Report VA4028.220504.NIA

136 New Cross Road, London

Noise Impact Assessment

06 May 2022

Lit'u'ation Limited
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Contents

Attachments

1. Introduction

Retrospective consent is sought for mechanical plant installed to the rear of 136 New Cross Road, London.

Venta Acoustics has been commissioned by Lit'u'ation Limited to undertake an assessment of the noise impact of these plant items in support of an application for planning permission.

An environmental noise survey has been undertaken to determine the background noise levels at the most affected noise sensitive receptors and levels generated by the in-situ plant items. These levels are used to undertake an assessment of the likely impact with reference to the planning requirements of London Borough of Lewisham.

2. Design Criterion and Assessment Methodology

2.1 London Borough of Lewisham Requirements

London Borough of Lewisham have confirmed that their planning policy requirements that noise emissions from plant is at least 10dB below the local background noise level as assessed at the most affected noise sensitive receivers.

The assessment is to be undertaken with general reference to the methodology detailed in BS4142:2014.

2.2 BS8233:2014

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

The relevant section of the standard is shown below in Table 2.1.

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

3. Site Description

As illustrated on attached site plan VA4028/SP1, the site building is located in a terrace of properties, with commercial and retail premises at ground floor level, and apartments above. To the rear of the site are apartments located on Fishers Court.

The most affected noise sensitive receivers are expected to be rear windows of the apartment above the premises at 136A New Cross Road, and rear windows of the apartments on Fishers Court.

Existing building services plant was noted in close proximity to these receptors on several of the neighbouring rooftops.

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 Wednesday 27th and Friday 29th April 2022 at the external first-floor roof locations shown in site plan VA4028/SP1. These locations were chosen to be representative of the background noise level at the most 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. The 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-11461-E0	UCRT20/1699	27/7/20
NTi Class 1 Integrating SLM	XL2	A2A-11586-E0	UCRT20/1565	29/6/20
Larson Davis calibrator	CAL200	19816	44622-19816-CAL200	2/3/22

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 VA4028/TH1-3 for position 1 and VA4028/TH4-6 for position 2.

The background noise level is determined by existing rooftop extract plant on neighbouring 134 New Cross Road, and road traffic when the plant is not operating. Due to this, the plant noise has been assessed against the background noise levels present immediately after the neighbouring extract equipment turns off at the end of the night.

The typical background noise levels measured were:

Monitoring Period	Typical[1] $L_{A90,5min}$	
	Position 1	Position 2
07:00 – 23:00 hours	41 dB	46 dB
23:00 – 07:00 hours	32 dB	38 dB
After plant turns off	37 dB	40 dB

Table 4.2 – Typical background noise levels **[dB ref. 20 µPa]**

[1] The typical L_{A90} value is taken as the 10th percentile of all L_{A90} values measured during the relevant period.

4.3 Plant Noise Emission Limits

On the basis of the measured noise levels and the planning requirements of the Local Authority, and considering that it is not expected that tonal noise will be generated by the proposed plant units, the following plant specific sound levels should not be exceeded at the most affected noise sensitive receivers:

Monitoring Period	Design Criterion (L_{Aeq})	
	Position 1	Position 2
Plant noise design criteria	27 dB	30 dB

Table 4.3 – Specific sound pressure levels not to be exceeded at most affected noise sensitive receivers

5. Predicted Noise Impact

5.1 Proposed plant

Applicant plant items are summarised in Table 5.1. These items are installed at first-floor roof level at the locations indicated in Figure 5.1.

Where possible, details of the plant were taken from the manufacturer specification plates on the equipment. This information was available on the kitchen extract system and the two condensers. For all other plant items, measurements of the noise levels were taken with the unit operating at a distance of 1m.

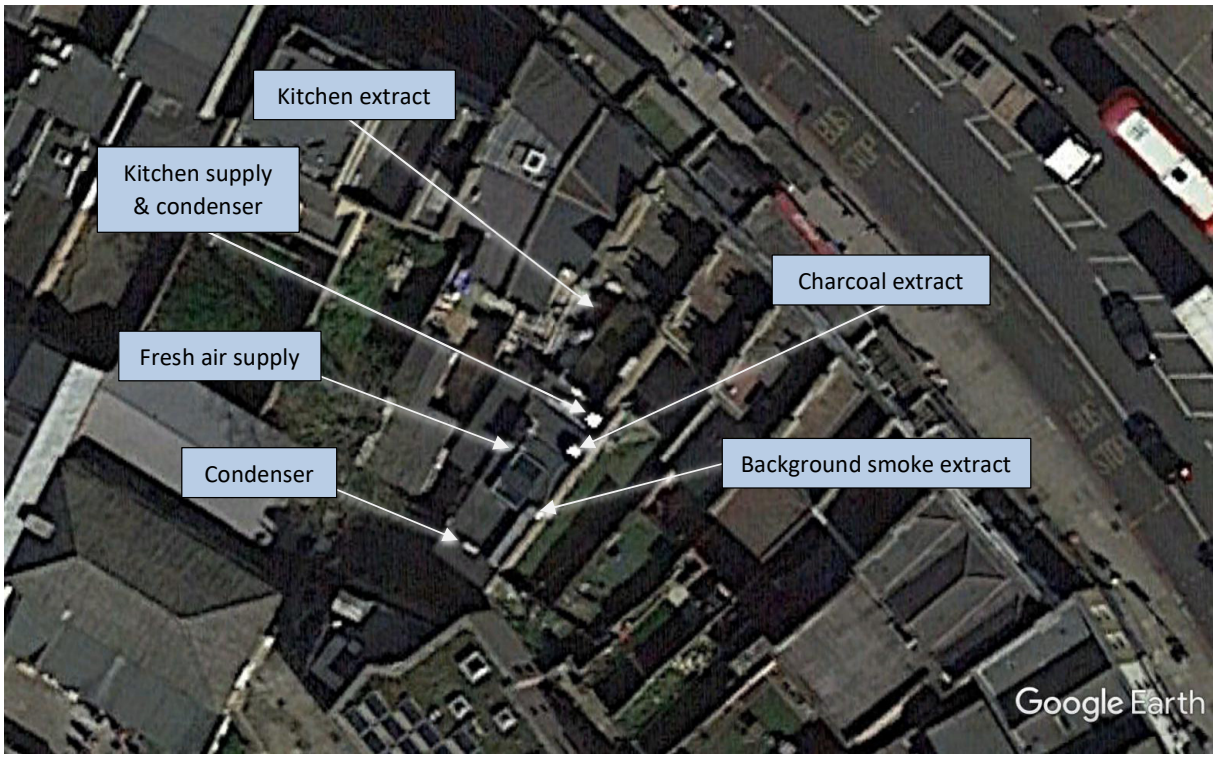


Figure 5.1 – Plant locations

Plant Item	Quantity	Model
Condensers	2	Mitsubishi FDC71VNP-W
Extract Fan	1	Helios GBW560/4

