

**Report No:**

38 Meadowbank – Noise Impact Assessment 26022020

**Date:**

26<sup>th</sup> February 2020

**For:**

World Famous Promotions Ltd

## **38 MEADOWBANK, LONDON**

## **NOISE IMPACT ASSESSMENT**

**By:**

Gillieron Scott Acoustic Design  
Studio 7  
130 Brixton Hill  
London  
SW2 1RS

t - 020 8671 2223

e - [info@gsacoustics.org](mailto:info@gsacoustics.org)

w - [www.gsacoustics.org](http://www.gsacoustics.org)

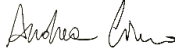

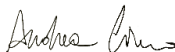

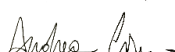

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## REVISION SCHEDULE

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| Document Revision | Date                                 | Document Title   | Details              | Prepared by  | Approved by  |
|-------------------|--------------------------------------|--|----------------------|--|--|
| 00                | 20 <sup>th</sup><br>February<br>2020 | 38 Meadowbank –<br>Noise Impact<br>Assessment<br>20022020  | DRAFT FOR<br>COMMENT | Andrea Cicero<br> | <br>Tim Scott |
| 01                | 20 <sup>th</sup><br>February<br>2020 | 38 Meadowbank –<br>Noise Impact<br>Assessment<br>20022020A | DRAFT FOR<br>COMMENT | Andrea Cicero<br> | <br>Tim Scott |
| 02                | 26 <sup>th</sup><br>February<br>2020 | 38 Meadowbank –<br>Noise Impact<br>Assessment<br>26022020  | ISSUED               | Andrea Cicero<br> | <br>Tim Scott |

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## 1.0 Introduction

A planning application is being submitted to London Borough of Camden for the refurbishment of the house at 38 Meadowbank, London NW3 3AY. The refurbishment will include the relocation of the existing condenser unit to the front of the property.

Gillieron Scott Acoustic Design have been commissioned to undertake a background noise survey and to assess the potential noise impact of the proposed condenser unit in accordance with BS4142 and London Borough of Camden's adopted noise policy.

The findings of this assessment are presented in the following sections of this report together with the supporting figures and appendices.

## 2.0 Brief

- Undertake noise measurements at one fixed monitoring location over an extended period of time.
- Identify noise sensitive dwellings located in the vicinity of the site and assess the topography of the intervening ground.
- Analyse the site-acquired data from the noise monitoring location and determine the appropriate noise criteria to adopt from London Borough of Camden's noise policy.
- Using representative measured data from the survey, recommend noise limits for the plant, and potential mitigation measures required, in accordance with BS 4142:2014+A1:2019 and Local Authority's noise policies.
- Provide a technical report detailing findings of the noise survey and provide outline recommendations to mitigate noise transfer from plant as required. Work with the client to ensure all appropriate noise mitigation methods are employed so that no significant adverse noise impacts arise.

### 3.0 Noise Assessment Criteria

#### 3.1 British Standard 4142:2019

BS4142:2019 provides methods for rating and assessing industrial and commercial sound. The standard is used to rate sound from fixed installations. The standard requires a “Specific Sound Level”, in terms of an  $L_{Aeq}$ , is determined either by measurement or calculation at a receptor location. This Specific Sound Level may then be corrected for the character of sound and is then termed the “Rating Level”.

Once the Rating Level has been determined, the background sound level is subtracted from it and the greater the difference, the greater the likelihood of an ‘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. The standard advocates that each site and situation should take the context of the scenario into consideration and that “not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact”.

The standard provides reference periods over which the assessment should take place which have been reproduced in the table below.

**Table 1 - Reference Periods**

| Period             | Hours         | Assessment Period           |
|--------------------|---------------|-----------------------------|
| Typical Daytime    | 07:00 – 23:00 | 1-hour assessment period    |
| Typical Night-time | 23:00 – 07:00 | 15-minute assessment period |

#### 3.2 Local Authority Noise Policy

In order to comply with London Borough of Camden’s Local Plan (2017), the following conditions must be met.

*A relevant standard or guidance document should be referenced when determining values for LOAEL (Low Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level) for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’ (BS 4142) will be used. For such cases a ‘Rating Level’ of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).*

**Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)**

| Existing Noise sensitive receptor | Assessment Location   | Design Period | LOAEL (Green)   | LOAEL to SOAEL (Amber)  | SOAL (Red)   |
|-----------------------------------|---|---------------|---|---|--|
| Dwellings**                       | Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade) | Day           | 'Rating level' 10dB* below background   | 'Rating level' between 9dB below and 5dB above background   | 'Rating level' greater than 5dB above background   |
| Dwellings**                       | Outside bedroom window (façade)   | Night         | 'Rating level' 10dB* below background and no events exceeding 57dBL <sub>Amax</sub> | 'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L <sub>Amax</sub> | 'Rating level' greater than 5dB above background and/or events exceeding 88dBL <sub>Amax</sub> |

*\*10dB should be increased to 15dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

*\*\*levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises. The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration. There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted  $L_{eq,5mins}$  noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.*

## 4.0 Site Layout, Environment and Context

Meadowbank is located in a primarily residential neighbourhood located within the London Borough of Camden's.

The site location, plant area and nearest residential receptors are indicated in Appendices A, B and C.

The existing condensing unit is proposed to be relocated at the front of 38 Meadowbank at ground level. The unit is to be contained within an acoustic enclosure next to the main entrance door, as shown on the corresponding drawings in Appendix D.

The unit will not have direct line of sight with the first-floor windows at the facade of 39 Meadowbank, deemed to be the closest noise sensitive receptors.

## 5.0 Survey Details and Results

Background noise levels have been measured from 12:15 on Friday 7<sup>th</sup> to 21:00 Saturday 8<sup>th</sup> February 2020 at a single fixed position deemed to be representative of the noise environment of the surrounding noise sensitive receptors. The measurement position is shown in Appendix C.

The levels were recorded in octave bands as  $L_{eq}$ ,  $L_{max}$  and  $L_{90}$  with Fast time-weighting along with their respective A-weighted single-figure values. The clock on the sound level meter was synchronised to the correct time before deployment. The meter was then set to integrate sound levels over 15-minute periods in synchronisation mode. A list of the measurement equipment is reported in Appendix I.

