ATKINS

Child House Camden

Plant Noise Impact Assessment

Mayor's Office for Policing and Crime (MOPAC)

3 January 2018

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1. Introduction

Atkins has been commissioned by Mayor's Office for Policing and Crime (MOPAC) to undertake a noise impact assessment to support the planning application for the installation of new and replacement items of external plant at Alexandra Ciardi House, 7-8 Greenland Place, Camden, NW1 0AP.

Three external Variable Refrigerant Flow (VRF) units, two condensing units, and one Air Handling Unit (AHU) are proposed to be located at the roof level of the four-storey building, as shown in Figure 3-1. It is understood that the units will operate between the hours of 10:00 to 20:00 Monday to Saturday, and 10:00 to 13:00 on Sundays.

This report details the noise impact assessment carried out, and provides recommendations for noise mitigation.

- Section 2 sets out the assessment criteria and methodology in line with BS 4142.
- Section 3 presents the details of the baseline noise survey of the site, and
- Section 4 describes the noise impact assessment results and mitigation.
- The key points are then summarised in Section 5.

A glossary of acoustic terms used in this report is located in Appendix A.

2. Assessment Criteria and Guidance

The methodology for undertaking this assessment has been taken from BS4142, as described below.

2.1. BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound

BS4142:2014 describes methods for rating and assessing sound of an industrial and/or commercial nature, including, *"sound from fixed installations which comprise mechanical and electrical plant and equipment".* Therefore, it is appropriate to use this standard for this assessment.

The methods described in this British 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.

BS4142:2014 requires the calculation of a rating level ($L_{Ar,Tr}$) based on the specific sound level of the industrial or commercial source ($L_{Aeq,Tr}$) at the affected receptor and penalties are included for acoustic features inherent in the plant that may attract attention. This includes tonal notes, distinct impulses, and intermittency of operation. The background sound level ($L_{A90,T}$) measured at the receptor is subtracted from the rating level and the difference is compared against the following impact significance criteria, taking into account the context of the proposed development and local conditions:

- *"Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *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 source having a low impact, depending on the context."*

In section 11 of the Standard, BS4142:2014 states that *"adverse impacts include, but not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact".*

2.2. Camden Council

Camden Council were contacted prior to undertaking the noise assessment to confirm their specific criteria for the assessment; at the time of writing, a response has not been received. The design team has recommended designing the proposed external plant to produce sound levels at 10dB below background sound level.

3. Baseline Noise Survey

3.1. Site Description and Location

Alexandra Ciardi House is an existing building located at 7-8 Greenland Place in Camden, NW1 0AP. The site is located between Greenland Road and Greenland Street which are located off Camden High Street. The site is surrounded predominantly by commercial buildings with some residential dwellings on the upper floors.

An aerial view showing the proposed location of the plant and the nearest noise sensitive receptors in the assessment is represented in Figure 3-1.

