Noise Impact Assessment

Proposed Fast-food Restaurant, London Road, Newark, NG24 1TN

14th February 2024

ENVIRONMENTAL AND
SUSTAINABILITY CONSULTANTS

encon associates

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Executive Summary

A background sound survey was undertaken to inform the assessment of the likelihood of adverse impact from the proposed Fast-food restaurant at an existing commercial unit at London Road, Newark, NG24 1TN. The sound survey was carried out in compliance with BS 4142 as detailed in this report. The sound survey considers the impacts at residential dwellings to the east of the site.

Long-term environmental noise monitoring was carried out at one location representing the true background of Russell House, the most exposed noise sensitive receptor to the north-west of the site. Additionally, background sound measurements that were influenced by noise from building services plant associated with the neighbouring sites were taken at the most exposed noise sensitive receptor for comparison. Noise measurements were taken from other sites to represent noise sources that will be associated with the proposed site, such as deliveries. Sound levels associated with noise sources such as mechanical plant and refuse collections have been established from Manufacturer datasheets and British Standards.

Plant noise emission limits have been determined that are not to be exceeded at Russell House.

It is predicted that the external fixed installations in the current proposals will exceed the specified plant noise emission limits at the most exposed noise sensitive receptor. As a result, mitigation measures in the form of in-line attenuators have been recommended in this report to reduce the noise impact of building services plant. Additionally, it is recommended that the S1 and D2 condensers run on the low-noise mode, as specified by the manufacturer. The plant noise emissions with these mitigation measures in-situ are predicted to reduce the contributed from the external plant to below the specified plant noise limits.

Limits have been set for the plant that will be housed inside the plant room so that the cumulative plant noise limits are not to be exceeded at the noise sensitive receptor. The plant layout for the plant room is to be approved by a suitably qualified acoustician once finalised.

The assessment of the typical worst-case including when stock deliveries are taking place indicates that adverse impact is not likely. Contextual considerations, notably the existing acoustic environment and the closest incorporating acoustic design measures result in the assessment outcome.

The assessment of the absolute worst-case daytime period indicates that significant adverse effect is likely. It should however be considered that these collections are only likely to take place over a maximum 5-minute period just once a week.

This Report concludes that from the established sound levels and subsequent BS 4142 assessment, that the proposed Fast-food Restaurant should not provide adverse impact to nearby residents if the mitigation measures stipulated in this report are adequately implemented.

1 Introduction

1.1 Overview

Encon Associates Ltd have been commissioned to prepare an environmental noise impact assessment for a proposed Fast-food Restaurant at an existing commercial unit at London Road, Newark, NG24 1TN.

The following report has been produced to accompany a planning application that is to be submitted to Newark & Sherwood District Council.

This report details existing background sound levels at the noise sensitive receptors considered as the worst affected, as well as noise emissions associated with the operations that are to take place.

Due to the necessary technical nature of the report, a glossary of terms can be found in Appendix A to assist the reader.

2 Site Description & Background Information

2.1 Site & Surrounding Area

The site is located at an unoccupied commercial unit off London Road, Newark. The surrounding area comprises predominantly commercial units. Immediately to the north of the site is Russell House Homeless shelter. This shelter has overnight accommodation and is therefore considered to the most exposed noise sensitive receptor for both the daytime and night-time assessments. Also to the north is Newark Services Club, which hosts regular functions. Immediately to the east of the site is the Odeon cinema and Costa Coffee. Immediately to the east of the Costa is Domino's Pizza. Approximately 38m to the south-east of the site is Newark Library. Immediately to the south of the building is a carpark associated with the commercial units off London Road. On the opposite side of the carpark is Beaumon Gardens. Immediately to the west of the site Asda Petrol Station. Approximately 46m to the west of the site is London Road, which facilitates regular traffic flow.

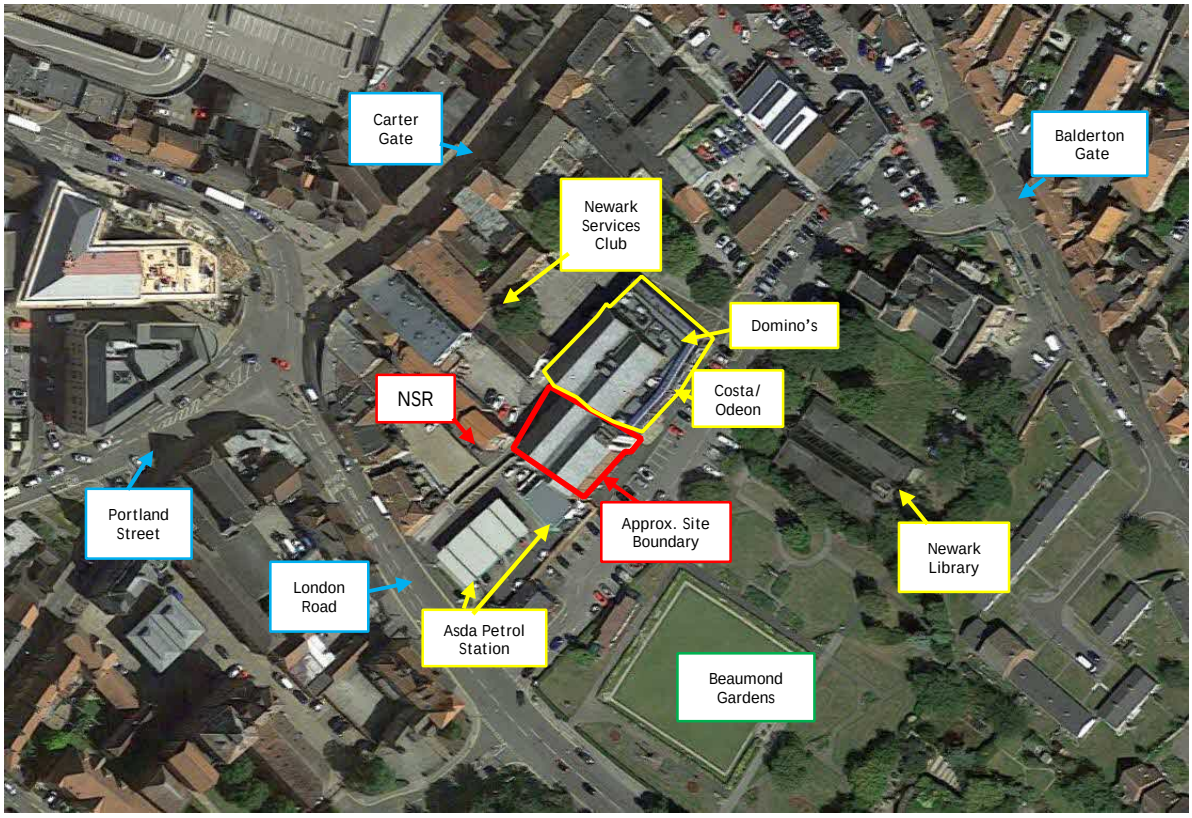


Figure 1.0 - Site and Surrounding Area

2.2 Background

It is proposed that a Fast-food restaurant be situated within an unoccupied commercial unit off London Road. The fast-food restaurant is seeking permission to trade everyday between the hours of 06:00 and 23:00 at this facility. Consequently, a noise impact assessment was required to determine the likelihood of adverse impact upon nearby residents.