An automatic logging weather station was deployed as part of the assessment to ensure all data used in the determination of the representative background sound level occurred during conditions that are considered conducive to acoustic measurements. Weather data is available on request.

As the plant will have the facility to operate 24 hrs, the noise impact assessment will be undertaken using the minimum  $L_{A90,15min}$  over the night-time reference period as worst-case scenario.

Full survey results to one decimal place are presented in Appendix G. A graphical representation of the results is presented in Appendices E and F.

**Table 2 – Summary of representative background noise level**

|  |                 |
|--|-----------------|
| <b>Typical Background Noise Level <math>L_{A90,15min}</math> (23:00-07:00)</b> | <b>35 dB(A)</b> |
|--|-----------------|

A level of 35 dB  $L_{A90,15min}$  has been determined and will be used in the assessment of the newly proposed plant item in the following section.

## 6.0 Noise Impact Assessment

The existing condensing unit is 1x Toshiba RAS-5M34UAV, for which published manufacturers sound data and proposed location have been included in the Appendix D. The unit will have the facility to operate 24 hrs. During one of the site visits, the unit was kept running in cooling mode in order to subjectively assess potential acoustic features e.g. tonality. Tonal components were deemed to be not audible at the closest noise sensitive receptor. The noise impact assessment is shown in Table 3.

**Table 3 - Noise Impact Assessment**

| Element                                 | Level     |              | Comments  |
|---|-----------|--------------|---|
| Source SPL                              | 51        | dB(A)        | 1x Toshiba RAS-5M34UAV (SPL @ 1m in semi-anechoic conditions from manufacturer data, cooling mode)  |
| Reflections                             | + 3       | dB           | 1 other reflective surface  |
| Partial Screening                       | - 5       | dB           | Partial screening due to the edge of the building   |
| Distance losses                         | - 12      | dB           | Point source distance attenuation over 4m to the nearest window   |
| <b>Rating Level</b>                     | <b>37</b> | <b>dB(A)</b> | <b>L<sub>Aeq,T</sub></b>  |
| <b>Minimum Background level</b>         | <b>35</b> | <b>dB(A)</b> | <b>L<sub>A90,15min</sub></b>  |
| Stipulated Limit                        | 25        | dB           | 10 dB below minimum Background level as per London Borough of Camden's Noise Policy   |
| <b>Rating level vs Background level</b> | <b>+2</b> | <b>dB</b>    | <b>The assessment indicates LOAEL to SOAEL at the closest noise sensitive receptor according to London Borough of Camden's Noise Policy</b> |

The plant noise assessment above indicates that noise mitigation measures will be required in order to achieve LOAEL at the closest noise sensitive receptor in accordance to London Borough of Camden's adopted noise policy. Table 4 shows the assessment including recommended measures.

**Table 4 - Noise Impact Assessment with mitigation measures**

| Element                                 | Level       |              | Comments   |
|---|-------------|--------------|--|
| Source SPL                              | 51          | dB(A)        | 1x Toshiba RAS-5M34UAV (SPL @ 1m in semi-anechoic conditions, cooling mode)                                      |
| Reflections                             | + 3         | dB           | 1 other reflective surface   |
| Partial Screening                       | - 5         | dB           | Partial screening due to the edge of the building  |
| Acoustic Enclosure                      | - 13        | dB(A)        | Acoustic enclosure to achieve 13 dB(A) Insertion Loss. <sup>1</sup>  |
| Distance losses                         | - 12        | dB           | Point source distance attenuation over 4m to the nearest window  |
| <b>Rating Level</b>                     | <b>24</b>   | <b>dB(A)</b> | <b>L<sub>Aeq,T</sub></b>   |
| <b>Minimum Background level</b>         | <b>35</b>   | <b>dB(A)</b> | <b>L<sub>A90,15min</sub></b>   |
| Stipulated Limit                        | 25          | dB           | 10 dB below minimum Background level as per Camden Noise Policy  |
| <b>Rating level vs Background level</b> | <b>- 11</b> | <b>dB(A)</b> | <b>The assessment indicates LOAEL at the closest noise sensitive receptor according to Camden's Noise Policy</b> |

**Note 1:** Acoustic enclosure with minimum 13 dB(A) insertion loss required. Alternatively, a less sensitive location could be considered. Examples of Acoustic Enclosures and Suppliers are given in Appendix H.



A rating level of 24 dB(A) @ 1m from the most affected residential façade has been determined with noise mitigation measures in place. The rating level is 11 dB below the typical measured  $L_{A90,15min}$  background sound level over the proposed operational hours which is an indication of a very low likelihood of adverse impact and demonstrates compliance with Camden's adopted noise policy.

## 7.0 Uncertainty

The measurement position was deemed representative of the immediate noise environment of the most affected noise sensitive receptor. The author of this report has a relatively high level of confidence that the measurement position used in this assessment was appropriate.

The author of the report has a relatively high level of confidence in measurements being made during meteorological conditions that are conducive to acoustic measurements during the survey period. Periods of adverse weather have been excluded from the assessment when determining the representative sound levels.

The sound level meter was calibrated before and after the measurement period and a drift of 0.1 dB was noted. In the context of this environmental survey, this amount of drift in calibration is considered insignificant.

Given the context of the location, the uncertainty of the assessment does not have any significance to the outcome of the assessment.

## 8.0 Statement of Competence

The assessment has been undertaken by the author of this report Andrea Cicero, MSc, AMIOA, an acoustic consultant with Gillieron Scott Acoustic Design with 2+ years' experience since completing his Master's Degree in Acoustics at the University of Salford. The author of this report has undertaken numerous assessments according to the most recent 2019 revision of the Standard.

The assessment has been checked by: Tim Scott BSc (Hons.), MIOA a Director at Gillieron Scott Acoustic Design with 20+ years' experience since completing a degree in Audio Technology at the University of Salford in the late 1990's. The author of this report has undertaken numerous assessments according to the 1997 revision of the British Standard and the most recent 2019 revision of the Standard.

## 9.0 Conclusion

Gillieron Scott Acoustic Design have been commissioned to undertake a background noise survey and plant noise impact assessment in accordance with London Borough of Camden's noise policy.

The building located at 38 Meadowbank, London NW3 3AY is undergoing refurbishment works which include the relocation of the existing condenser unit to the front of the property.