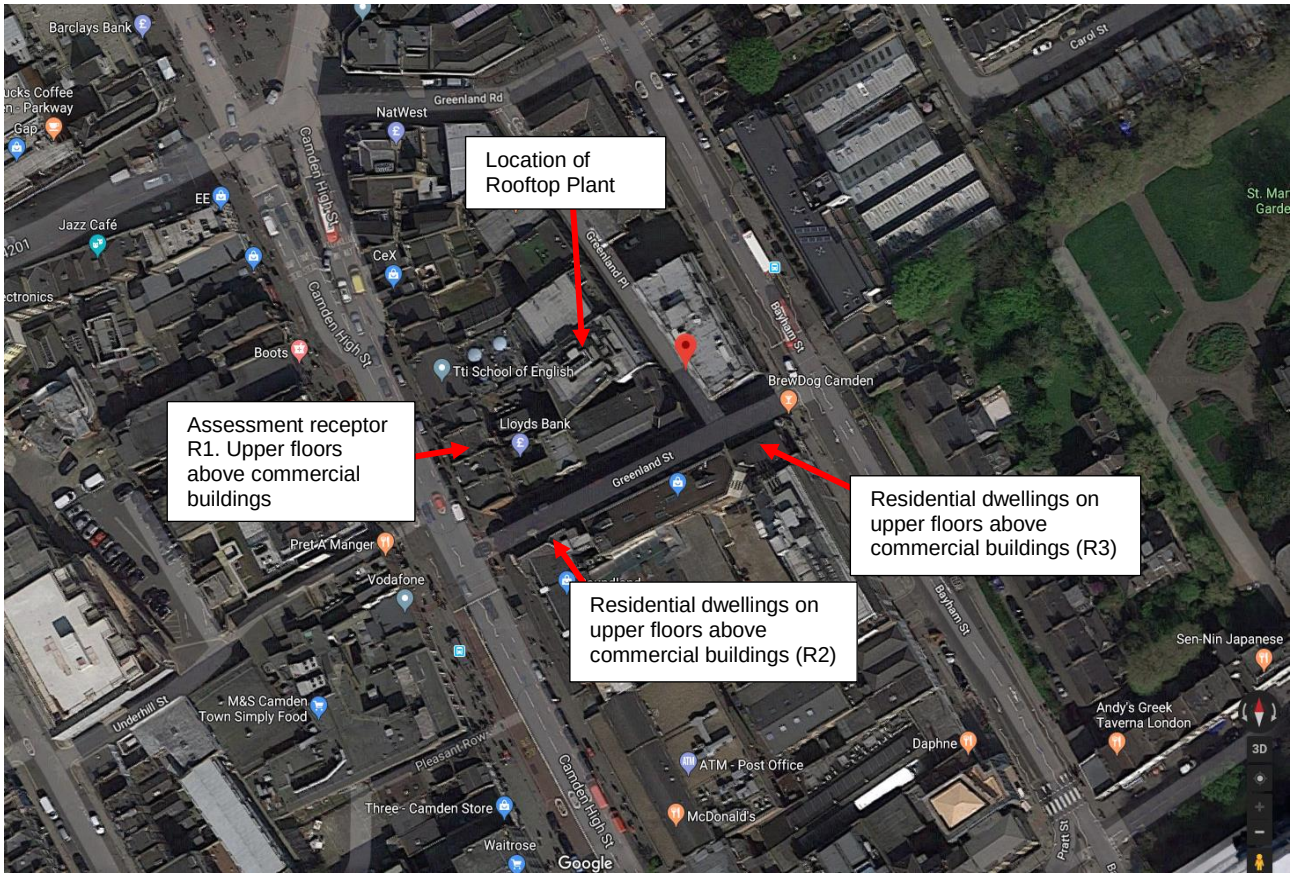

Figure 3-1 Aerial view of the site taken from Google Maps

The nearest noise sensitive properties are the residential dwellings on the upper floors of the mixed use buildings along Camden High Street, southwest of the site (Reference R1 in Figure 3-1). Given the proposed location of the plant, the rear of these properties are considered to be the most exposed facade to the noise emissions from the proposed plant units. There are further residential dwellings on the upper floors of the mixed use buildings along Greenland Street, South and Southeast of site (Reference R2 and R3), but at a further distance to the plant location.

3.2. Survey Methodology

A baseline noise survey was carried out at the site on Tuesday 12th December 2017 between the hours of 13:30pm and 16:00pm to establish the background sound levels during 'typical' conditions in the local area.

Short term sample noise measurements were taken at three locations (A, B, C) to obtain background sound levels for the assessment, shown in Figure 3-2.

All noise measurements were 15 minutes duration and taken under façade conditions (approximately 1m from a wall or reflective surface). During each measurements, the active noise sources and meteorological conditions including wind speed and direction were noted.