Table 5.1 – Plant from specification plates used for this assessment

Consulting the manufacturer's datasheets, the following noise emissions levels are attributed to the proposed plant items:

Plant Item		Octave Band Centre Frequency (Hz) Sound Pressure/Power Level, L_p@1m, L_w (dB)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Mitsubishi FDC71VNP-W	L_p@ 1m	35	39	42	48	47	44	40	34	51
Helios GBW560/4 - Breakout	L_w	86	78	70	54	50	47	43	39	66
Helios GBW560/4 - Exhaust	L_w	95	87	82	79	77	73	69	62	82

Table 5.2 – Manufacturer plant noise data used for the assessment

Where manufacturer information was not available, measurements were taken of the equipment, which is summarised in Table 5.3.

Plant Item		Octave Band Centre Frequency (Hz) Sound Pressure Level, L_p@1m (dB)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Charcoal extract	L_p@ 1m	80	76	74	71	70	67	62	52	75
Background smoke extract	L_p@ 1m	60	63	54	56	49	44	38	28	56
Kitchen supply	L_p@ 1m	67	62	59	54	49	44	40	30	56
Fresh air supply	L_p@ 1m	74	72	68	63	63	57	49	44	67

Table 5.3 – Measured plant noise data used for the assessment

5.2 Recommended Mitigation Measures

The atmospheric side ductwork of some plant items will need to be fitted with attenuators providing the minimum insertion losses shown in Table 5.4. Alternative attenuation performance shape curves may be suitable and should be confirmed prior to installation.

Attenuation Component	Octave Band Centre Frequency (Hz) Minimum Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Kitchen extract attenuator 1	11	21	32	35	30	32	32	40
Kitchen extract attenuator 2	11	21	32	35	30	32	32	40
Charcoal extract attenuator	12	23	40	50	50	50	50	49
Background smoke extract attenuator	6	10	16	30	37	37	30	24
Kitchen supply attenuator	4	6	11	19	24	23	18	12
Fresh air supply attenuator	8	15	25	42	50	50	46	34

Table 5.4 – Minimum attenuator insertion loss

Should multiple attenuators be required to meet any given minimum insertion loss performance, then the attenuators should be separated from each other by a distance of minimum 3-4 x D, where D is the largest internal dimension of the duct work (e.g. D is 0.5m, so a minimum of 1.5-2m apart). Attenuators should be fitted as close to the fan as possible, and attached to the ductwork using flexible connections.

For the extract attenuator, it is recommended that a Melinex lined silencer is used to prevent grease impregnation into the acoustic media which may degrade the performance realised over time.

The kitchen extract fan motor and the condenser nearest to Fisher's Court will need to be fully enclosed within plant housings providing the minimum losses shown in Table 5.5.

Attenuation Component	Octave Band Centre Frequency (Hz) Acoustic Louvre Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Kitchen extract fan motor	24	28	33	38	42	38	42	43
Condenser (south)	6	6	8	10	14	18	16	15

Table 5.5 – Enclosure loss requirements

The losses for the kitchen extract motor would be expected to be achieved utilising a well constructed box utilising two layers of 15mm cement particle board, and lined internally with 60mm depth of medium density mineral wool (≈ 45 kg/m^3). Another option would be to relocate the fan motor internally.

For the condenser, it is expected that an enclosure with suitably specified acoustic louvres would be capable of providing the required sound reduction performance.

Please note that the above recommendations relate to acoustic issues only. It is recommended that professional advice confirming the suitability of these measures be sought from others with regards to issues such as airflow, structural stability and visual impact.

5.3 Predicted noise levels

The cumulative noise level at the most affected noise sensitive receivers has been calculated on the basis of the above information and assuming the recommended mitigation measures, with reference to the guidelines set out in ISO 9613-2:1996 *Attenuation of sound during propagation outdoors - Part 2: General method of calculation.*

A summary of the calculations are shown in Appendix B.

Receiver	Predicted Cumulative Noise Level	Design Criterion
136A New Cross Road	L_{Aeq} 27 dB	L_{Aeq} 27 dB
Fisher's Court	L_{Aeq} 29 dB	L_{Aeq} 30 dB

Table 5.6 – Predicted cumulative noise level at most affected noise sensitive receiver and design criterion.

5.3.1 Structureborne Noise

All plant and ductwork should be fitted with anti-vibration mounts in accordance with the manufacturer guidelines.

The extract fan will have a dominant case frequency of 50-60Hz. To mitigate this and remove the tonal element, the fan motor should be mounted on rubber or neoprene mounts with a minimum deflection of 5mm, which would provide 95% isolation efficiency, considerably more than the recommended minimum of 90% isolation.

The fan should be attached to the ductwork on either side using flexible coupling to minimise vibration transfer to the ductwork. Ductwork should be attached to the building using isolated fixings, with either a rubber or neoprene isolator with a minimum deflection of 1mm, which would provide 90% isolation, considerably more than would be required considering the reduced energy transmitted to the ductwork.

The above measures are to control structureborne noise and re-radiated noise to other areas of the building to considerably below current internal noise levels and hence would be considered acceptable.

5.4 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for noise ingress via a partially open window. The external noise level shown in would result in internal noise levels that are below all limiting guideline levels shown in Table 2.1.