The existing acoustic environment is dominated by vehicle movements from the London Road carpark, as well as Asda Petrol Station. The background acoustic environment was dominated by road traffic along London Road and other local transport networks.

3 Legislation, Policy and Guidance

This report is based on the following policy, guidance and legislation.

3.1 BS4142: 2014 'Methods for rating and assessing industrial and commercial sound

British Standard 4142: 2014 describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

> Sound from industrial and manufacturing processes;
>
> Sound from fixed installations which comprise mechanical and electrical plant and equipment;
>
> Sound from the loading and unloading of goods and materials and/or commercial premises; and
>
> Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as the from fork-lift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described in the standard use outdoor sound levels 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.

The standard presents methods to measure and determine ambient, background and residual sound levels, and the rating levels of industrial/commercial sound. BS4142 requires consideration of the level of uncertainty in the data and associated calculations.

The determination of noise amounting to a nuisance is beyond the scope of BS4142. The standard stipulates that it not intended to be applied to the rating and assessment of sound from the passage of vehicles of vehicles on public roads and railway systems, recreational activities, music and entertainment, shooting grounds, construction and demolition, domestic animals, public address systems and other sources not specified within the document.

The Reference Time Interval, T, is defined in the standard as the **"**specified interval over which the specific sound level is determined**"**, which is 1 hour during the daytime (07:00 to 23:00 hours) and 15 minutes during the night (23:00 to 07:00 hours).

Ambient sound is defined as "totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far". It comprises the residual sound and the specific sound when present.

Residual sound is defined as "ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound".

The background sound level is the $L_{A90,\,T}$ of the residual sound level, and is the underlying level of sound. Measurements of background sound level should be undertaken at the assessment location where possible or at a comparable location.

The measurement time interval should be sufficient to obtain a representative value (normally not less than 15 minutes) and the monitoring duration should reflect the range of background sound levels across the assessment period. The background sound level used for the assessment should be representative of the period being assessed.

The specific sound level is the $L_{Aeq,T}$ of the sound source being assessed over the reference time interval, Tr. BS 4142: 2014 advises that Tr should be 1 hour during the day and 15 minutes at night.

The rating level is the specific sound level plus any adjustment for the characteristics that are present with the sound including tonality, impulsivity, intermittency or other acoustic characteristics. The standard describes subjective and objective methods to establish the appropriate adjustment. The characteristics and coinciding adjustments are defined as:

> Tonality: A rating penalty of + 2dB is applicable for a tone which I "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".
>
> Impulsivity: A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".
>
> Intermittency: When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on-time if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied."
>
> Other Sound Characteristics: Where the specific sound features that are neither tonal nor impulsive but are otherwise readily distinctive against the residual acoustic environment, a 3 dB penalty can be applied.

The level of impact is assessed by comparing the rating level with the background sound level. Typically the greater the difference between the rating level and background sound level the greater the magnitude of impact, depending on context. A difference of +5 dB is likely to indicate an adverse impact and a difference of +10 dB is likely is likely to indicate a significant adverse impact, depending on context.

4 Environmental Noise Survey

To characterise the acoustic environment of the area, a long-term noise survey was carried out from the 2nd - 5th February 2024.

4.1 Measurement Methodology

Unattended monitoring was carried out at one measurement position (MP1) infront of the north-facing façade of the Newark Library. The sound level meter was installed inside a secure case attached to a lamppost approximately 3.5m above the ground and in free-field conditions i.e. more than 3m away from any other reflective surfaces. This measurement position was chosen to obtain background sound levels over a weekday/weekend period that are representative noise sensitive receptor. Ideally background sound monitoring would be taken at the most exposed noise sensitive receptor, which in this case is Russell House. However, the acoustic environment at Russell House is completely dominated by building services plant associated with Odeon/Costa Coffee. Therefore, background sound levels were taken at a location where true background could be obtained. This ensures that the assessment is robust because the background sound levels at this location are lower than at the assessment location, where the background is flatlined by noise from existing plant. Additionally, there was no secure location by Russell House for equipment to be left unattended. Measurements were also taken outside of Russell House (MP2) during night-time hours to obtain background sound levels at the receptor with plant associated with the Odeon/Costa running.

