64.0**	**61.0**	**63.0**	**52.0**	**46.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Nightime								
Sound Pressure, Lp:	**35.1**	**28.0**	**20.6**	**10.8**	**4.9**	**5.6**	**-6.4**	**-15.7**

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Calculation Sheet

CCU 1 Freezer to The Judges Lodging Nightime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CCU 1 Freezer								
Noise Levels	**82.0**	**77.0**	**72.0**	**65.0**	**62.0**	**64.0**	**53.0**	**47.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Nightime								
Sound Pressure, Lp:	**36.1**	**29.0**	**21.6**	**11.8**	**5.9**	**6.6**	**-5.4**	**-14.7**

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Calculation Sheet

CCU 1 Freezer to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CCU 1 Freezer								
Noise Levels	**82.0**	**77.0**	**72.0**	**65.0**	**62.0**	**64.0**	**53.0**	**47.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**36.1**	**29.0**	**21.6**	**11.8**	**5.9**	**6.6**	**-5.4**	**-14.7**

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Calculation Sheet

CCU 2 Fridge to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CCU 2 Fridge								
Noise Levels	**81.0**	**76.0**	**71.0**	**64.0**	**61.0**	**63.0**	**52.0**	**46.0**
Noise Control Treatments								
Treatment - none								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**35.1**	**28.0**	**20.6**	**10.8**	**4.9**	**5.6**	**-6.4**	**-15.7**

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Calculation Sheet

KEF1 Discharge to The Judges Lodging Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - KEF1 Discharge									
Sound Pressure Levels @ m		**90.0**	**101.0**	**97.0**	**93.0**	**89.0**	**84.0**	**81.0**	**75.0**
Silencer									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Rect Duct Losses									
Width (m)	0.7								
Height (m)	0.7								
Length (m)	2.0								
Face Velocity (m/s)	8.7								
		-1.2	*-0.8*	*-0.6*	*-0.2*	*-0.2*	*-0.2*	*-0.2*	*-0.2*
Bend Loss									
		-1.0	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
Rect Duct Losses									
		-0.6	*-0.4*	*-0.3*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*
End Reflection & Directional Directivity		*-9.0*	*-6.3*	*-6.2*	*-8.2*	*-11.2*	*-14.5*	*-15.0*	*-15.0*
Dc - Reflections & Directivity									
		6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance									
		-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption									
		0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation									
		3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation									
		-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver									
External Receiver - The Judges Lodging Daytime									
Sound Pressure, Lp:		**32.3**	**43.6**	**36.5**	**28.3**	**18.4**	**8.7**	**4.3**	**-5.0**

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Calculation Sheet

KEF1 Discharge to The Judges Lodging Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - KEF1 Discharge									
Sound Pressure Levels @ m		**90.0**	**101.0**	**97.0**	**93.0**	**89.0**	**84.0**	**81.0**	**75.0**
Silencer									
Silencer Type - None									
Silencer Reference -									
Width (m)	0.6								
Height (m)	0.6								
% Free Area (%)	100.0								
Face Velocity (m/s)	11.8								
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Duct Break-Out									
		-6.1	*-9.1*	*-12.1*	*-15.1*	*-18.1*	*-22.1*	*-28.1*	*-32.1*
ISO 9613 Calculation									
Horiz. Distance (m)	40.0								
Source Height (m)	10.0								
Receiver Height (m)	10.0								
Q Factor - Corner									
		-31.0	*-31.1*	*-31.1*	*-31.1*	*-31.2*	*-31.4*	*-32.4*	*-35.7*
ISO 9613 Barrier Attenuation									
		-11.9	*-13.9*	*-16.3*	*-19.0*	*-21.9*	*-23.0*	*-23.0*	*-23.0*
External Receiver									
External Receiver - The Judges Lodging Daytime									
Sound Pressure, Lp:		**41.1**	**47.0**	**37.5**	**27.8**	**17.9**	**7.5**	**-2.4**	**-15.8**