6. Conclusion

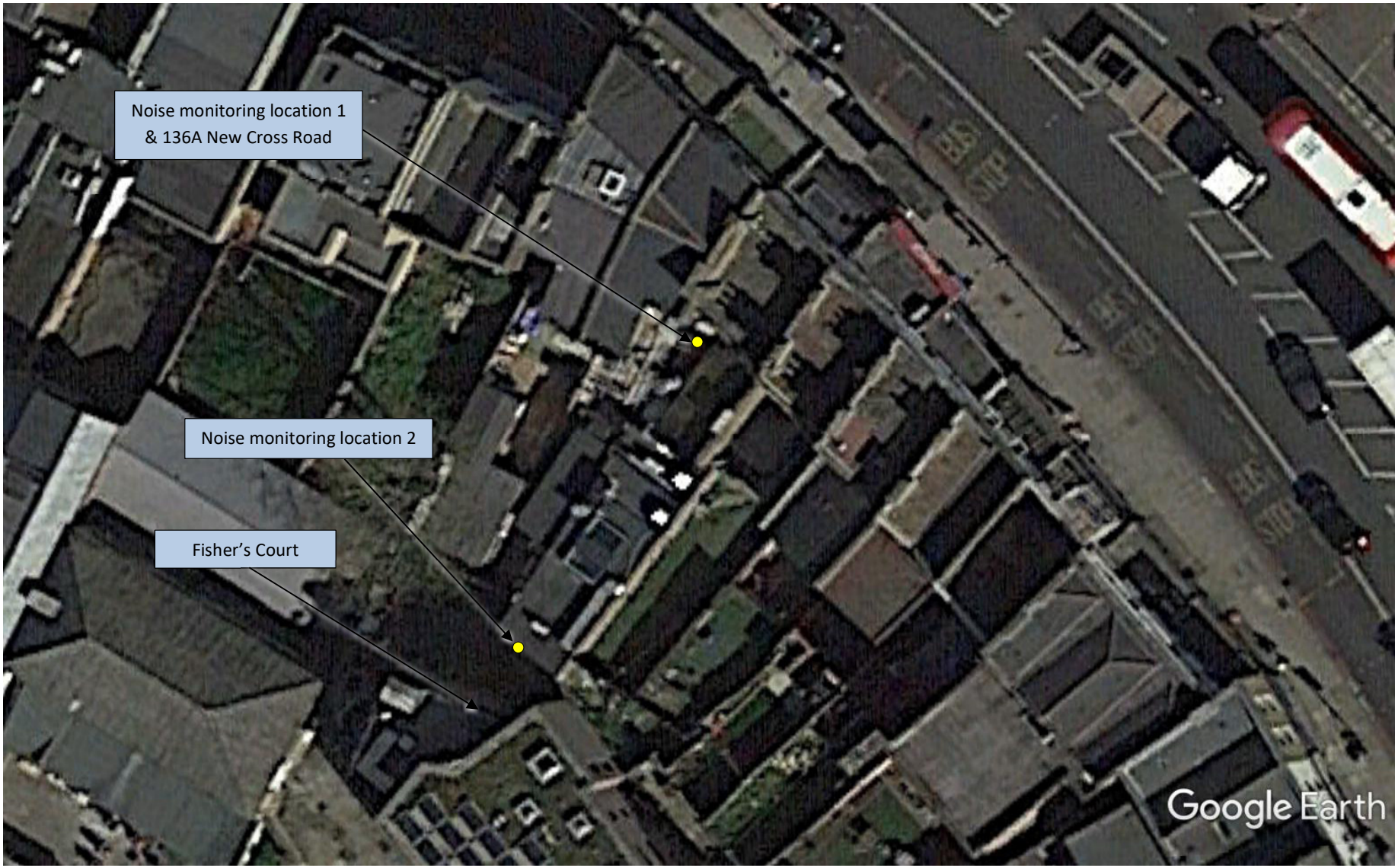
A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 136 New Cross Road, London in support of a retrospective planning application for the introduction of new building services plant.

This has enabled noise emission limits to be set at the most affected noise sensitive receivers such that the proposed installation meets the requirements of London Borough of Lewisham.

The installed plant scheme will require mitigation to bring noise emissions in line with the established noise limits. Details of suitable mitigation have been specified.

Where the specified mitigation measures are installed, cumulative noise emission levels from the installed plant items have been assessed to be compliant with the plant noise emission limits and the scheme would not be expected to have a significant adverse noise impact on neighbouring receptors.

Jamie Duncan MIOA


Noise monitoring location 1
& 136A New Cross Road
Noise monitoring location 2
Fisher's Court
Google Earth