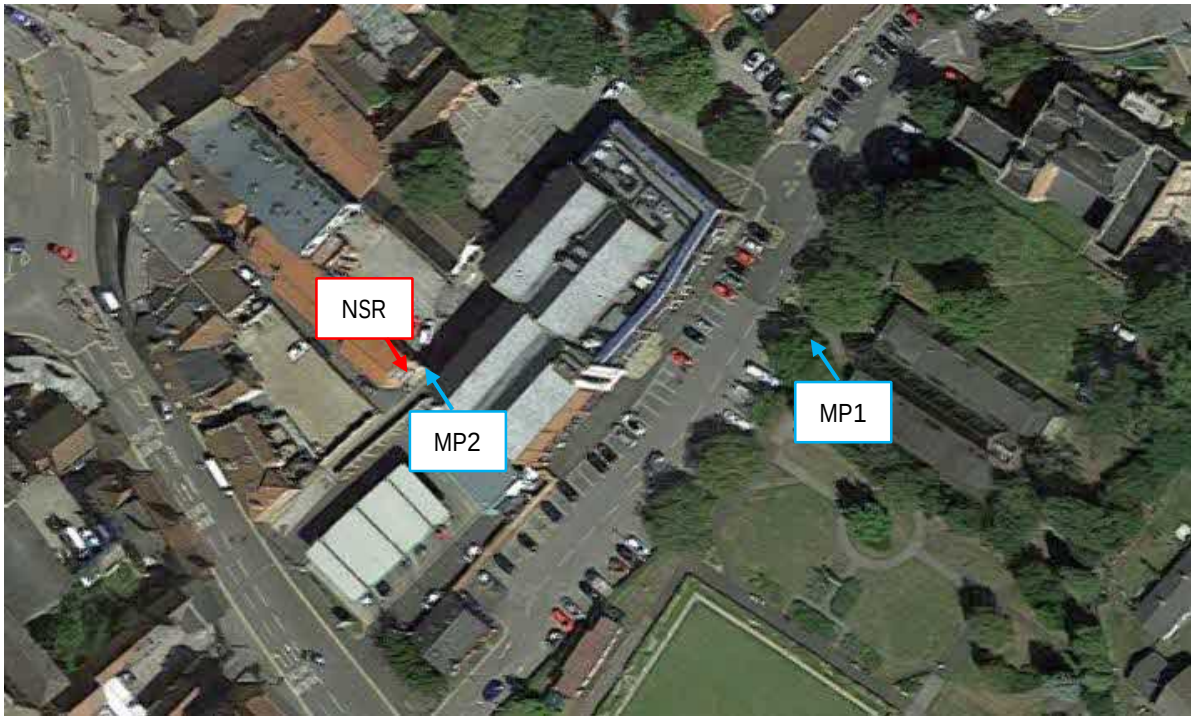


Figure 2.0 - Measurement Positions

4.2 Instrumentation

Equipment	Serial No.	Laboratory Calibration
Cirrus Optimus Green+ Class 1 Sound Level Meter	G303153	01/06/2023
Cirrus CR:515 Class 1 Acoustic Calibrator	96656	01/06/2023

Table 1.0 - Instrumentation

All sound level meters were field calibrated immediately before and after the measurement period and no significant drift (≤0.5 dB) occurred. Laboratory calibration by a third-party is carried out on all sound level meters every twenty-four months with all calibrators being calibrated every twelve months. All microphones were fitted with a protective windshield. Calibration certificates can be seen in Appendix C.

4.3 Weather Conditions

The conditions from 2nd - 5th February 2024 were considered suitable i.e. in accordance with those laid out in BS 7445-2:1991 and provided no significant uncertainty to the measured data.

4.4 Survey Results

Time History Graphs showing the results of the survey can be found in Appendix B. These graphs display the 15-minute L_{A90}, L_{A10} L_{Aeq}, and L_{AFmax} sound levels at each monitoring location throughout the survey period.

4.4.1 Background Measurement Results

The table below shows the L_{A90} measurements at MP1 throughout the daytime and night-time hours.

Measurement Position 1			
Daytime (07:00 - 23:00)	Typical $L_{A90,\ 15\ min}$ (mode)	Min. $L_{A90,\ 15\ min}$	Max. $L_{A90,\ 15\ min}$
Friday - 02/02/24 (14:00 - 23:00)	51	42	51
Saturday - 03/02/24 (07:00 - 23:00)	50	42	51
Sunday - 04/02/24 (07:00 - 23:00)	46	39	49
Monday - 05/02/24 (07:00 - 12:15)	48	47	59

Table 2.0 - Daytime Background Measurements - MP1

Measurement Position 1			
Night-time (23:00 - 07:00)	Typical $L_{A90,\ 15\ min}$ (mode)	Min. $L_{A90,\ 15\ min}$	Max. $L_{A90,\ 15\ min}$
Friday - Saturday - 02-03/02/24 (23:00 - 07:00)	38	36	42
Saturday - Sunday - 03-04/02/24 (23:00 - 07:00)	39	37	43
Sunday - Monday - 04-05/02/24 (23:00 - 07:00)	39	39	49

Table 3.0 - Night-time Background Measurements - MP1

The following table shows the dB $L_{A90,\ 15\ min}$ measured during night-time hours at Russell House, when plant associated with Odeon and Costa was running.

Measurement Position 2	
Night-time (23:00 - 07:00)	$L_{A90,\ 15\ min}$
Monday - 19/02/24 - 11:39	56

Table 4.0 - Night-time Background Measurements - MP2

5 Plant Noise Emission Criteria

The following plant noise criteria has been proposed for the daytime and night-time periods. It is proposed that the during daytime hours, plant noise emissions must not exceed the statistically most-repeated background sound level during the quietest day.

The plant associated with the Odeon/Costa runs consistently throughout night-time hours. Ideally, limits for mechanical plant noise emissions are to be set based on true background so that if for whatever reason the existing plant is removed or replaced, the plant emissions from the new plant do not then become the dominant source in terms of the background sound environment, thus ensuring that the assessment is robust. However, it is considered highly unlikely that the plant associated with the Odeon/Costa is to stop running, be replaced or removed. For several practical reasons, the external units cannot be relocated. Therefore, it is unlikely that plant noise emissions can be reduced to below the 'true' background sound level during night-time hours. Considering that it is highly unlikely that the plant from the Odeon/Costa is to stop running or be removed, it is therefore proposed that accumulative plant noise limit of 46dB(A) be set during night-time hours. This level is 10dB below the background measured at the noise sensitive receptor during night-time hours and if this level is not exceeded, it will not result in an increase to the background sound level when the plant associated with the Odeon/Costa is running. Also, if for whatever reason the plant is removed from the Odeon/Costa, the background sound environment will still be significantly reduced at the most exposed noise sensitive receptor. It should be considered that in 8.1 of BS 4142, it is noted that in some circumstances the background sound level can legitimately include industrial and/or commercial sounds that are present separate to the specific sound, including noise from building services plant.

Plant Noise Emission Criteria (dBA)	
Daytime (07:00 - 23:00)	Night-time (23:00 - 07:00)
46	46

Table 5.0 - Plant Noise Emission Criteria.

6 Plant Noise Impact Assessment

It is proposed that items of mechanical plant be located in a plant room to the rear of the building as well as on the external north-west facing façade. The items of plant that are to be housed internally, as well as the layout of plant room have not yet been finalised. Therefore, the plant noise assessment only considers plant that is to be situated externally on the north-west facing façade. Sound level data has been obtained from manufacturer datasheets quoted as either A-weighted sound pressure level at 1m or as a sound power level. The following table details the sound levels associated with all items of externally mounted mechanical plant associated with the development and predicts cumulative A-weighted sound pressure level at the closest noise sensitive receptors (Russell House) with all plant running simultaneously

Plant Ref/Plant Item	dBA @1m	dB LWA	Distance to NSR (m)	Screening Correction	A-weighted SPL @ NSR
S1 Weatherite IL200 S1		86	17.7	-0	54
S1/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	17.7	-0	37
S1/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	16.6	-0	38
S1/C3 Mitsubishi PUZ-ZM200YKA - Worst case - Heating	62	-	15.2	-0	38
S2/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	19.4	-0	36
S2/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	20.4	-0	36
DH1/C1 Mitsubishi PUZ-ZM71 - Worst case - Heating	49	-	14.2	-0	26
AC1/C1 Mitsubishi ZM35VKA - Worst case - Heating	46	-	14.2	-0	23
AC2/C2 Mitsubishi ZM35VKA - Worst case - Heating	46	-	14.2	-0	23
A-weighted total (dB) (All plant running simultaneously)					54

Table 6.0 - Noise Emissions from Proposed External Mechanical Plant Installations

6.1.1 Plant Noise Mitigation Measures

It is predicted that with the current site proposals, the plant noise emissions will greatly exceed the prevailing background sound levels. Therefore, mitigation measures have been proposed to reduce plant noise emissions. The plant schedule that has been provided by the M&E consultant proposes an inline attenuator for the Kitchen Extract. The following table shows the insertion loss values for each octave band centre frequency for the proposed attenuator.