A typical measured background sound level of 35 dB  $L_{A90,15min}$  has been determined over the proposed operational hours (24 hrs).

The London Borough of Camden's adopted noise policy states that noise from mechanical units must not exceed 10 dB below the typical measured background sound level over the proposed hours of operation.

A noise impact assessment has been conducted to determine rating noise levels due to the new position of the unit. The process has determined that an acoustic enclosure will be required in order to mitigate noise from the condensing unit to 10 dB below the typical measured background noise level at the closest noise sensitive receptor.

The assessment shows that London Borough of Camden's adopted noise policy has been met.

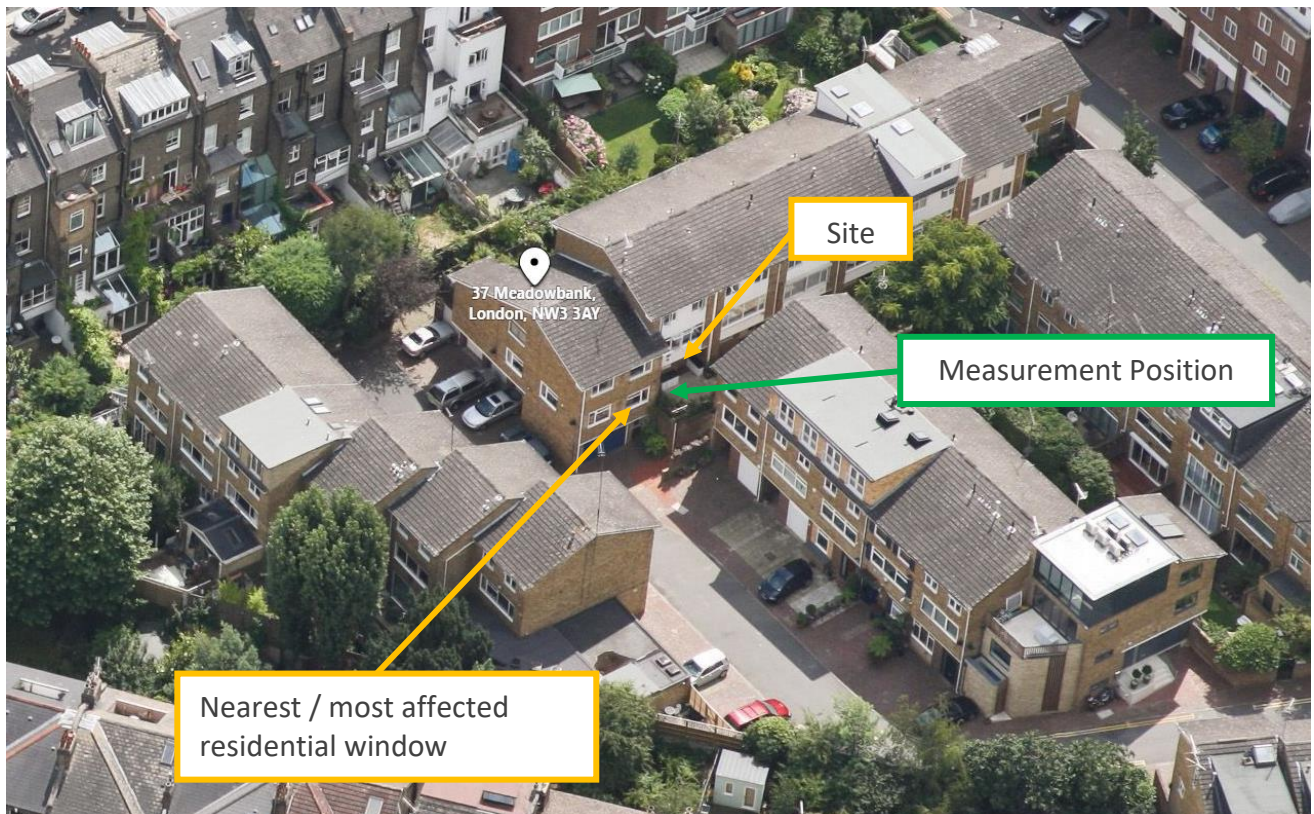
# APPENDICES

## APPENDIX A: Site Overview





## APPENDIX B: Survey Arrangement and Site Information

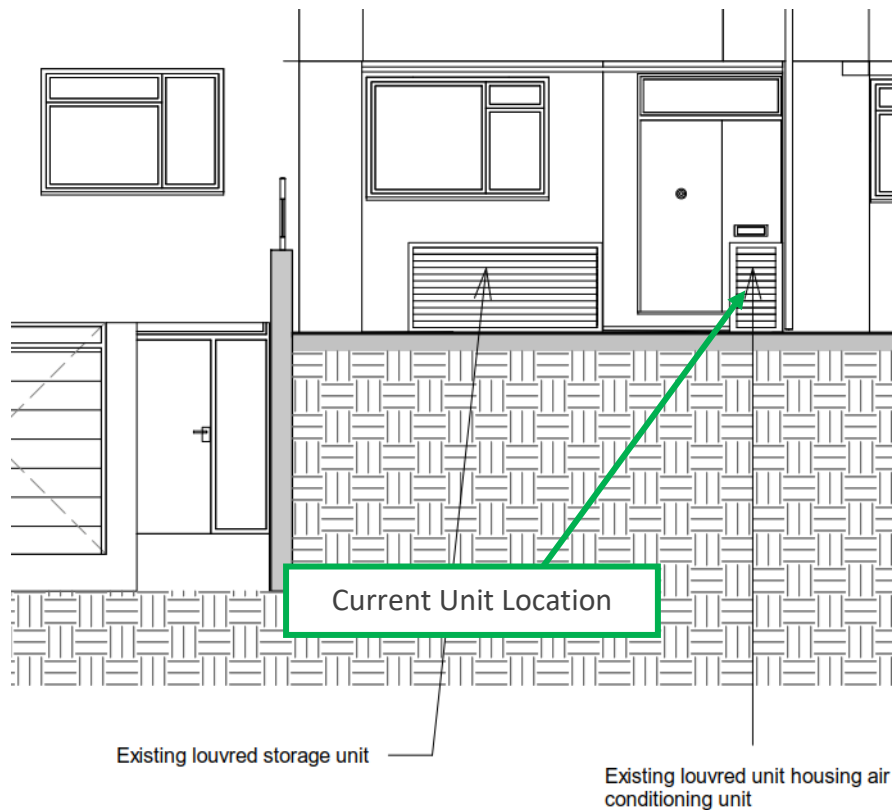


**APPENDIX C: Measurement Position**

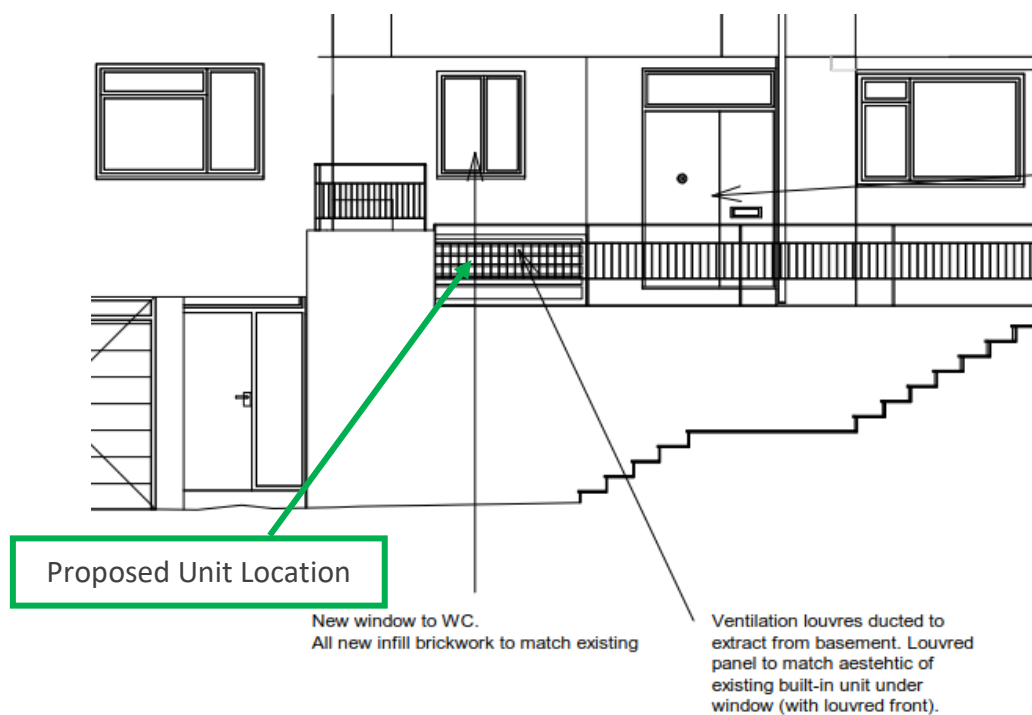


## APPENDIX D: Proposed Unit Location and Manufacturer Noise Data

### Existing Front Elevation



### Proposed Front Elevation



## Manufacturer Noise Data

**TOSHIBA** Leading Innovation >>>



### PRODUCT UPDATE 2010 – Residential 5 Room Multi Outdoor Unit

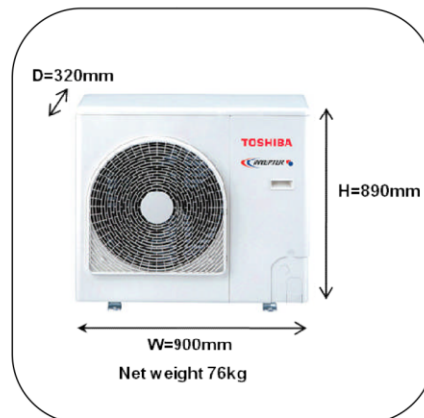
Toshiba Air Conditioning are pleased to introduce a new product into our current range of units within the RAV-SDI product range.



#### RAS-5M34UAV-E Residential 5 Room Multi Outdoor Unit

##### Key features and benefits.

- High efficiency COP of up to 4.24\*
- Wide capacity Range 3.4kW to 14kW\*<sup>1</sup>
- Small footprint only 320 x 900
- Wide operating range, (-10°C to +22°C)\*<sup>2</sup>
- Large selection of indoor units, High wall, 4 way cassette (600 x 600), ducted models and the new Bi-Flow console unit.
- Utilises the latest digital hybrid inverter technology
- Flexible application, from 1 to 5 individual controlled indoor units.\*<sup>3</sup>
- Quiet operation as low as 51 dB(A)\*<sup>4</sup>
- RoHS, WEEE, EN,IEC,AS, C-tick, GOST, NOM and IRAM compliant.