New Cross Road

Environmental Noise Time History: 1

Position 1

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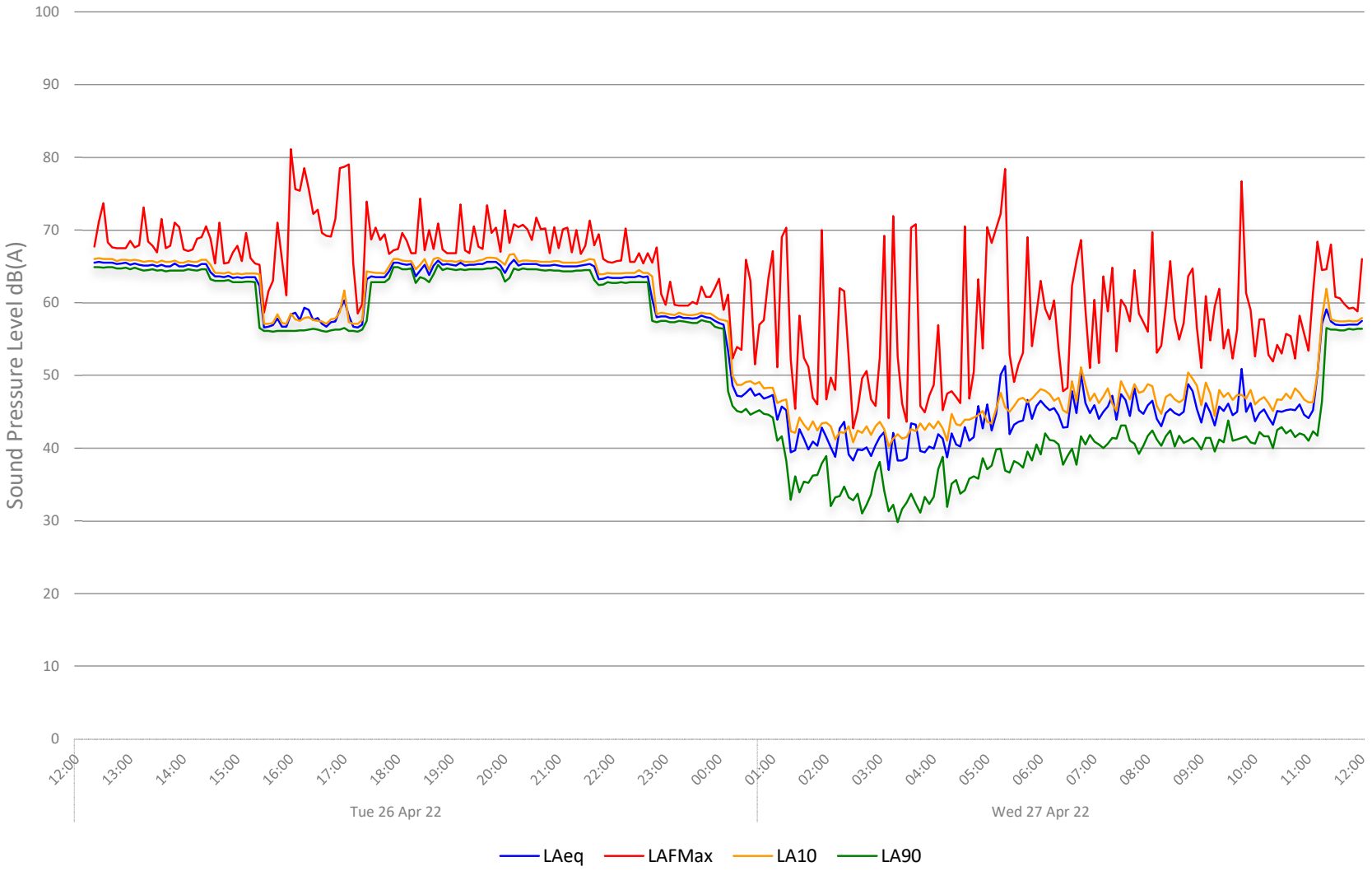
Figure VA4028/TH1



New Cross Road

Environmental Noise Time History: 2

Position 1

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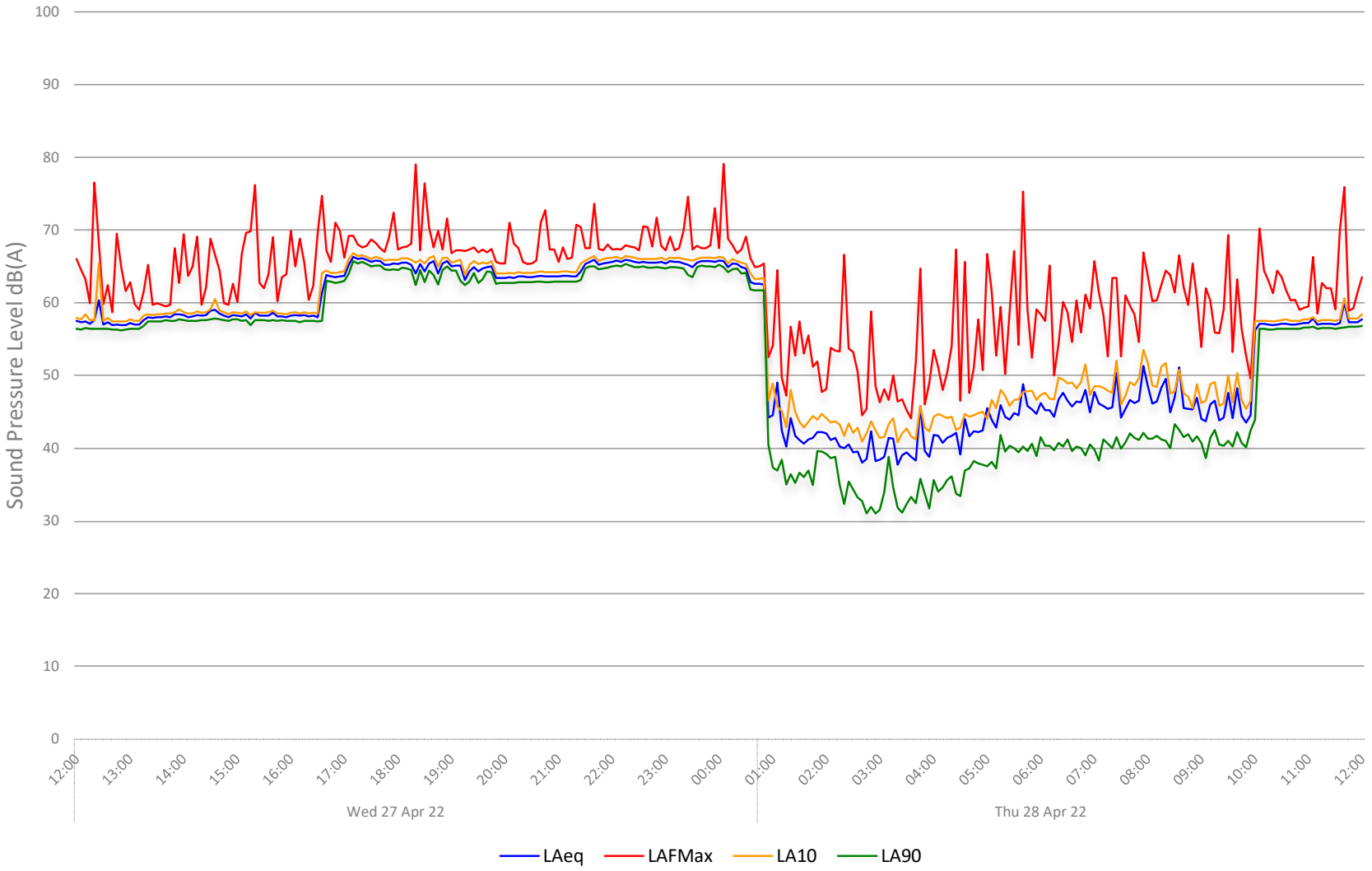
Figure VA4028/TH2



