



**Appendix A9.1**  
Noise & Vibration Survey

## Contents

<b>Appendix A9.1: Baseline Noise &amp; Vibration Surveys .....</b>	<b>1</b>
1.1 Introduction .....	1
1.2 Survey Methodology .....	1
1.3 Survey Results .....	6
<b>2. Baseline Vibration Monitoring .....</b>	<b>20</b>
2.1 Introduction .....	20
2.2 Survey Methodology .....	20
2.3 Survey Results – Harristown Bus Depot .....	23
2.4 Survey Results – Malahide Road .....	25
<b>3. References .....</b>	<b>30</b>
<b>4. Calibration Certificates for Monitoring Equipment .....</b>	<b>31</b>
4.1 Rion NL-52 S/N 998411 .....	32
4.2 Rion NL-52 S/N 186672 .....	34
4.3 Rion NL-52 S/N 1076330 .....	36
4.4 Rion NL-52 S/N 586944 .....	38
4.5 Rion NL-52 S/N 1076328 .....	40
4.6 Rion NL-52 S/N 586940 .....	42
4.7 Bruel and Kjaer 2250L .....	44
4.8 Rion VM-56 (S/N 680043) .....	47
<b>5. Unattended Monitoring Equipment Set Up .....</b>	<b>51</b>

## Appendix A9.1: Baseline Noise & Vibration Surveys

### 1.1 Introduction

This Report includes the relevant survey details and results associated with baseline noise monitoring undertaken as part of Ballymun / Finglas to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme). The survey has been undertaken to inform Chapter 9 (Noise & Vibration) of the Proposed Scheme EIAR.

Survey details and results for each of the noise monitoring locations are included within this Report.

### 1.2 Survey Methodology

#### 1.2.1 Study Area

The assessment study area is split into four geographical areas for the Ballymun Section and three geographical areas for the Finglas Section, as described in Table 1.

**Table 1: Description of Geographical Zones in the Study Area**

Geographical Zone	Description of Study Area
Ballymun Section (Ballymun Road: St Margaret Rd to Griffith Ave)	Within this study area, the key sensitive receptors are , Our Lady of Victories Church, Our Lady of Victories Infant School and Our Lady of Victories Girls and Boys National Schools, Ballymun Youth Reach Centre, Trinity Comprehensive School and St. Michael's House Special Needs National School are in close proximity to the Proposed Scheme.
Ballymun Section (St Mobhi Road and Botanic Road: Griffith Ave to Hart's Corner)	Within this study area, the key sensitive receptors are predominately residential dwellings which are in close proximity to the Proposed Scheme and altered road. In addition, there are a number of educational and health facilities within 200m for the roads impacted by the Proposed Scheme and diversions. These are; Scoil Chaitríona, Scoil Mobhi, Whitehall College of Further Education, Glasnevin Educate Together, St. Mary's Secondary School, Holy Faith Sisters Convent, Scoil and tSeachtar Laoch Bon Secours Hospital and Glasnevin National School.
Ballymun Section (Prospect Road, Phibsborough Road: Hart's Corner to Western Way)	The main sensitive receptors in this study area are residential properties that are within 5m of the road edge. These properties are particularly close to the road alignment on the eastern edge of the road due to a lack of gardens. The Mater Hospital is roughly 250m from Doyle's Corner and is a highly sensitive receptor.
Ballymun Section (Constitution Hill and Church Street to Arran Quay)	Within this geographic area, the Proposed Scheme will be within 100m of St. Paul's CBS Secondary School, St. Mary of the Angels, Church Street and St. Michan's Church. There are residential properties within 5m of the Proposed Scheme alignment. These are predominantly on the eastern side of the Proposed Scheme route with the western side containing a higher number of commercial properties alongside the residential properties.
Finglas Section (Finglas Road: St Margaret Road to Wellmount Road)	There are several sensitive residential receptors between R104 St. Margaret's Road and Ballyboggan Road, including residential properties in The Lawn, Finglas Village and North Road. A wide grass area and trees located to the east and west of the Proposed Scheme, north of the Finglas Village overpass, will result in sensitive receptors being further back (50m to 100m) from the road alignment.
Finglas Section (Finglas Road: Wellmount Road to Ballyboggan Road)	The key sensitive receptors in this section are residential and include the Tolka Vale Apartments, Prospect Hill, Carechoice Finglas Nursing Home and Premier Square.
Finglas Section (Ballyboggan Road to Hart's Corner)	Between Ballyboggan Road and Slaney Road there are lower sensitivity industrial / commercial receptors to the west of the Proposed Scheme. Glasnevin Cemetery is located to the east of the Proposed Scheme in this area. Beyond Glasnevin, sensitive receptors include Claremount Lawns, St. Vincent's Secondary School and a number of residential properties. For the remainder of this section, the key sensitive receptors, which are residential properties are typically within 50m to 100m and include the Church of Jesus Christ of Latter-day Saints.