##### Summary of Specification.

|                                  |                 |
|----------------------------------|-----------------|
| Model Number.                    | RAS-5M34UAV-E   |
| Size (Height x Width x Depth mm) | 890 x 900 x 320 |
| Available Date.                  | Ex Stock        |
| Retail Price ex VAT.             | £2,380          |



Product Update S706-1007 1 of 3 26/07/2010

For further details, please contact TCUK Customer Services on 0870 8430333 or your local sales representative.

The manufacturer reserves the right to change the product specifications and information without notice.



## TOSHIBA Leading Innovation >>>

Specification.

| OUTDOOR UNIT MODEL                             | RAS-5M34UAV-E     |
|--|-------------------|
| Heating Capacity kW                            | 12.0              |
| Cooling Capacity kW                            | 10.0              |
| Energy Label (C/H)                             | A / A             |
| Power consumption W                            | 2833              |
| Sound Pressure levels dB(A) (C/H)              | 51 / 54           |
| Sound Power levels dB(A) (C/H)                 | 68 / 69           |
| Operating Range °C (cooling)                   | 10 / +43          |
| Operating Range °C (heating)                   | -10 / +22         |
| Minimum Pipe Length (mtrs) per unit            | 3                 |
| Maximum Pipe Length (mtrs) per unit            | 25                |
| Maximum Pipe Length (mtrs) Total               | 80                |
| Changeless Pipe length (mtrs)                  | 40                |
| Flare Connections all terminals (gas – liquid) | 1/2" – 1/4"       |
| Additional Refrigerant (grams/m - 41 to 80m)   | 20                |
| Dimensions H x W x D (mm)                      | 890 x 900 x 320   |
| Weight (kgs)                                   | 75                |
| Power Supply (Voltage – Frequency – Phase)     | 220-240V 50Hz 1ph |
| Retail Price (Outdoor Unit) ex VAT             | £2,380            |
| Availability                                   | Ex Stock          |