New Cross Road

Environmental Noise Time History: 3

Position 1

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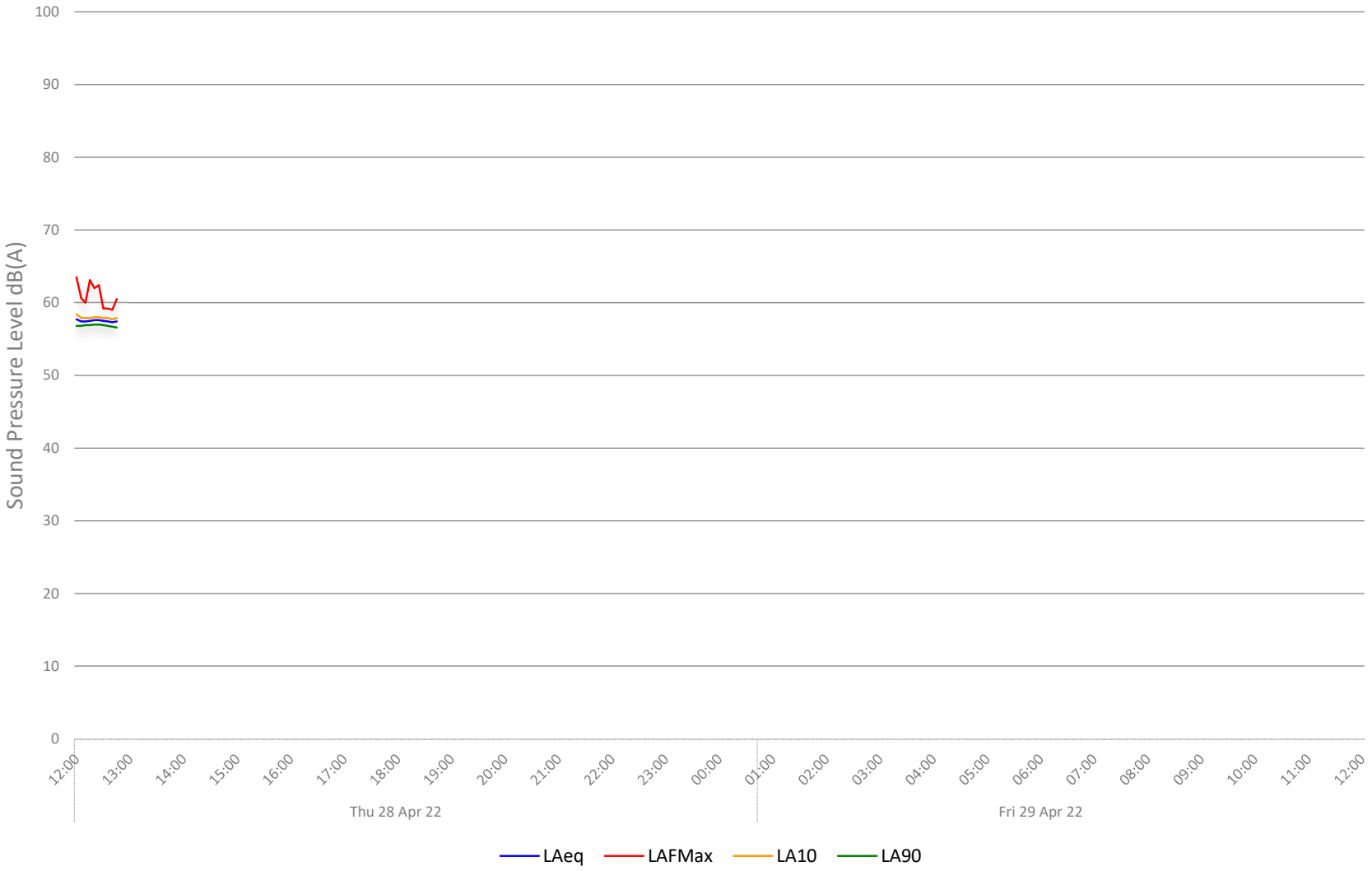
Figure VA4028/TH3