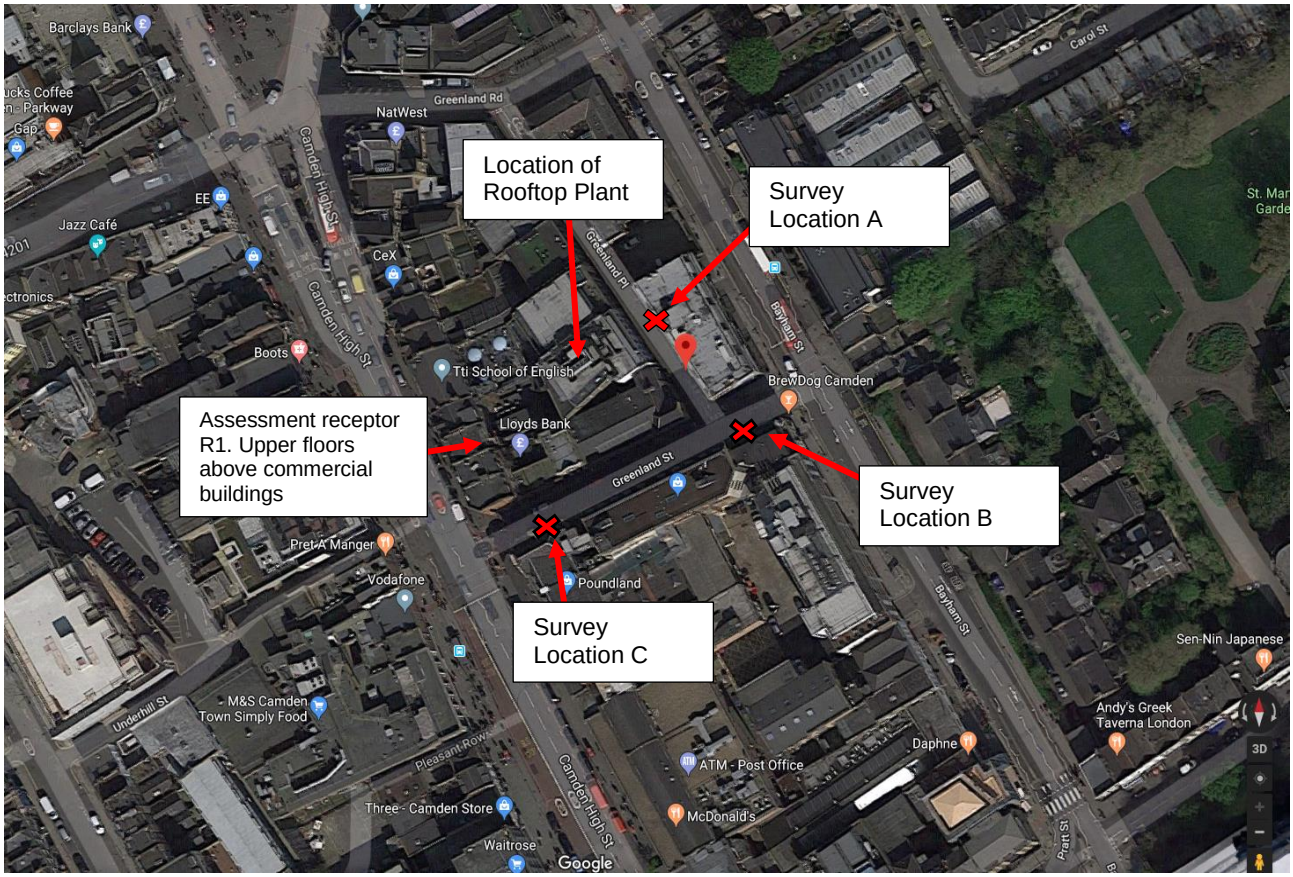

Figure 3-2 Site and survey measurements locations, aerial view taken from Google Maps

Sound level measurements were taken using a 01dB Fusion sound level meter, which conforms to the specification of sound level meters of Class 1 as given in BS EN 616721:2013.

The sound level meter was placed on a tripod with the microphone at 1.5m above the local ground level, and a windshield fitted to the microphone, using 'fast' time averaging. The sound level meter was field calibrated using a 01dB Cal 21 acoustic calibrator, both before and on completion of the noise survey, and no drift in calibration was observed.

Table 3-1 summaries the equipment used of the survey and full UKAS calibration certificates are available on request.