Note: \* Indoor configuration 13 x 13 x 13 x 13 units  
 \*<sup>1</sup> Heating mode  
 \*<sup>2</sup> Heating mode  
 \*<sup>3</sup> Heat pump (either Heating or Cooling)  
 \*<sup>4</sup> Sound Pressure Level High Fan Speed Cooling Mode



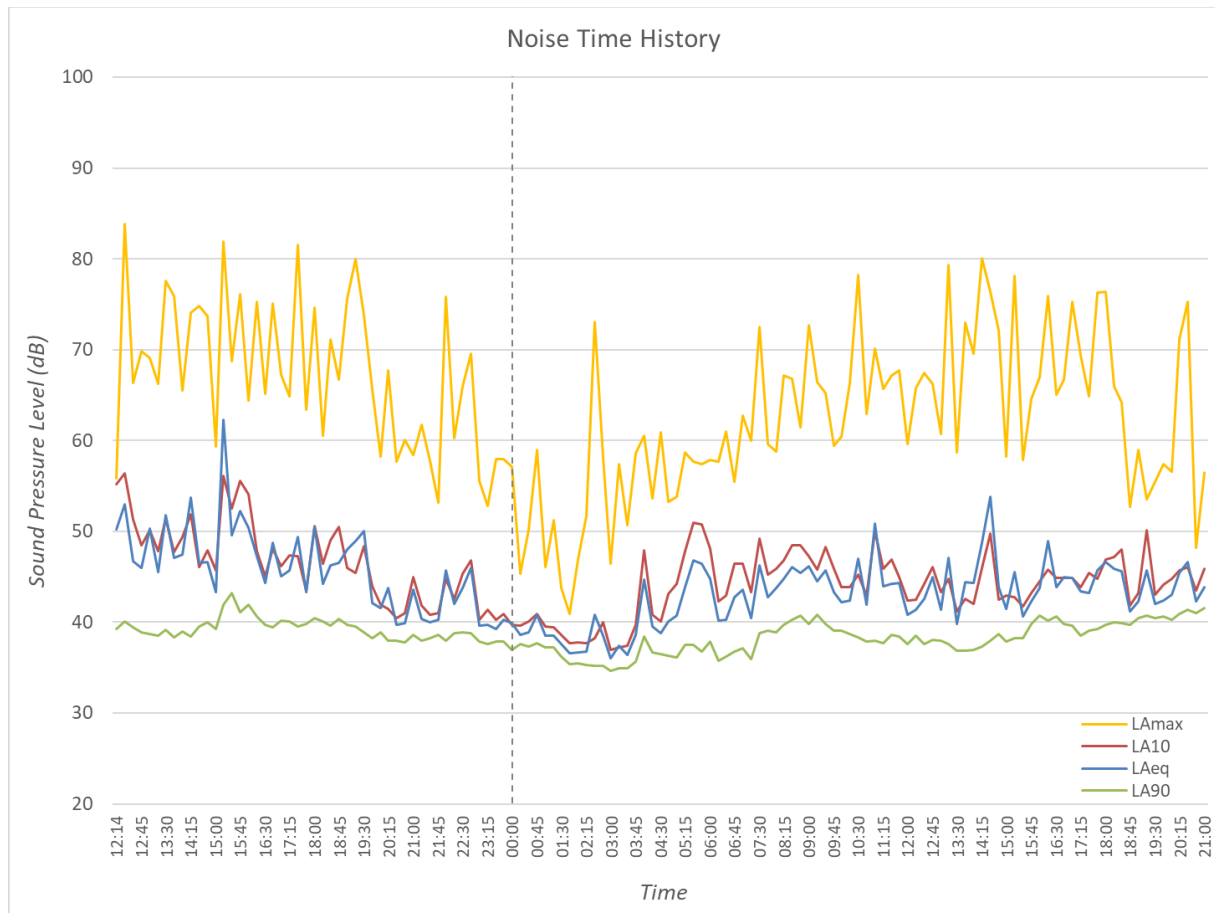
**TOSHIBA AIRCONDITIONING**  
Advancing the **ECO**-evolution

Product Update S706-1007 2 of 3 26/07/2010

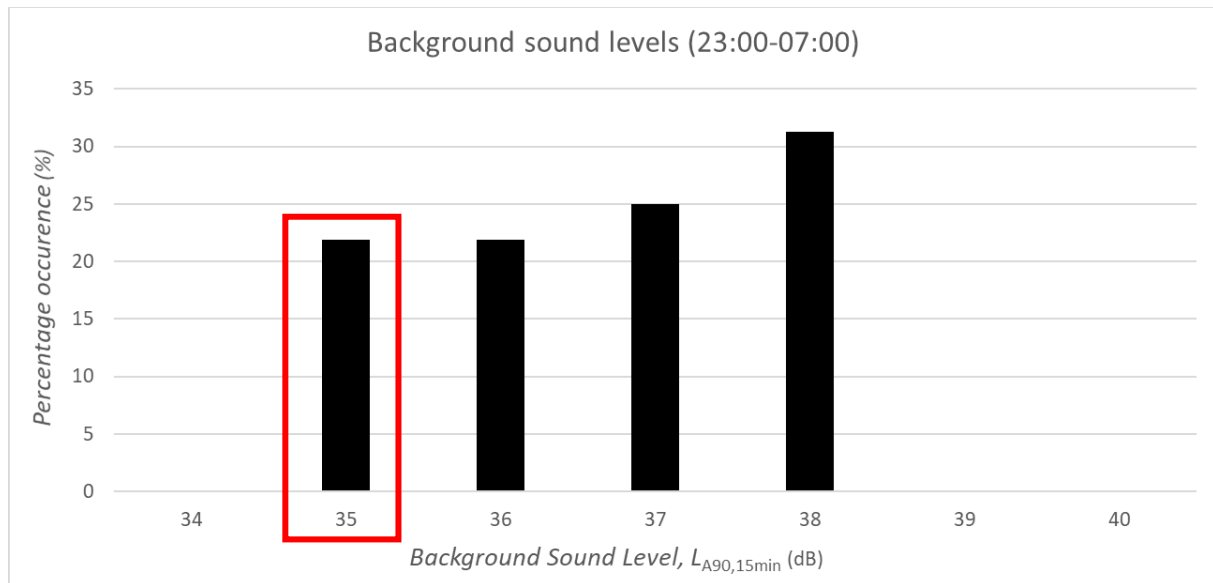
For further details, please contact TCUK Customer Services on 0870 8430333 or your local sales representative.