136 New Cross Road, London

Environmental Noise Time History: 4

Position 2

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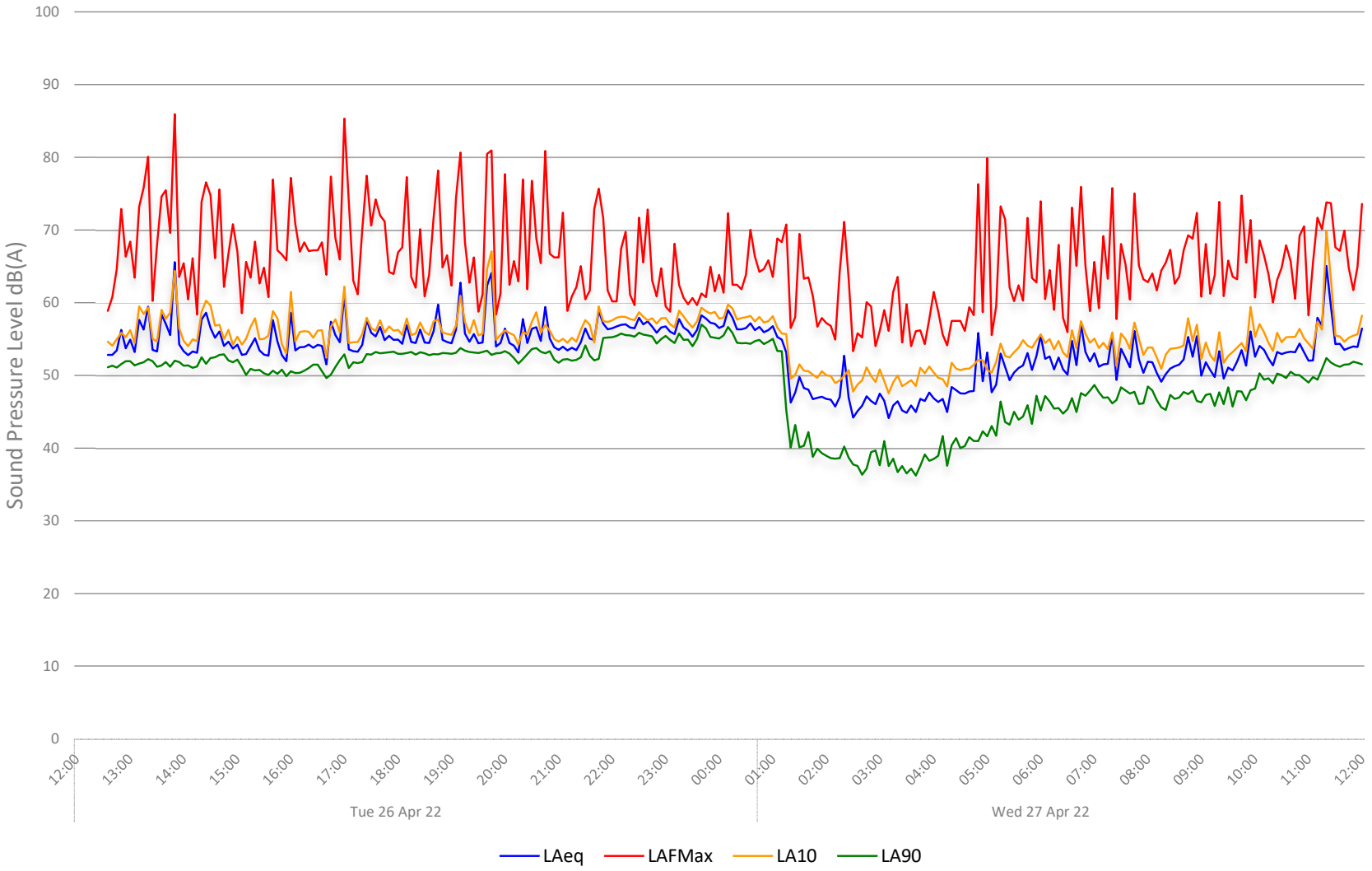
Figure VA4028/TH4



136 New Cross Road, London

Environmental Noise Time History: 5

Position 2

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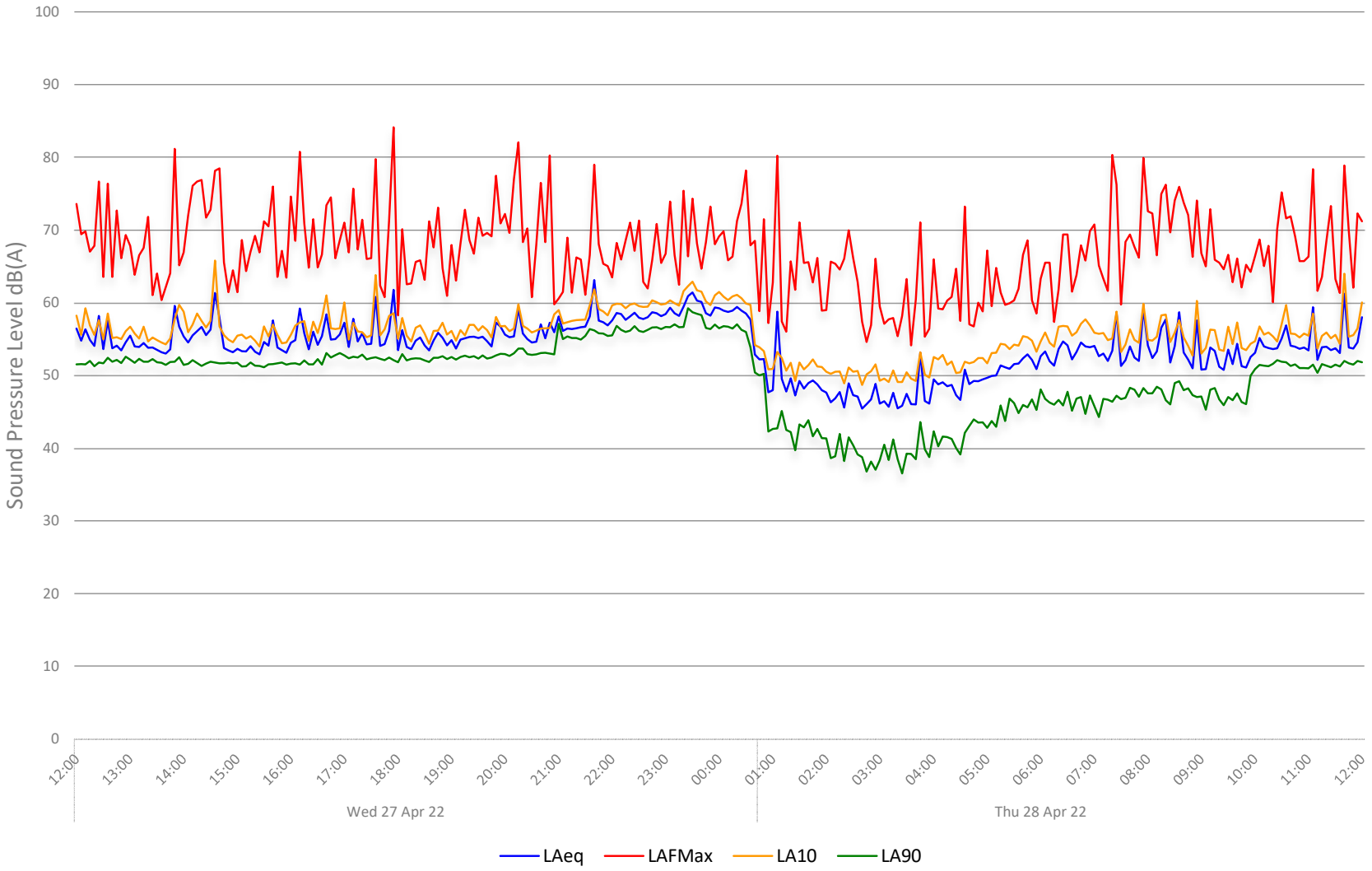
Figure VA4028/TH5