Description	Insertion Loss (dB) at Octave Band Centre Frequency					
	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz
Kitchen Extract Attenuator	10	20	39	45	38	35

Table 7.0 - Sound Attenuator Insertion Loss Values

The following table predicts the plant noise emissions from with the recommended mitigation measures in-situ. Octave-band calculations have been carried out for the kitchen extract and the Air Handling-Units using the sound power levels stipulated in the manufacturer datasheets. These calculations are available upon request. The table below considers an attenuator with the same insertion loss values as shown in table 5 being implemented for each Air Handling-Unit.

Plant Ref/Plant Item	dBA @1m	dB LWA	Distance to NSR (m)	Screening Correction	A-weighted SPL @ NSR
S1 Weatherite IL200 S1		61	17.7	-0	28
S1/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	17.7	-0	37
S1/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	16.6	-0	38
S1/C3 Mitsubishi PUZ-ZM200YKA - Worst case - Heating	62	-	15.2	-0	38
S2/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	19.4	-0	36
S2/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	62	-	20.4	-0	36
DH1/C1 Mitsubishi PUZ-ZM71 - Worst case - Heating	49	-	14.2	-0	26
AC1/C1 Mitsubishi ZM35VKA - Worst case - Heating	46	-	14.2	-0	23
AC2/C2 Mitsubishi ZM35VKA - Worst case - Heating	46	-	14.2	-0	23
A-weighted total (dB) (All plant running simultaneously)					44

Table 8.0 - Noise Emissions from Proposed Mechanical Plant Installations (Attenuated)

The table above predicts that the plant noise emissions are likely to fall just below the specified daytime and night-time plant noise limits. However, considering that night-time limits have been set based on background sound measurements that contains plant noise from the Odeon/Costa, it is advised that plant noise levels are reduced to the lowest practicable level. The S1 and S2 condensers can be altered so that they run on a 'Low-level sound mode'. According to the manufacturer, this alteration means that the condensers can run at 3dB lower than the quoted sound pressure level in the manufacturer datasheet. The following table shows the predicted plant noise emissions for all externally mounted plant running simultaneously with the S1 and S2 condensers on low noise mode.

Plant Ref/Plant Item	dBA @1m	dB LWA	Diffuse Field Correction	Distance to NSR (m)	Screening/ Louvre Correction	A-weighted SPL @ NSR
S1 Weatherite IL200 S1		61		17.7	-0	28
S1/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	59	-		17.7	-0	34
S1/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	59	-		16.6	-0	35
S1/C3 Mitsubishi PUZ-ZM200YKA - Worst case - Heating	59	-		15.2	-0	35
S2/C1 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	59	-		19.4	-0	33
S2/C2 Mitsubishi PUZ-ZM250YKA - Worst case - Heating	59	-		20.4	-0	33
DH1/C1 Mitsubishi PUZ-ZM71 - Worst case - Heating	49	-		14.2	-0	26
AC1/C1 Mitsubishi ZM35VKA - Worst case - Heating	46	-		14.2	-0	23
AC2/C2 Mitsubishi ZM35VKA - Worst case - Heating	46	-		14.2	-0	23
A-weighted total (dB) (All plant running simultaneously)						42

Table 9.0 – Noise Emissions from Proposed Mechanical Plant Installations (Attenuated) – Low-noise Mode

Considering that the plant noise emissions specified in table 5 of this report are for all items associated with the site running simultaneously, including plant housed in the plant room. In order to comply these limits, plant noise emissions from all plant housed within the plant room must no exceed 41dB(A) at Rusell House.

7 Deliveries and Waste Collections

7.1 Delivery Noise

It is understood that the restaurant will require two deliveries per week, which will be made on a tail lift HGV. The deliveries shall take place within the hours of 07:00 - 22:00. The delivery vehicle will pull into the carpark at the front of the building and the goods will be transported manually on Once the delivery has been completed, the HGV will pull forward and leave the car park. Sound Measurements were taken of a HGV delivery being made at a similar restaurant in Arnold, Nottingham. The table below shows sound levels associated with the loading and unloading of goods from the HGV.

Source	Measurement Distance (m)	Time (mm:ss)	Sound Level dB $L_{Aeq, T}$	Sound Exposure Level (L_{AE})
Goods Loading and Unloading	6	13:10	71	100
HGV Engine Starting and Idling	5	00:20	76	89
HGV Reversing	5	00:21	78	91
HGV Pulling Off	7	00:13	76	88
HGV Passage	5	00:11	73	83

Table 10.0 - Individual Noise Sources - Delivery

The following table predicts the delivery noise levels at the receptor. It is considered that the restaurant building will screen all the delivery activity from the receptor. Subsequently, screening attenuation of -10dB (BS 5228:2009) has been applied to all activities associated with the delivery.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
HGV Reversing	5	38	-10	65	1	29
Goods Loading and Unloading	6	32	-10	75	1	40
HGV Engine Starting and Idling	5	34	-10	62	1	27
HGV Pulling Off	7	34	-10	64	1	29
HGV Passage	5	44	-10	54	1	19
HGV Pulling Off	7	64	-10	59	1	23
HGV Passage	5	63	-10	59	1	23
Total dBLAeq, 1hour						41

Table 11.0 - Delivery Noise Emissions

7.2 Waste Collection

It is understood that waste from the restaurant is stored in bins provided by a private contractor employed by the franchisee. Subsequently, the company making the waste collections is currently unknown, meaning that sound level data which relates specifically to waste collections at this particular site cannot be obtained due to the potential difference in vehicles, bins and the method of collection. It is understood that waste collections will take place once a week during daytime hours. BS 5228:2009 provides sound level data for a refuse wagon quoted at 10m, as shown in the table below.