The manufacturer reserves the right to change the product specifications and information without notice.

## APPENDIX E: Time Series Graph



## APPENDIX F: Histogram Plot



## APPENDIX G: Survey Results

| Date       | Time  | L <sub>Aeq</sub> | L <sub>Amax</sub> | L <sub>A10</sub> | L <sub>A90</sub> |
|------------|-------|------------------|-------------------|------------------|------------------|
| 07/02/2020 | 12:14 | 50.2             | 55.8              | 55.2             | 39.3             |
| 07/02/2020 | 12:15 | 53.0             | 83.8              | 56.4             | 40.1             |
| 07/02/2020 | 12:30 | 46.7             | 66.3              | 51.3             | 39.4             |
| 07/02/2020 | 12:45 | 46.0             | 69.8              | 48.5             | 38.9             |
| 07/02/2020 | 13:00 | 50.3             | 69.1              | 50.1             | 38.7             |
| 07/02/2020 | 13:15 | 45.5             | 66.2              | 47.8             | 38.5             |
| 07/02/2020 | 13:30 | 51.8             | 77.6              | 51.4             | 39.2             |
| 07/02/2020 | 13:45 | 47.1             | 75.9              | 47.7             | 38.3             |
| 07/02/2020 | 14:00 | 47.5             | 65.5              | 49.4             | 39.0             |
| 07/02/2020 | 14:15 | 53.7             | 74.1              | 51.9             | 38.4             |
| 07/02/2020 | 14:30 | 46.5             | 74.8              | 46.1             | 39.5             |
| 07/02/2020 | 14:45 | 46.6             | 73.7              | 47.9             | 40.0             |
| 07/02/2020 | 15:00 | 43.3             | 59.3              | 45.7             | 39.3             |
| 07/02/2020 | 15:15 | 62.3             | 81.9              | 56.1             | 41.9             |
| 07/02/2020 | 15:30 | 49.6             | 68.7              | 52.5             | 43.2             |
| 07/02/2020 | 15:45 | 52.2             | 76.1              | 55.6             | 41.1             |
| 07/02/2020 | 16:00 | 50.4             | 64.4              | 54.1             | 41.9             |
| 07/02/2020 | 16:15 | 47.3             | 75.3              | 47.8             | 40.6             |
| 07/02/2020 | 16:30 | 44.3             | 65.1              | 45.1             | 39.7             |
| 07/02/2020 | 16:45 | 48.7             | 75.1              | 48.1             | 39.4             |
| 07/02/2020 | 17:00 | 45.1             | 67.3              | 46.2             | 40.2             |
| 07/02/2020 | 17:15 | 45.7             | 64.9              | 47.4             | 40.1             |
| 07/02/2020 | 17:30 | 49.4             | 81.5              | 47.3             | 39.5             |
| 07/02/2020 | 17:45 | 43.3             | 63.4              | 43.5             | 39.8             |
| 07/02/2020 | 18:00 | 50.5             | 74.6              | 50.6             | 40.5             |
| 07/02/2020 | 18:15 | 44.2             | 60.5              | 46.4             | 40.1             |
| 07/02/2020 | 18:30 | 46.3             | 71.1              | 49.0             | 39.6             |
| 07/02/2020 | 18:45 | 46.5             | 66.7              | 50.5             | 40.4             |
| 07/02/2020 | 19:00 | 48.0             | 75.6              | 46.0             | 39.7             |
| 07/02/2020 | 19:15 | 48.9             | 80.0              | 45.4             | 39.5             |
| 07/02/2020 | 19:30 | 50.0             | 73.8              | 48.4             | 38.9             |
| 07/02/2020 | 19:45 | 42.1             | 65.6              | 44.0             | 38.2             |
| 07/02/2020 | 20:00 | 41.6             | 58.2              | 41.9             | 38.9             |
| 07/02/2020 | 20:15 | 43.8             | 67.7              | 41.5             | 38.0             |
| 07/02/2020 | 20:30 | 39.7             | 57.7              | 40.5             | 38.0             |
| 07/02/2020 | 20:45 | 39.9             | 60.1              | 41.0             | 37.8             |
| 07/02/2020 | 21:00 | 43.6             | 58.4              | 45.0             | 38.6             |
| 07/02/2020 | 21:15 | 40.4             | 61.7              | 41.8             | 38.0             |
| 07/02/2020 | 21:30 | 40.0             | 57.8              | 40.8             | 38.2             |
| 07/02/2020 | 21:45 | 40.3             | 53.2              | 41.0             | 38.6             |
| 07/02/2020 | 22:00 | 45.7             | 75.8              | 44.8             | 38.0             |
| 07/02/2020 | 22:15 | 42.0             | 60.3              | 42.6             | 38.8             |