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Environmental Noise Time History: 6

Position 2

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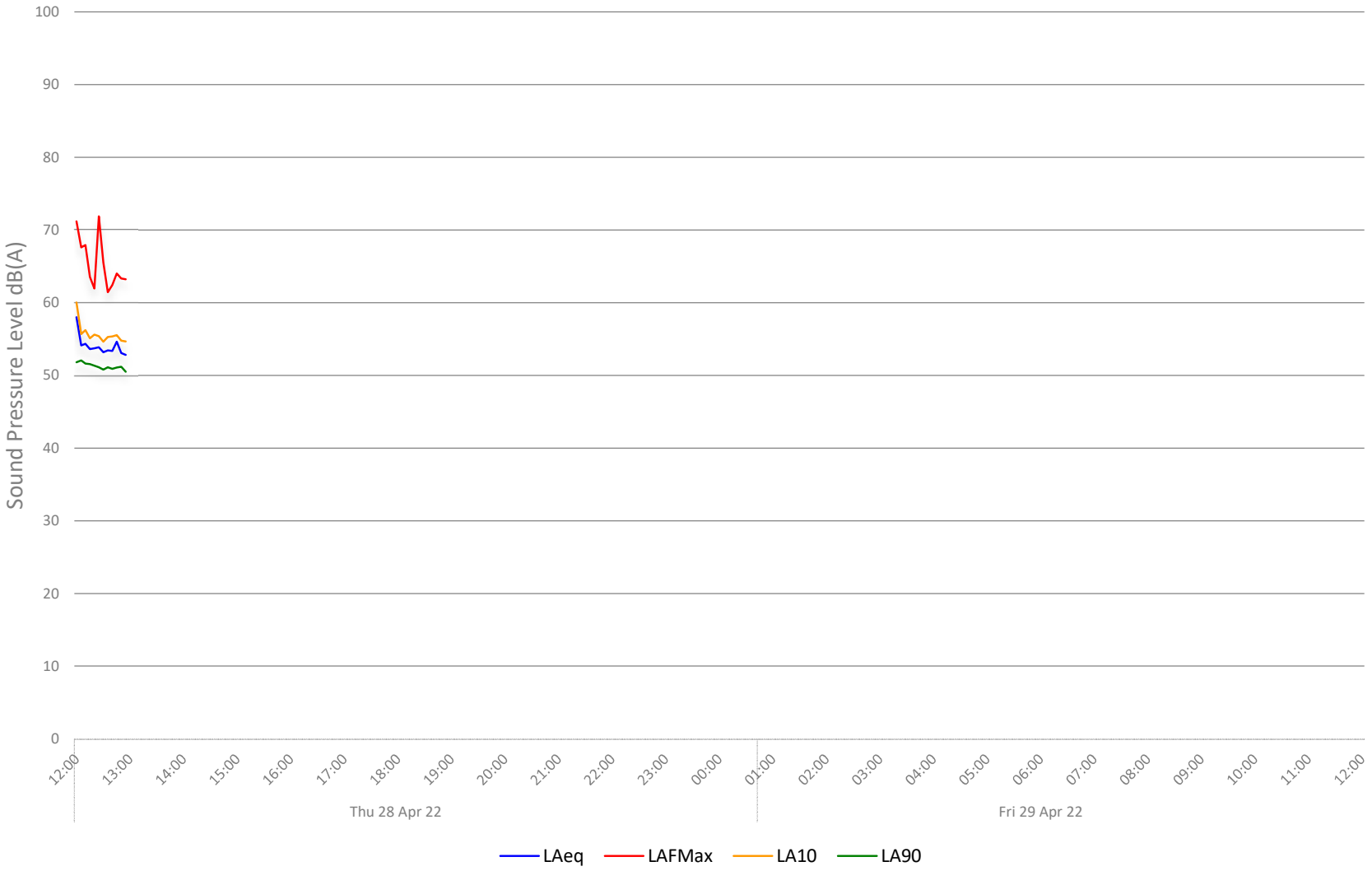
Figure VA4028/TH6



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.
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.
R	*Sound Reduction Index.* Effectively the *Level Difference* 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

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

APPENDIX B

VA4028 - 136 New Cross Road, London

Noise Impact Assessment - 136A New Cross Road

Kitchen Extract - Ductborne		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Helios GBW 560/4 - Exhaust	Lw	95	87	82	79	77	73	69	62	82
Acoustica R02-2-1500 - Melinex faced		-11	-21	-32	-35	-30	-32	-32	-40	
Acoustica R02-2-1500 - Melinex faced		-11	-21	-32	-35	-30	-32	-32	-40	
Distance Loss	To 5m	-14	-14	-14	-14	-14	-14	-14	-14	
Radiation Correction		-11	-11	-11	-11	-11	-11	-11	-11	
Directivity (Hor:0,Vert:135)		-1	-1	-3	-6	-9	-8	-8	-8	
Level at receiver		**47**	**19**	**-9**	**-22**	**-16**	**-24**	**-28**	**-51**	**21**

Kitchen Extract - Motor		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Helios GBW 560/4 - Breakout	Lw	86	78	70	54	50	47	43	39	66
Cement Board Enclosure		-24	-28	-33	-38	-42	-38	-42	-43	
Distance Loss	To 3m	-10	-10	-10	-10	-10	-10	-10	-10	
Radiation correction		-8	-8	-8	-8	-8	-8	-8	-8	
Level at receiver		**44**	**32**	**19**	**-2**	**-10**	**-9**	**-17**	**-22**	**21**

Charcoal Extract		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	80	76	74	71	70	67	62	52	**75**
Acoustica R02-3-2100		-12	-23	-40	-50	-50	-50	-50	-49	
Distance Loss	To 11m	-21	-21	-21	-21	-21	-21	-21	-21	
Screening loss*		-10	-13	-15	-18	-18	-18	-18	-18	
Level at receiver		**37**	**20**	**-2**	**-18**	**-19**	**-22**	**-27**	**-36**	**12**