Source	Octave Band Sound Pressure Levels @10m (Hz)								A-weighted sound pressure level $L_{Aeq,\ T}$ @10m
	63	125	250	500	1k	2k	4k	8k	
Refuse Wagon	88	81	79	76	72	70	64	60	78

Table 12.0 - Refuse Wagon Sound Levels

It is assumed that each waste collection will take place over a 5-minute period. Therefore, the activity on-time correction has been applied based on a 1-hour reference period. It is assumed that the refuse wagon will pull into the same space as the delivery vehicle 49m away from the most exposed noise sensitive receptor to the east. The following tables show the sound levels associated with the refuse wagon at the most exposed noise sensitive receptors after the on-time correction has been applied.

Source	dB $L_{Aeq,\ T}$ @10m	On-time (m)	On-time Correction (dB)	dB $L_{Aeq,\ 1\text{-hour}}$ @10m	Receptor Distance	Screening Correction	dB $L_{Aeq,\ 1\text{-hour}}$ @Receptor
Refuse Wagon	78	5	-11	67	5	-0	73

Table 13.0 - Waste Collection Noise Emissions

7.3 Determining the Specific Sound Level

In order to carry out the BS 4142 assessments the specific sound level must be determined. BS 4142 stipulates a 1-hour daytime reference period. As such, the typical worst-case daytime 1-hour period considers an hour where all building services plant is running simultaneously at the daytime noise limit of 46 dB(A) and a delivery is being made. It is understood that deliveries will only take place between the hours of 07:00 and 22:00. The following table shows the specific sound level for the absolute worst-case 1-hour daytime period, where deliveries are to take place within the same 1-hour daytime period with all building services plant running simultaneously. It is acknowledged that this scenario will only occur occasionally.

Source	dB $L_{Aeq,\ 1hour}$
Fixed Plant Installations	46
Delivery Noise	41
Specific Sound Level $dB_{LAeq,1hour}$	47

Table 14.0 - Specific Sound Level - Daytime - Typical Worst Case Including Deliveries

Although it is highly unlikely that waste collections and goods deliveries will take place within the same hour, these events have been factored into a one-hour calculation to provide an absolute worst-case scenario. The table below shows the specific sound level for the absolute worst-case 1-hour daytime period.

Source	dB $L_{Aeq, 1hour}$
Fixed Plant Installations	46
Delivery Noise	41
Waste Collection	73
Specific Sound Level $dB_{LAeq,1hour}$	73

Table 15.0 - Specific Sound Level - Daytime - Absolute Worst-case

8 BS 4142:2014 Assessments

8.1 BS 4142 Assessment Tables

Daytime Assessment - Typical Worst-Case Including Deliveries			
Assessment		Relevant Clause	Commentary
Specific Sound Level @ Noise Sensitive Receptor	47 $dB_{LAeq,1hour}$		Calculated based on all items of plant running simultaneously and stock deliveries taking place within the same 1-hour period. Table 14.0 for determination of specific sound level.
Background Sound Level	46 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	The statistically most-repeated $L_{A90,15min}$ value during the quietest day. Shown in Table 2.0 of this report.
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity	+3 dB	9.2	The sound of loading and unloading goods can be impulsive in nature but the physical distance from the source to the receptor as well as the presence of some screening means it is likely to be 'just perceptible'.
Rating Level at Receiver	50 dB_A	9.1	
Excess of rating level over background level	(50 - 46) = +4 dB_A	11	
Impact	The Assessment indicates that adverse impact is not likely, depending on context	11	The excess of rating level over background sound level is +4 dBA, which is 1dBA below the level of difference that indicates likelihood of adverse impact, depending on context

Table 16.0 - BS 4142: 2014 Assessment - Daytime Assessment - Typical Worst-Case Including Deliveries

Daytime Assessment - Absolute Worst-Case			
Assessment		Relevant Clause	Commentary
Specific Sound Level @ Noise Sensitive Receptor	73 $dB_{LAeq,1hour}$		Calculated based on all items of plant running simultaneously , waste collections and stock deliveries taking place within the same 1-hour period. Table 15.0 for determination of specific sound level.
Background Sound Level	46 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	The statistically most-repeated $L_{A90,15min}$ value during the quietest day. Shown in Table 2.0 of this report.
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity	+6 dB	9.2	The sound of waste being tipped from a height is impulsive in nature. Due to the proximity to the receptor, it is considered to be 'clearly perceptible'.
Rating Level at Receiver	79 dB_A	9.1	
Excess of rating level over background level	(79 - 46) = +33 dB_A	11	
Impact	The Assessment indicates that significant adverse impact is likely, depending on context	11	The excess of rating level over background sound level is +33 dBA, which is 23dBA below the level of difference that indicates likelihood of significant adverse impact, depending on context

Table 17.0 - BS 4142: 2014 Assessment - Daytime Assessment - Absolute Worst-Case

9.2 Discussion

9.2.1 Overview

The assessment of adverse impact at the noise sensitive receptors considered to be the worst affected has been employed by the measured sound levels from the environmental noise survey. The measurement and subsequent assessment have been carried out in accordance with methodology outlined in BS 4142:2014. BS 4142 requires that human response to activity sound is rated via numerical values as well as careful consideration for the context in which the sound exists.

The assessments at the most exposed noise sensitive receptor during the typical worst-case daytime period and both night-time scenarios indicate that adverse effect is not likely, depending on context. The absolute worst-case daytime assessment, in the scenario where a delivery and a waste collection are to take place in the same hour, indicates that significant adverse impact is likely, subject to context.

9.2.2 Context

It is stated in section 11 of BS 4142: 2014 that **"**where the initial estimate of the impact needs to be modified due to context, take all pertinent factors into consideration, including the following.**"**

1) The character and level of the residual sound compared to the character and level of the specific sound. Considering that the specific sound will exist within proximity of existing plant compounds, it is reasonable that the nearby residents would expect an acoustic climate which includes noise from building services plant. Additionally, the sound of HGV movements, which is likely to be masked by road traffic noise and is not distinguishable from the residual sound environment.

2) The sensitivity of the receptor and whether the dwellings will already incorporate design measures that secure good internal and/or another acoustic conditions, such as:

   i) Façade insulation treatment. It is understood that the windows at Russell House all comprise secondary glazing. Typically, even the most basic double-glazing systems provide at least 24dB of attenuation when closed. This amount of attenuation should ensure that the rating level is well below the internal ambient noise level criteria of BS 8233:2014 at the closest property during the typical worst case including when stock deliveries are taking place.

   ii) Ventilation and/or cooling that will reduce the need to have windows open. BS 8233:2014 suggests that 15dB of attenuation can be achieved with a partially opened window. This amount of attenuation should ensure that the rating level for the typical worst-case is below the internal ambient noise level criteria of BS 8233:2014, even when deliveries are taking place. It should be considered that waste collections are only occurring very occasionally and should therefore not result in increases to internal ambient noise levels within the dwellings even if he windows to remain open throughout the day.