| Date       | Time  | L <sub>Aeq</sub> | L <sub>Amax</sub> | L <sub>A10</sub> | L <sub>A90</sub> |
|------------|-------|------------------|-------------------|------------------|------------------|
| 07/02/2020 | 22:30 | 43.8             | 66.0              | 45.3             | 38.9             |
| 07/02/2020 | 22:45 | 46.0             | 69.6              | 46.8             | 38.8             |
| 07/02/2020 | 23:00 | 39.6             | 55.6              | 40.3             | 37.9             |
| 07/02/2020 | 23:15 | 39.7             | 52.8              | 41.4             | 37.6             |
| 07/02/2020 | 23:30 | 39.3             | 58.0              | 40.3             | 37.9             |
| 07/02/2020 | 23:45 | 40.3             | 58.0              | 40.9             | 37.9             |
| 08/02/2020 | 00:00 | 39.9             | 57.1              | 39.7             | 37.0             |
| 08/02/2020 | 00:15 | 38.6             | 45.3              | 39.6             | 37.6             |
| 08/02/2020 | 00:30 | 38.9             | 50.2              | 40.1             | 37.3             |
| 08/02/2020 | 00:45 | 40.8             | 59.0              | 40.9             | 37.7             |
| 08/02/2020 | 01:00 | 38.5             | 46.1              | 39.5             | 37.2             |
| 08/02/2020 | 01:15 | 38.5             | 51.2              | 39.4             | 37.2             |
| 08/02/2020 | 01:30 | 37.6             | 43.8              | 38.6             | 36.2             |
| 08/02/2020 | 01:45 | 36.6             | 40.9              | 37.7             | 35.4             |
| 08/02/2020 | 02:00 | 36.7             | 46.9              | 37.8             | 35.5             |
| 08/02/2020 | 02:15 | 36.8             | 51.7              | 37.7             | 35.3             |
| 08/02/2020 | 02:30 | 40.8             | 73.1              | 38.2             | 35.2             |
| 08/02/2020 | 02:45 | 38.5             | 58.1              | 40.0             | 35.2             |
| 08/02/2020 | 03:00 | 36.0             | 46.4              | 37.0             | 34.7             |
| 08/02/2020 | 03:15 | 37.4             | 57.4              | 37.2             | 34.9             |
| 08/02/2020 | 03:30 | 36.4             | 50.7              | 37.4             | 34.9             |
| 08/02/2020 | 03:45 | 38.6             | 58.6              | 39.7             | 35.7             |
| 08/02/2020 | 04:00 | 44.7             | 60.5              | 47.9             | 38.4             |
| 08/02/2020 | 04:15 | 39.5             | 53.6              | 40.8             | 36.7             |
| 08/02/2020 | 04:30 | 38.8             | 60.9              | 40.1             | 36.5             |
| 08/02/2020 | 04:45 | 40.1             | 53.3              | 43.1             | 36.3             |
| 08/02/2020 | 05:00 | 40.7             | 53.8              | 44.2             | 36.1             |
| 08/02/2020 | 05:15 | 43.9             | 58.7              | 47.8             | 37.5             |
| 08/02/2020 | 05:30 | 46.8             | 57.7              | 51.0             | 37.5             |
| 08/02/2020 | 05:45 | 46.4             | 57.4              | 50.8             | 36.8             |
| 08/02/2020 | 06:00 | 44.8             | 57.9              | 48.1             | 37.9             |
| 08/02/2020 | 06:15 | 40.2             | 57.7              | 42.3             | 35.8             |
| 08/02/2020 | 06:30 | 40.3             | 61.0              | 42.9             | 36.2             |
| 08/02/2020 | 06:45 | 42.8             | 55.5              | 46.4             | 36.8             |
| 08/02/2020 | 07:00 | 43.6             | 62.7              | 46.4             | 37.1             |
| 08/02/2020 | 07:15 | 40.5             | 60.0              | 43.3             | 35.9             |
| 08/02/2020 | 07:30 | 46.3             | 72.5              | 49.2             | 38.8             |
| 08/02/2020 | 07:45 | 42.8             | 59.6              | 45.2             | 39.1             |
| 08/02/2020 | 08:00 | 43.8             | 58.8              | 45.9             | 38.9             |
| 08/02/2020 | 08:15 | 44.8             | 67.2              | 46.8             | 39.7             |
| 08/02/2020 | 08:30 | 46.1             | 66.8              | 48.5             | 40.3             |
| 08/02/2020 | 08:45 | 45.4             | 61.5              | 48.5             | 40.7             |

| Date       | Time  | L <sub>Aeq</sub> | L <sub>Amax</sub> | L <sub>A10</sub> | L <sub>A90</sub> |
|------------|-------|------------------|-------------------|------------------|------------------|
| 08/02/2020 | 09:00 | 46.2             | 72.7              | 47.3             | 39.8             |
| 08/02/2020 | 09:15 | 44.5             | 66.4              | 45.8             | 40.8             |
| 08/02/2020 | 09:30 | 45.7             | 65.2              | 48.3             | 39.8             |
| 08/02/2020 | 09:45 | 43.3             | 59.4              | 45.9             | 39.1             |
| 08/02/2020 | 10:00 | 42.2             | 60.4              | 43.9             | 39.1             |
| 08/02/2020 | 10:15 | 42.4             | 66.3              | 43.9             | 38.7             |
| 08/02/2020 | 10:30 | 47.0             | 78.2              | 45.2             | 38.3             |
| 08/02/2020 | 10:45 | 41.9             | 62.9              | 42.9             | 37.9             |
| 08/02/2020 | 11:00 | 50.9             | 70.1              | 50.0             | 38.0             |
| 08/02/2020 | 11:15 | 44.0             | 65.7              | 45.9             | 37.7             |
| 08/02/2020 | 11:30 | 44.2             | 67.2              | 46.9             | 38.6             |
| 08/02/2020 | 11:45 | 44.3             | 67.7              | 45.0             | 38.4             |
| 08/02/2020 | 12:00 | 40.8             | 59.6              | 42.4             | 37.6             |
| 08/02/2020 | 12:15 | 41.4             | 65.8              | 42.5             | 38.5             |
| 08/02/2020 | 12:30 | 42.6             | 67.4              | 44.2             | 37.6             |
| 08/02/2020 | 12:45 | 45.0             | 66.2              | 46.1             | 38.1             |
| 08/02/2020 | 13:00 | 41.4             | 60.7              | 43.3             | 38.0             |
| 08/02/2020 | 13:15 | 47.1             | 79.3              | 44.8             | 37.6             |
| 08/02/2020 | 13:30 | 39.8             | 58.7              | 41.2             | 36.9             |
| 08/02/2020 | 13:45 | 44.4             | 73.0              | 42.6             | 36.9             |
| 08/02/2020 | 14:00 | 44.3             | 69.6              | 42.0             | 37.0             |
| 08/02/2020 | 14:15 | 48.7             | 80.1              | 46.0             | 37.3             |
| 08/02/2020 | 14:30 | 53.8             | 76.4              | 49.8             | 38.0             |
| 08/02/2020 | 14:45 | 43.9             | 72.1              | 42.5             | 38.7             |
| 08/02/2020 | 15:00 | 41.5             | 58.2              | 42.9             | 37.9             |