Table 3-1 Instrumentation details

Type	Manufacturer	Model	Serial	Last Laboratory Calibration
Sound Meter	01dB	Fusion	11199	27/10/2016
Microphone	GRAS	40CE	233344	27/10/2016
Preamplifier	01dB	Pre No22	1605096	27/10/2016
Calibrator	01dB	CAL21	34565046	28/10/2016

3.3. Survey Results

During the survey, the dominant source of noise was local road traffic noise from Camden High Street, Greenland Street and/or Bayham Street. Also, beeping sounds from the pedestrian crossings on Camden High Street and Bayham Street, pedestrians conversing and noises from the movement of suitcases being rolled along the road/pavement could be heard. However, it is considered that road traffic is the dominant source of noise contributing to the background sound level at all receptors.

During the survey, the weather conditions were noted as dry with approximately 70% cloud cover. Wind speeds were measured below 5m/s and in a South Westerly direction. The air temperature was approximately 3°C throughout the survey.

The sound levels measured during the survey on the 12th December 2017 are presented in Table 3-2, and include the following metrics, where the L_{A90} represents the Background Sound Level specifically relevant to this assessment;

- L_{Aeq},T The A-weighted equivalent continuous sound level over the measurement period;
- $L_{A90,T}$ The A-weighted sound level exceeded for 90% of the measurement period; and
- $L_{AF,max}$ The maximum A-weighted sound level during the sample period, measured using a fast time weighting.

Table 3-2 Measured sound levels

Location	Time	$L_{Aeq, 15mins}$ dB	$L_{A90, 15mins}$ dB	$L_{Max, T}$ dB
A	14:00	60.2	55.0	78.8
	15:32	59.8	55.0	72.9
B	14:23	67.8	59.1	83.8
	15:16	70.7	59.8	96.9
C	14:42	66.2	59.4	86.3
	15:00	65.7	60.4	81.3

From the measured results a typical background sound level of 55dB L_{A90}, measured at location A is considered representative for this assessment, as it is the lowest measured L_{A90} during the survey period, it will be the worst-case scenario.

4. Assessment of Noise Impact

This assessment considers sound emissions from the proposed external plant units only, which are to be located on the roof top of the existing four storey building, as shown in Figure 3-2.

The cumulative sound level from the proposed new plant units has been predicted at the nearest noise sensitive receptor, which is considered to be the residential dwellings on the upper floors at 146 Camden High Street, approximately 20m from the proposed plant locations. It has been assumed that there is likely to be direct line of sight from the rooftop plant location to the residential fourth/fifth floor windows.

As provided in Section 3, the baseline survey results indicate that 55dB $L_{A90,15minutes}$ is considered representative of the typical Background Sound Level at the nearest representative property.

The standard uses this existing background noise at the assessment location, to rate the predicted cumulative noise level of the specific source at the assessment location.

4.1. Noise Sources

4.1.1. Plant Operation

The VRF and condensing units are convertor driven and therefore the simultaneous operation of the plant will be down to the demand during the operating hours, which is as yet unknown. For the purposes of the assessment, it has been assumed that all plant are operational at the same time during the measurement period.

4.1.2. Plant Source Sound Levels

The details of the plant items, as provided by the design team, include descriptions and sound power levels for the proposed plant items as presented below and in Table 4-1, with details of the proposed attenuator for the AHU in Table 4-2, included in the scheme. The manufacturer's sound power data in octave bands have been used for the assessment.

- The proposed replacement VRF units to be located on the rooftop of the site building are 2No. Mitsubishi PURY-P300YLM-A1 (-BS) and 1No. Mitsubishi PURY-P250YLM-A1(-BS).
- The proposed condensing units to be located on the rooftop of the site building are 2No. Mitsubishi PUHZ-ZRP60VHA.
- The proposed AHU unit to be located on the rooftop of the site building is 1No. Nuaire XBC25.
- The proposed attenuators for the AHU unit to be located on the rooftop of the site building are XBC25-HS-MS10 for the Supply & Extract

Table 4-1 Sound power levels of plant

Frequency Hz (dB)									**dBA**
Unit	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
PURY-P300YLM-A1 (-BS)	97	92	89	85	79	72	65	61	86
PURY-P250YLM-A1(-BS)	100	90	86	82	76	70	65	58	84
PUHZ-ZRP60VHA	71	70	71	63	61	57	52	45	67
XBC25 – Induct Supply	82	83	78	82	72	72	68	70	82
XBC25 – Induct Extract	76	70	68	71	65	62	54	54	71

The Insertion loss for the proposed attenuators for the AHU unit are presented below in Table 4-1. The manufacturer's Insertion loss data in octave bands have been used for the assessment.