9.2.3 Rating Level Assessment

BS 4142 requires the assessment of acoustic features. Considering that the specific sound is currently not present, feature corrections have been applied based on observations which were made when taking sound measurements which would be used for the specific sound, as well as information gathered from an existing fast-food restaurant.

The sound of the loading and unloading of goods can be impulsive, however, due to the physical distance to the receptors as well as the presence of acoustic screening, the impact of impulsivity from the loading and unloading of goods is not considered 'just' perceptible against the background. Subsequently, a 3dB penalty for impulsivity has been applied for the assessment which includes deliveries taking place. Impulsivity has been deemed to be 'clearly' perceptible when refuge collections are taking place. The sound of waste being tipped from a height is impulsive in nature and this taking place within proximity of the receptor result in it being 'clearly perceptible'.

For fixed plant installations, considering that there will be several items of plant running simultaneously, it is possible that the specific sound will contain tonal components. However, as long as the plant noise emissions are compliant with the specified limits, they will be well below the background level at the receptor which is dominated by plant noise from the Odeon/Costa and should not be perceptible at the receptor.

The sources associated with the restaurant do not contain perceivable on/off characteristics and therefore, no penalty has been applied for intermittency. The noise sources from the site also do not possess other characteristics that are particularly discernible from the residual noise environment.

9.2.4 On-time Impact

BS 4142:2014 uses a reference period of 1-hour during the daytime and 15-minutes assess the likelihood of adverse impact. The activities within these periods are required to be typical of the operation under investigation both in terms of level and duration. This identifies whether the sounds associated with the activity have the likelihood of adverse impact, depending on context. The proportion of time the activity takes place within extended periods of time greater than the one-hour reference period provides part of the acoustic context that the BS 4142:2014 assessment is subject to.

It is understood that the restaurant's opening hours are 06:00 – 23:00 with deliveries and waste collections takin place between 07:00 and 22:00. However, there will be periods where the site will be busier. The assessment has been based on the typical worst-case 1-hour scenario and a worst-case 15-minute night-time period. It is therefore considered that the assessment accurately represents the impact of site activity during the busiest 1-hour period and the worst-case 15-minute night-time period, therefore the noise environment will be improved during all other time periods.

9.2.5 Uncertainty

Reasonable steps have been undertaken to reduce uncertainty in both measurement and assessment in line with section 10 of BS 4142:2014. These steps include the use of class 1 instrumentation, measurements being taken in suitable weather conditions, the measurement locations chosen to obtain background sound levels being representative of the assessment locations and the number of measurements taken. Considering that the assessment has been carried out for a proposed site, uncertainty has been reduced by taking measurements of a comparable car park with the same road surface, as well as observations made at existing fast-food restaurants to understand the typical scenarios that are likely to take place. Uncertainty has been reduced by the inclusion of considered and supported contextual issues, as they provide a greater understanding of the residual acoustic environment and the level of variability in sound emission from the source.

10 Assessment of Impacts

The significance of sound of a commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context. An initial estimate of the impact of the specific sound is made by subtracting the background level.

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on
the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

Based on the above, the assessment of the typical worst-case including when stock deliveries are taking place indicates that adverse impact is not likely. Contextual considerations, notably the existing acoustic environment and the closest receptor incorporating acoustic design measures result in no change in the assessment outcome.

The assessment of the absolute worst-case daytime period indicates that significant adverse effect is likely. It should however be considered that these collections are only likely to take place over a maximum 5-minute period just once a week.

11 Conclusions

A background sound survey was undertaken to inform the assessment of the likelihood of adverse impact from the proposed Fast-food restaurant at an existing commercial unit at London Road, Newark, NG24 1TN. The sound survey was carried out in compliance with BS 4142 as detailed in this report. The sound survey considers the impacts at residential dwellings to the east of the site.

Long-term environmental noise monitoring was carried out at one location representing the true background of Russell House, the most exposed noise sensitive receptor to the north-west of the site. Additionally, background sound measurements that were influenced by noise from building services plant associated with the neighbouring sites were taken at the most exposed noise sensitive receptor for comparison. Noise measurements were taken from other sites to represent noise sources that will be associated with the proposed site, such as deliveries. Sound levels associated with noise sources such as mechanical plant and refuse collections have been established from Manufacturer datasheets and British Standards.

Plant noise emission limits have been determined that are not to be exceeded at Russell House.

It is predicted that the external fixed installations in the current proposals will exceed the specified plant noise emission limits at the most exposed noise sensitive receptor. As a result, mitigation measures in the form of in-line attenuators have been recommended in this report to reduce the noise impact of building services plant. Additionally, it is recommended that the S1 and D2 condensers run on the low-noise mode, as specified by the manufacturer. The plant noise emissions with these mitigation measures in-situ are predicted to reduce the contributed from the external plant to below the specified plant noise limits.

Limits have been set for the plant that will be housed inside the plant room so that the cumulative plant noise limits are not to be exceeded at the noise sensitive receptor. The plant layout for the plant room is to be approved by a suitably qualified acoustician once finalised.

The assessment of the typical worst-case including when stock deliveries are taking place indicates that adverse impact is not likely. Contextual considerations, notably the existing acoustic environment and the closest incorporating acoustic design measures result in the assessment outcome.

The assessment of the absolute worst-case daytime period indicates that significant adverse effect is likely. It should however be considered that these collections are only likely to take place over a maximum 5-minute period just once a week.

This Report concludes that from the established sound levels and subsequent BS 4142 assessment, that the proposed Fast-food Restaurant should not provide adverse impact to nearby residents if the mitigation measures stipulated in this report are adequately implemented.