| Date       | Time  | L <sub>Aeq</sub> | L <sub>Amax</sub> | L <sub>A10</sub> | L <sub>A90</sub> |
|------------|-------|------------------|-------------------|------------------|------------------|
| 08/02/2020 | 15:15 | 45.5             | 78.1              | 42.8             | 38.2             |
| 08/02/2020 | 15:30 | 40.6             | 57.9              | 41.7             | 38.2             |
| 08/02/2020 | 15:45 | 42.3             | 64.6              | 43.2             | 39.8             |
| 08/02/2020 | 16:00 | 43.8             | 67.0              | 44.5             | 40.7             |
| 08/02/2020 | 16:15 | 48.9             | 75.9              | 45.8             | 40.2             |
| 08/02/2020 | 16:30 | 43.9             | 65.0              | 44.9             | 40.6             |
| 08/02/2020 | 16:45 | 45.0             | 66.7              | 44.9             | 39.8             |
| 08/02/2020 | 17:00 | 44.9             | 75.3              | 44.9             | 39.6             |
| 08/02/2020 | 17:15 | 43.4             | 69.4              | 43.9             | 38.5             |
| 08/02/2020 | 17:30 | 43.2             | 64.9              | 45.4             | 39.1             |
| 08/02/2020 | 17:45 | 45.7             | 76.3              | 44.8             | 39.3             |
| 08/02/2020 | 18:00 | 46.6             | 76.4              | 46.9             | 39.7             |
| 08/02/2020 | 18:15 | 45.9             | 66.0              | 47.2             | 40.0             |
| 08/02/2020 | 18:30 | 45.6             | 64.2              | 48.0             | 39.9             |
| 08/02/2020 | 18:45 | 41.2             | 52.7              | 41.8             | 39.7             |
| 08/02/2020 | 19:00 | 42.3             | 59.0              | 43.2             | 40.5             |
| 08/02/2020 | 19:15 | 45.7             | 53.5              | 50.1             | 40.7             |
| 08/02/2020 | 19:30 | 42.0             | 55.5              | 43.0             | 40.5             |
| 08/02/2020 | 19:45 | 42.4             | 57.4              | 44.1             | 40.6             |
| 08/02/2020 | 20:00 | 43.0             | 56.6              | 44.8             | 40.3             |
| 08/02/2020 | 20:15 | 45.4             | 71.1              | 45.7             | 40.9             |
| 08/02/2020 | 20:30 | 46.6             | 75.3              | 46.1             | 41.4             |
| 08/02/2020 | 20:45 | 42.3             | 48.2              | 43.5             | 41.0             |
| 08/02/2020 | 21:00 | 43.9             | 56.5              | 45.9             | 41.6             |

## **APPENDIX H: Example Acoustic Enclosure Suppliers**

### **ALLAWAY**

Old Police Station  
1 Queens Road  
Hertford  
SG14 1EN  
Tel: 01992 550825  
Email: [enquiries@allawayacoustics.co.uk](mailto:enquiries@allawayacoustics.co.uk)

### **CAICE**

Riverside House  
Unit 3  
Winnersh Fields  
Wokingham  
Berkshire  
RG41 5QS  
t: +44 (0)118 918 6470  
f: +44 (0)118 918 6480  
Email: [enquiries@caice.co.uk](mailto:enquiries@caice.co.uk)

### **NOICO**

Noico Ltd, Landmark House, Station Road, Hook, Hampshire, RG27 9HA  
Phone: +44 (0)1256 766207  
Fax: +44 (0)1256 768413  
Email: [sales@noico.co.uk](mailto:sales@noico.co.uk)

## APPENDIX I: Equipment

| Equipment Type     | Manufacturer | Type        |
|--------------------|--------------|-------------|
| Real Time Analyser | NTi Audio    | XL2         |
| Microphone         | NTi Audio    | M2230       |
| Calibrator         | Norsonic     | 1251        |
| Weather Station    | Davis        | Vantage VUE |

Calibration certificates are available on request.

## APPENDIX J: Glossary of Acoustic Terms

DECIBEL (dB) - A unit of sound pressure measurement

Sound Pressure Level in dB ( $L_p$ ) =  $20 \log (\text{Measured sound pressure}/\text{Reference sound pressure} = 20 \mu\text{Pa})$

dB(A) - The A-weighted sound pressure level, the weighting network reduces low frequency sound in a similar way to the human ear.

REVERBERATION TIME (RT or  $T$ ) – decay of sound in rooms

The time taken for a sound, once terminated, to fall through 60dB i.e. to one millionth of its original sound intensity.  $T_{30}$  – RT for first 30dB of decay.  $RT_{500}$  - Mid frequency RT.

HERTZ (Hz) - a unit of frequency measurement. The normal range of hearing is from 20Hz to about 15kHz.

ABSORPTION COEFFICIENT – degree to which a material absorbs sound.

The ratio of absorbed to incident sound energy (perfect absorber = 1)

SOUND REDUCTION INDEX  $R$  – quantity which describes a material's ability to reduce the sound pressure level across it (e.g. a wall or floor)

$$R = L_1 - L_2 + 10 \log (S/A)$$

$L_1$  - Average sound pressure level in source room (averaged from 100 Hz – 3150 Hz)

$L_2$  - Average sound pressure level in receiving room (averaged from 100 Hz – 3150 Hz)

$S$  – Wall Area ( $\text{m}^2$ )

$A$  – Total absorption in receiving room ( $\text{m}^2$  units)

$R_w$  – weighted sound reduction index

AVERAGE ROOM TO ROOM LEVEL DIFFERENCE –  $D$ , dB =  $L_1 - L_2$ , averaged 1/3 octave bands from 100Hz – 3150kHz.

$D_w$  – weighted value of  $D$  (usually 2 - 3dB higher)

$D_{nT}$ ,  $w$  –  $D_w$  corrected for reverberation time of receiving room

NOISE RATING CURVES (NR CURVES) – set of curves used to describe optimum background noise levels for different tasks.

$L_{10/90}$  LEVEL (dB) - The level in dB of a time varying sound pressured level (e.g. traffic) exceeded for 10%/90% of the time of measurement.

$L_{90}$  is usually called the BACKGROUND NOISE LEVEL.

$L_{eq}$  AVERAGE SOUND PRESSURE LEVEL – level dB of a time varying sound pressure level with equal amounts of energy above and below it, for the time of measurement.

TONAL NOISE – noise of a single frequency (or a narrow band of frequencies that can be perceived as a tone), audible above the broad band noise background. Noise which is at least 5dB above the average of the 1/3 octave band sound pressure levels immediately on either side of it.