Table 4-2 Insertion losses of attenuators

Attenuator	**Insertion Loss (dB)**							
	63Hz	**125Hz**	**250Hz**	**500Hz**	**1000Hz**	**2000Hz**	**4000Hz**	**8000Hz**
XBC25-HS-MS10 - Supply	5	8	15	30	41	31	21	16
XBC25-HS-MS10 - Extract	4	4	10	22	26	15	10	8

4.2. Predicted Plant Noise Level at Receptor

In line with the assessment methodology outlined in BS4142:2014, sound levels from the proposed plant have been predicted and assessed at receptor R1, (upper floors above commercial buildings on Camden High Street), based on calculating the following at the receptor:

1. The Specific Sound Level: The cumulative external sound level from the proposed external plant units operating simultaneously, corrected for distance attenuation, screening and source directivity.
2. The Rating Level: The Specific Sound Level corrected for acoustic features in line with BS4142:2014. In this case a correction of +2dB for tonality has been applied based on the subjective method due to the assumption that tonal characteristics might just be perceptible at the assessed receptor.
3. The difference between the Rating Level and the Background Sound Level: Used to assess the level of impact and compliance with the design criteria.

The prediction point is based at the fourth/fifth floor façade of the assessed receptor's dwellings, which is at an approximate distance of 20m away from the proposed plant locations. A façade correction of +3dB has been applied to the measured level as the measurements were made 1m from a façade. This is adjusted as according to BS4142:2014 to equivalent a free-field level.

Table 4-3 presents a summary of the results of the noise impact assessment with the inclusion of the schemes mitigation measures in the form of the attenuator selections for the AHU unit.

Table 4-3 BS 4142:2014 noise impact assessment for the assessment receptor

Unit	Specific Sound Level (dB)	Façade Corrections (dB)	BS 4142:2014 Corrections (dB)	Rating Level (dB)	Background Sound Level (dB L_{A90})	Difference (Rating Level – Background Sound Level)	BS 4142:2014 level of Impact
			Tonality				
2No. PURY-P300YLM-A1 (-BS)	53[2]	3	2	58	55	+3	Between a low impact and an adverse impact
1No. PURY-P250YLM-A1(-BS)	49	3	2	54	55	-1	Low Impact
2No.PUHZ-ZRP60VHA	34	3	2	39	55	-16	Low Impact
XBC25 – radiated casing	24	3	2	29	55	-26	Low Impact
XBC25 – Induct Supply	13[1]	3	2	18	55	-37	Low Impact
XBC25 – Induct Extract	9[1]	3	2	14	55	-41	Low Impact
Total	**55**	**3**	**2**	**60**	**55**	**5**	**An adverse impact**

[1]Inclusion of the selected attenuators in section Table 4-2
[2]Combined figure for the 2 units.

The result of the noise impact assessment, summarised in the Table 4-3, indicates that the Rating Level of the proposed plant items located on the rooftop of the site building is likely to be 5dB above the typical Background Sound Level at the nearest noise sensitive receptor, the residential dwellings at 146 Camden High Street. This indicates it is an adverse impact with regards to noise emissions, according to BS4142:2014.

The assessment result also indicates non-compliance with the design criteria where noise emissions are to be at least 10dB below the background sound level. Therefore, to meet this target, the overall noise emissions from the plant items must be reduced by at least 15dB.

To mitigate noise levels to the design criteria of 10dB below background sound level, acoustic enclosures for the 2No. PURY-P300YLM-A1 (-BS) and 1No. PURY-P250YLM-A1(-BS) units should be considered.