* Screening loss limited to 18dB

Background Smoke Extract		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	60	63	54	56	49	44	38	28	**56**
Acoustica R02-4-900		-6	-10	-16	-30	-37	-37	-30	-24	
Distance Loss	To 14m	-23	-23	-23	-23	-23	-23	-23	-23	
Screening loss		-5	-5	-5	-5	-5	-5	-5	-5	
Level at receiver		**26**	**25**	**10**	**-2**	**-16**	**-21**	**-20**	**-24**	**10**

Kitchen Supply		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	67	62	59	54	49	44	40	30	**56**
Acoustica R02-5-600		-4	-6	-11	-19	-24	-23	-18	-12	
Distance Loss	To 9m	-19	-19	-19	-19	-19	-19	-19	-19	
Screening loss*		-10	-13	-15	-18	-18	-18	-18	-18	
Level at receiver		**34**	**24**	**14**	**-2**	**-12**	**-16**	**-15**	**-19**	**12**

* Screening loss limited to 18dB

Condenser		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC71VNP-W	Lp @ 1m	35	39	42	48	47	44	40	34	**51**
Distance Loss	To 9m	-19	-19	-19	-19	-19	-19	-19	-19	
Screening loss*		-10	-13	-15	-18	-18	-18	-18	-18	
Level at receiver		**6**	**7**	**8**	**11**	**10**	**7**	**3**	**-3**	**14**

* Screening loss limited to 18dB

Fresh Air Supply		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	74	72	68	63	63	57	49	44	**67**
Acoustica R02-3-1200		-8	-15	-25	-42	-50	-50	-46	-34	
Distance Loss	To 11m	-21	-21	-21	-21	-21	-21	-21	-21	
Level at receiver		**45**	**36**	**22**	**0**	**-8**	**-14**	**-18**	**-11**	**23**

Condenser		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC71VNP-W	Lp @ 1m	35	39	42	48	47	44	40	34	**51**
Enclosure loss	SL-150	-6	-6	-8	-10	-14	-18	-16	-15	
Distance Loss	To 17m	-25	-25	-25	-25	-25	-25	-25	-25	
Screening loss		-5	-5	-5	-5	-5	-5	-5	-5	
Level at receiver		**-1**	**3**	**4**	**8**	**3**	**-4**	**-6**	**-11**	**8**

Cumulative plant noise level at receiver 27 dB(A)

APPENDIX B

VA4028 - 136 New Cross Road, London

Noise Impact Assessment - Fisher's Court

Kitchen Extract - Ductborne		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Helios GBW 560/4 - Exhaust	Lw	95	87	82	79	77	73	69	62	82
Acoustica R02-2-1500 - Melinex faced		-11	-21	-32	-35	-30	-32	-32	-40	
Acoustica R02-2-1500 - Melinex faced		-11	-21	-32	-35	-30	-32	-32	-40	
Distance Loss	To 22m	-27	-27	-27	-27	-27	-27	-27	-27	
Radiation Correction		-11	-11	-11	-11	-11	-11	-11	-11	
Directivity (Hor:0,Vert:100)		0	0	0	-2	-7	-8	-8	-8	
Level at receiver		**35**	**7**	**-20**	**-30**	**-28**	**-37**	**-41**	**-64**	**9**

Kitchen Extract - Motor		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Helios GBW 560/4 - Breakout	Lw	86	78	70	54	50	47	43	39	66
Cement Board Enclosure		-24	-28	-33	-38	-42	-38	-42	-43	
Distance Loss	To 22m	-27	-27	-27	-27	-27	-27	-27	-27	
Radiation correction		-8	-8	-8	-8	-8	-8	-8	-8	
Level at receiver		**27**	**15**	**2**	**-19**	**-27**	**-26**	**-34**	**-39**	**4**

Charcoal Extract		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	80	76	74	71	70	67	62	52	**75**
Acoustica R02-3-2100		-12	-23	-40	-50	-50	-50	-50	-49	
Distance Loss	To 14m	-23	-23	-23	-23	-23	-23	-23	-23	
Level at receiver		**45**	**30**	**11**	**-2**	**-3**	**-6**	**-11**	**-20**	**20**

Background Smoke Extract		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	60	63	54	56	49	44	38	28	**56**
Acoustica R02-4-900		-6	-10	-16	-30	-37	-37	-30	-24	
Distance Loss	To 10m	-20	-20	-20	-20	-20	-20	-20	-20	
Level at receiver		**34**	**33**	**18**	**6**	**-8**	**-13**	**-12**	**-16**	**18**

Kitchen Supply		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	67	62	59	54	49	44	40	30	**56**
Acoustica R02-5-600		-4	-6	-11	-19	-24	-23	-18	-12	
Distance Loss	To 16m	-24	-24	-24	-24	-24	-24	-24	-24	
Level at receiver		**39**	**32**	**24**	**11**	**1**	**-3**	**-2**	**-6**	**20**

Condenser		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC71VNP-W	Lp @ 1m	35	39	42	48	47	44	40	34	**51**
Distance Loss	To 16m	-24	-24	-24	-24	-24	-24	-24	-24	
Line of sight screening		-5	-5	-5	-5	-5	-5	-5	-5	
Level at receiver		**6**	**10**	**13**	**19**	**18**	**15**	**11**	**5**	**22**

Fresh Air Supply		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Source Noise Level	Lp @ 1m	74	72	68	63	63	57	49	44	**67**
Acoustica R02-3-1200		-8	-15	-25	-42	-50	-50	-46	-34	
Distance Loss	To 14m	-23	-23	-23	-23	-23	-23	-23	-23	
Level at receiver		**43**	**34**	**20**	**-2**	**-10**	**-16**	**-20**	**-13**	**21**

Condenser		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC71VNP-W	Lp @ 1m	35	39	42	48	47	44	40	34	**51**
Enclosure loss		-6	-6	-8	-10	-14	-18	-16	-15	
Distance Loss	To 5m	-14	-14	-14	-14	-14	-14	-14	-14	
Level at receiver		**15**	**19**	**20**	**24**	**19**	**12**	**10**	**5**	**24**

Cumulative plant noise level at receiver 29 dB(A)