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Calculation Sheet

KEF1 Inlet to The Judges Lodging Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - KEF1 Inlet									
Noise Levels		**89.0**	**99.0**	**95.0**	**91.0**	**87.0**	**83.0**	**79.0**	**73.0**
Silencer									
Silencer Type - None									
Silencer Reference -									
Width (m)	0.6								
Height (m)	0.6								
% Free Area (%)	100.0								
Face Velocity (m/s)	11.8								
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Bend Loss									
		0.0	*-1.0*	*-4.0*	*-6.0*	*-4.0*	*-4.0*	*-4.0*	*-4.0*
Rect Duct Losses									
		-0.3	*-0.2*	*-0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Duct Break-Out									
		-6.1	*-9.1*	*-12.1*	*-15.1*	*-18.1*	*-22.1*	*-28.1*	*-32.1*
ISO 9613 Calculation									
Horiz. Distance (m)	40.0								
Source Height (m)	10.0								
Receiver Height (m)	10.0								
Q Factor - Junction									
		-34.0	*-34.1*	*-34.1*	*-34.1*	*-34.2*	*-34.4*	*-35.4*	*-38.7*
ISO 9613 Barrier Attenuation									
		-11.9	*-13.9*	*-16.3*	*-19.0*	*-21.9*	*-23.0*	*-23.0*	*-23.0*
External Receiver									
External Receiver - The Judges Lodging Daytime									
Sound Pressure, Lp:		**36.8**	**40.8**	**28.4**	**16.7**	**8.8**	**-0.5**	**-11.4**	**-24.8**

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Calculation Sheet

SF1 Inlet to The Judges Lodging Daytime

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Inlet								
Noise Levels	**85.0**	**95.0**	**91.0**	**88.0**	**86.0**	**82.0**	**79.0**	**73.0**
Silencer								
	0.1	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*
Rect Duct Losses								
	-0.2	*-0.1*	*-0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
End Reflection & Directional Directivity	*-7.4*	*-5.9*	*-7.0*	*-9.6*	*-12.8*	*-15.0*	*-15.0*	*-15.0*
Dc - Reflections & Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-43.0	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*	*-43.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.4*	*-1.3*	*-4.7*
Agr - Ground Attenuation								
	3.0	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Abar - Barrier Attenuation								
	-11.9	*-12.3*	*-14.8*	*-17.5*	*-20.4*	*-21.5*	*-21.5*	*-21.5*
External Receiver								
External Receiver - The Judges Lodging Daytime								
Sound Pressure, Lp:	**31.7**	**41.0**	**33.5**	**25.2**	**17.1**	**9.6**	**5.7**	**-3.7**

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Calculation Sheet

SF1 Inlet to The Judges Lodging Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - SF1 Inlet									
Noise Levels		**85.0**	**95.0**	**91.0**	**88.0**	**86.0**	**82.0**	**79.0**	**73.0**
Silencer									
Silencer Type - None									
Silencer Reference -									
Width (m)	0.6								
Height (m)	0.6								
% Free Area (%)	100.0								
Face Velocity (m/s)	10.2								
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Duct Break-Out									
		-6.8	*-9.8*	*-12.8*	*-15.8*	*-18.8*	*-22.8*	*-28.8*	*-32.8*
ISO 9613 Calculation									
Horiz. Distance (m)	40.0								
Source Height (m)	10.0								
Receiver Height (m)	10.0								
Q Factor - Junction									
		-34.0	*-34.1*	*-34.1*	*-34.1*	*-34.2*	*-34.4*	*-35.4*	*-38.7*
ISO 9613 Barrier Attenuation									
		-11.9	*-13.9*	*-16.3*	*-19.0*	*-21.9*	*-23.0*	*-23.0*	*-23.0*
External Receiver									
External Receiver - The Judges Lodging Daytime									
Sound Pressure, Lp:		**32.3**	**37.3**	**27.8**	**19.1**	**11.2**	**1.8**	**-8.1**	**-21.5**

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Appendix B

Acoustic Mitigation Treatments

Attenuator Schedule

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
ATT1 EF1 Discharge		600L 45% Free Area c/w Melinex	4	7	10	14	15	10	8	5

Notes:
1. All dimensions in mm
2. Performance shown as static insertion loss. Dynamic insertion loss performance allowing for airflow generated noise is shown on the relevant calculation sheet.
3. Selections are nominal and the successful supplier should ensure their proposal achieves the minimum required static and dynamic insertion loss performance.

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