4.3. Uncertainty

There is some uncertainty arising from the typical background sound level used in the assessment, due to the noise survey measurement period.

The background sound level was measured during a weekday, as detailed in Section 3 of this report. It is understood that the proposed plant will also operate on Saturday and Sundays, and therefore the typical Background Sound Level could be different to that used in the assessment. However, as road traffic noise is considered to be the dominant source of noise at the assessment receptor, it is considered that the background sound level is likely to be similar during the plant operating periods on Saturday and Sundays morning, and therefore the likely noise impact will remain the same.

5. Conclusions

A noise assessment was undertaken for the proposed external plant to be installed at Alexandra Ciardi House, 7-8 Greenland Place, Camden, NW1 0AP, to assess the likely impact at neighbouring residential receptors.

Existing noise levels were measured through an attended noise survey undertaken on Tuesday 12th December 2017. Suitable assessment criteria have been set out in the report using the measured noise levels and with reference to the appropriate guidance documents.

The total noise levels from the proposed and replacement plant operating under normal conditions, and including the selected attenuators on the AHU unit, are predicted to result in an ‘adverse impact’ at the nearest noise sensitive receptor according to BS4142:2014. The 10dB below the background sound level design criteria is likely to be exceeded.

Therefore, acoustic enclosures are recommended to house the 2No. PURY-P300YLM-A1 (-BS) and 1No. PURY-P250YLM-A1(-BS) units, which are to be located on the rooftop of the site building. With the inclusion of acoustic enclosures that will provide mitigation of at least 15dBA, the proposed plant items are predicted a ‘low impact’ and are likely to meet the design criteria.

Appendix A. Glossary of Acoustic Terms

A-weighting:

An electrical frequency weighting used to represent the response of the human hearing mechanism to sound. A-weighted sound level is indicated either by placing the capital letter A after the letters dB to get dB(A) or it may be added as a subscript to the noise level parameter as in $L_{Aeq,T}$.

Ambient Sound Level ($L_{Aeq,T}$):

Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Background Sound Level ($L_{AF90,T}$):

The A-weighted sound pressure level of the existing ambient noise level that is exceed for 90% of a given time period, T, measured using time weighting 'Fast'.

Decibel (dB)

The unit of measurement used for sound pressure levels. The scale is logarithmic rather than linear. The threshold of hearing is 0dB and the threshold of pain is 120dB. In practical terms these limits are seldom experienced and typical levels lie within the range 30dB (a quiet night time level in a bedroom) to 90dB (at the kerbside of a busy city street).

Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$):

Equivalent continuous A-weighted sound pressure level is the steady sound level that has the same sound energy as the fluctuating A-weighted sound pressure level occurring over the same time period and at the same location.

Free-Field (acoustical):

Free-field means a position far away from any reflecting surfaces other than the ground. Several standards and guidelines recommend that to achieve free field conditions the microphone should be positioned at least 3.5 metres from any reflecting surfaces, other than the ground.

Maximum Sound Level, ($L_{AF, Max}$):

The L_{AFMAX} is defined as the maximum A-weighted sound pressure level occurring within the measurement period.

Percentile Level (Statistical Sound Level Indices, L_{AN}, L_{A10}, L_{A90})

L_{AN} is the dB(A) level exceeded N% of the time measured on a sound level meter with Fast(F) time weighting, e.g. L_{A90} the dB(A) level exceeded for 90% of the time, is commonly used to estimate background sound level. L_{A10}, the level exceeded for 10% of the time, is commonly used in the assessment of road traffic noise.

Rating Sound Level ($L_{Ar,Tr}$)

Specific sound level plus any adjustment for the characteristic features of the sound.

Residual Sound

The 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.

Specific Sound Level ($L_{Aeq,Tr}$)

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of approximately 20Hz to 20kHz, and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands, and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. (For instance, the octave bands above and below the 500Hz octave band are 1kHz and 250Hz respectively). For finer analysis, each octave band may be split into three one-third octave bands or in some cases, fine frequency bands.