This Report has been prepared by:

Encon Associates Limited
10 Chapel Lane
Arnold
Nottingham
NG5 7DR

[redacted]

Signed for and on behalf of Encon Associates Limited

[redacted]

Ben Phipps BSc (Hons), AMIOA
Acoustic Consultant
Date: 14th February 2024

Appendix A – Acoustic Terminology & Definitions

Sound Pressure	The fluctuations in air pressure, from the steady atmospheric pressure, created by sound, measured in pascals (Pa).
Sound Pressure Level (SPL)	The sound pressure measured on a decibel scale relative to a standard reference pressure of 20μPa (20x10-6 Pascals).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
Frequency (Hz)	The pitch of the sound, measured in Herts (Hz)
Integrating Sound Level Meter	An instrument used for measuring sound levels with the capacity to perform calculations to derive other parameters.
Calibration	A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level. This is performed in the field before and after measurement and by a laboratory every year calibrators and every two years for Sound Level Meters.
A-Weighting, dB(A)	A frequency waiting devised to attempt to take the fact that human response to sound is not equally sensitive at all frequencies into account.
Z-Weighting	A zero frequency weighting (often referred to as unweighted).
Attenuation	Noise reduction, measured in decibels.
Ambient Sound Level $L_{Aeq.T}$	The total encompassing sound in a given situation, at a given time. Usually composed of sounds from many sources, near and far.
Residual Sound Level $L_{Aeq.T}$	The ambient sound remaining when the specific sound source is suppressed to a degree it does not contribute to the ambient sound.
Specific Sound Level $L_{Aeq.T}$	The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
Rating Level $L_{Ar, tr}$	The specific sound level plus any adjustment for the characteristic features of the sound.
Background Sound Level $L_{A90.T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Sound Exposure Level , SEL (L_{AE})	A measure of A-weighted sound energy used to describe noise events such as the passing of trains; it is the A-weighted sound pressure level which, is occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event.
Frequency Analysis	Analysis of a sound into its frequency components. Commonly 1/1 or 1/3 octave bands
Frequency Spectrum	A graph resulting from frequency analysis and showing different levels of the signal in the various frequency bands.
Octave-bands	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
Noise Index	A method of evaluating or rating a noise, usually by assigning a single number to it, based on some combination of its physical parameters (sound pressure level, frequency, duration) and other factors such as time of day, tonal characteristics and impulsive characteristics.
Leq, T	Otherwise referred to as the 'continuous equivalent noise level' of a period of time (T). This is the steady noise level which contains the same amount of energy as the time varying sound level that was recorded.
Lmax,T	The maximum RMS sound pressure level that occurs within a specified time period. It is used often to describe occasional loud noise events that may have little influence on the Leq but will have an effect on the overall acoustic environment. The time weighting (Fast or Slow) is usually specified.

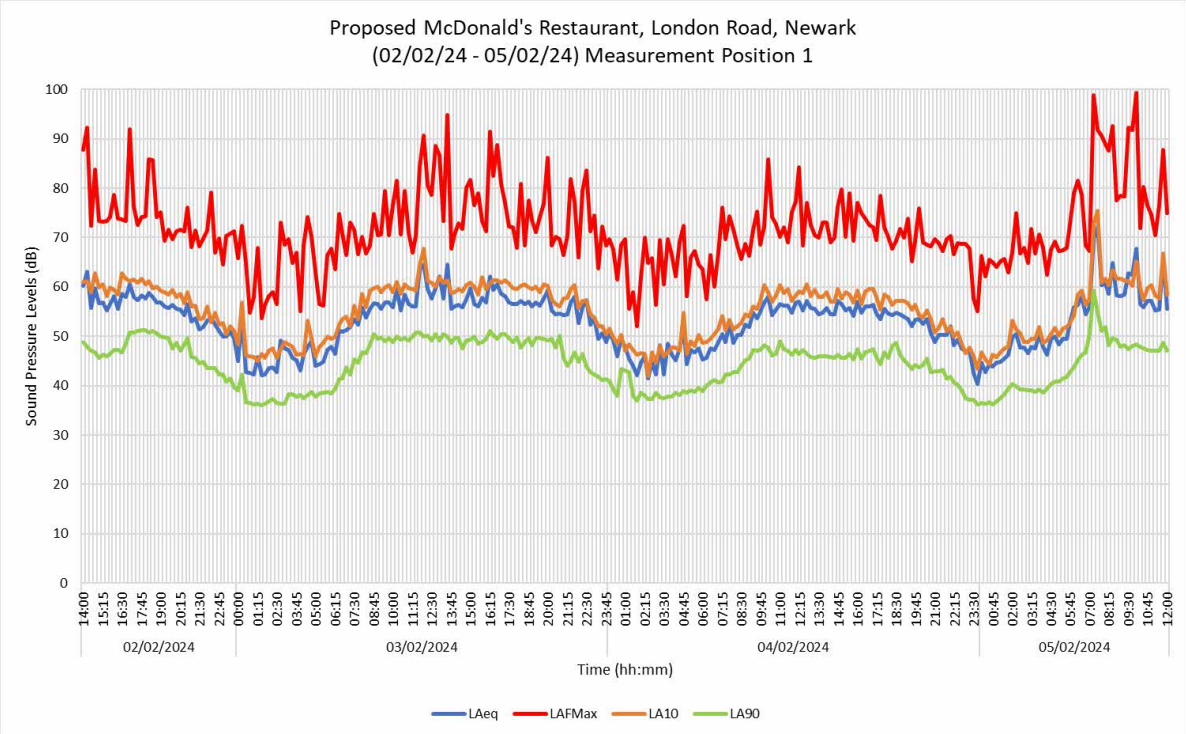
L90, T	The noise level exceeded for 90% of the specified time period (T). It is often used to characterise the background noise.
L10, T	The noise level exceeded for 10% of the specified time period (T). It is often used to characterise road traffic noise.
Free-Field	A situation where the radiation from a sound source is completely unaffected by the presence of reflective surfaces. In terms of environmental noise measurement, it is usually taken to mean at least 3.5m away from 3.5m away from reflective surfaces with the exception of the ground.
Façade Noise Level	A noise level measured within 3m of a building façade, which contains a contribution arising from reflection of sound at the façade. The difference between the façade level and free-field level is described as the façade correction factor.
Noise Sensitive Receptor	Premises that are used for purposes sensitive to noise and that require protection.
Line Source	A source of sound that as distance increases away from the source it still appears large in one dimension. Attenuation of this form of source occurs at a distance of (a/π) where a is the largest dimension of the source.
Point Source	A source of sound that as distance increases away from the source it appears as a point in space. Attenuation of this form of source occurs at a distance of (b/π) where b is the smallest dimension of the source.
Time Weighting	One of the standard averaging times (Fast, Slow or Impulsive) used for the measurement of RMS sound pressure level in sound level meters, specified in ISO 61671-1.
Rw	Single number quantity which characterises the airborne the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
DnT,w + Ctr	A single value that characterises the airborne sound insulation performance using the Ctr: spectrum adaption terms described in BS EN ISO 717-1. The value is based on field measurements and the value represents total sound transmission including flanking sound, not just the partition.

The table below presents an indication of sound levels associated with the environment starting from 0dB (the threshold of hearing) to 140dB (The threshold of pain).

Sound Level	Location/Activity
0 dB(A)	Threshold of Hearing
20 - 30 dB(A)	Inside Quiet Bedroom at Night
30 - 40 dB(A)	Inside a Living Room During the Day
40 - 50 dB(A)	Inside Typical Office
50 - 60 dB(A)	Inside a Car
60 - 70 dB(A)	Typical High Street
70 - 90 dB(A)	Inside Factory
100 - 110 dB(A)	Burglar Alarm at 1m
110 - 130 dB(A)	Jet Aircraft on Take Off
140 dB(A)	Threshold of Pain

The 'A' denotes the A-weighting scale used to replicate the frequency response of the human ear.

Appendix B - Time History Graph



Appendix C – Instrument Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **02 June 2023** CERTIFICATE NUMBER **193047**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
T.Goodrich
Electronically signed:
[redacted]

Outdoor Kit Calibration Information

Instrument information

Manufacturer:	Cirrus Research plc
Model:	CK:685
Preamp Model	MK:172
Microphone Serial Number	2290
Primary Calibration Certificate Number	193044

Summary

Date of calibration: 01 June 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
This information is in addition to the primary calibration certificate for the sound level meter. The calibration certificate number is shown above and should be used in conjunction with this additional information.

The sound level meter detailed above has been calibrated to the published test and calibration data as detailed in the instrument handbook, using the techniques recommended in the standards to which the instrument has been designed.

All calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

The microphone capsule was calibrated using an electrostatic calibration system to produce the frequency response and a reference acoustic source for the final sensitivity testing.

In addition to the calibration of the complete sound level meter in its standard configuration, (instrument, MV:200 series preamplifier and microphone capsule), the sound level meter and microphone capsule were tested with the MK:172 preamplifier in place of the MV:200 series.

The sound level meter, G303153 , has been tested with Outdoor Microphone/Preamplifier Type MK:172 Serial Number 2290 and conforms to the requirements of the standards stated in the instrument user manual.

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **02 June 2023** CERTIFICATE NUMBER **193044**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
T.Goodrich
Electronically signed:

[redacted]

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G303153	
Class:	1	
Firmware version:	5.8.3251	

Test summary

Date of calibration: 01 June 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

CERTIFICATE OF CALIBRATION

Certificate Number: **193044**

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Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	102.15 kPa	Temperature:	20.6 °C	Humidity:	49.3 %
After	Pressure:	102.16 kPa	Temperature:	20.8 °C	Humidity:	49.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TGA1241	257309
Attenuator	Cirrus Research	ZE:952	78135
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 11542F

Microphone

Model: MK:224

Serial number: 214523A

Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **30 May 2023** CERTIFICATE NUMBER **193048**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:
[redacted]

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 214523A

Calibration procedure

Date of calibration: 30 May 2023

Open circuit: 41.6 mV/Pa

Sensitivity at 1 kHz: -27.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 102.50 kPa

Temperature: 21.0 °C

Humidity: 44.0 %

CERTIFICATE OF CALIBRATION

Certificate Number: **193048**

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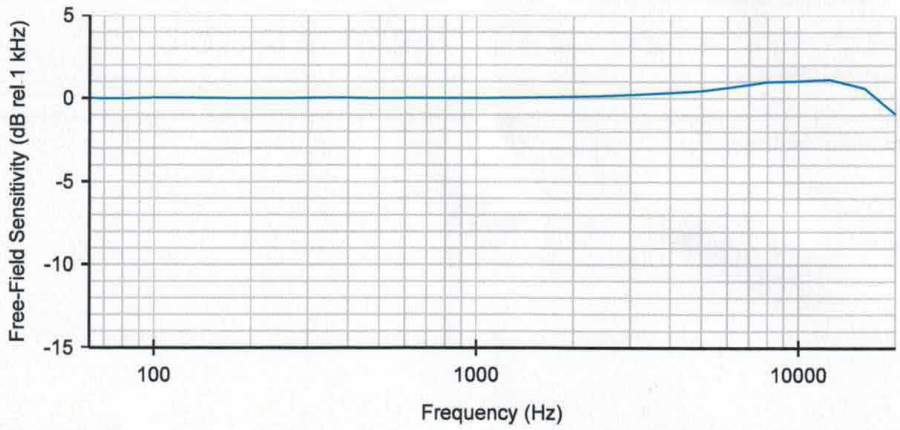
Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	**-0.01**	**-0.17**
80	-0.02	-0.08
100	0.02	0.00
125	**0.02**	**0.04**
160	0.01	0.05
200	-0.01	0.05
250	**-0.01**	**0.05**
315	0.02	0.05
400	0.01	0.06
500	**-0.01**	**0.03**
630	0.00	0.04
800	0.00	0.03
1 000	**0.00**	**0.02**
1 250	0.01	0.00
1 600	0.05	-0.04
2 000	**0.09**	**-0.09**
2 500	0.13	-0.17
3 150	0.23	-0.31
4 000	**0.33**	**-0.52**
5 000	0.45	-0.86
6 300	0.71	-1.33
8 000	**1.00**	**-2.12**
10 000	1.04	-3.55
12 500	1.14	-5.34
16 000	**0.62**	**-7.30**
20 000	-0.96	-10.04

Free-Field Frequency Response : Graphical



CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **02 June 2023** CERTIFICATE NUMBER **193043**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory
T.Goodrich
Electronically signed:

[redacted]

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc **Notes:**
Model: CR:515
Serial number: 96656
Class: 1

Test summary

Date of calibration: 01 June 2023

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC60942_2003 Annex A to Class 1. This has been confirmed by Laboratoire National d'Essais (LNE), PhysikalischTechnische Bundesanstalt (PTB) and APPLUS (APPLUS).

Notes:

CERTIFICATE OF CALIBRATION

Certificate Number: **193043**

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 102.08 kPa
Temperature: 21.5 °C
Humidity: 50.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0994818
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Initial Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	93.68	93.69	93.69	**93.69**	-0.31	±0.40	0.11 dB
Distortion (%)	< 3.00	0.53	0.44	0.43	**0.46**	0.46	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	**1000.3**	0.3	±10.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.00	93.98	94.01	**94.00**	0.00	±0.40	0.11 dB
Distortion (%)	< 3.00	0.39	0.33	0.42	**0.38**	0.38	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	**1000.3**	0.3	±10.0	0.1 Hz

End of results

Appendix D - Proposed Plant Layout