#### 1.2.2 Survey Locations

Baseline noise surveys have been conducted at locations representative of the nearest noise sensitive areas which have the potential to be impacted by construction works and / or those likely to be impacted during the

Operational Phase of the Proposed Scheme. Baseline noise measurements were made over both long-term and short-term periods to inform the assessment.

- Long-term surveys (typically one week in duration) were made at a total of six locations; and
- Short-term surveys (attended day-time measurements) were made at a total of twenty locations along the length of the Proposed Scheme.

Figure 9.2 in Volume 3 of this EIAR illustrates the baseline noise monitoring locations. Each is discussed in the relevant geographical zone in the following sections.

### 1.2.2.1 Ballymun Section (Ballymun Road from St. Margaret’s Road to Griffith Avenue)

A total of four long-term unattended monitoring locations and four attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 2.

**Table 2: Noise Monitoring Locations – Ballymun Road from St. Margaret’s Road to Griffith Avenue**

Location	Description of Survey Location
<b>Unattended Monitoring Locations</b>	
CBC0304UNML001	Rear garden to northeast of Shanliss Road, to south of Secondary Education building off R108 Ballymun Road. Located approximately 45m from R108 road edge.
CBC0304UNML002	Carpark area to northern side of Church in Whitehall, to southeast of R108 Ballymun Road / R103 Collins Avenue junction. Located approximately 85m from R108 road edge.
CBC0304UNML003	Paved area to front of residential property, 22m to south of R108 Ballymun / St Candice Road junction. Located approximately 15m from R108 road edge.
CBC0304UNML004	Green area within grounds of Special Education building off R108 Ballymun Road in Ballygall. Located approximately 30m from R108 road edge.
<b>Attended Monitoring Locations</b>	
CBC0304ANML001	On footpath to north of R108 Ballymun Road / Gateway Avenue junction, in line with facades of residential properties at 15m from R108 road edge.
CBC0304ANML002	Green area to southern side of Albert College Lawn housing estate, in line with closest facades to R108 Ballymun Road at 13m from R108 road edge.
CBC0304ANML003	On a footpath to west of R108 Ballymun Road / R102 Griffith Avenue junction, in line with facades of residential properties to south, at 20m from R108 road edge.
CBC0304ANML004	Green verge to southwest of R102 St Mobhi Road / R102 Griffith Avenue junction, in line with facades of residential properties at 12m from R108 St. Mobhi Road.

### 1.2.2.2 Ballymun Section (St. Mobhi Road and Botanic Road from Griffith Avenue to Hart’s Corner)

A total of one long-term unattended monitoring location and five attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 3.

**Table 3: Noise Monitoring Locations – St. Mobhi Road and Botanic Road from Griffith Avenue to Hart’s Corner**

Location	Description of Survey Location
<b>Unattended Monitoring Locations</b>	
CBC0304UNML005	Green area in residential front garden to west of R108 St. Mobhi Road. Located 25m from St Mobhi Road and 12m from St. Mobhi Drive road edge.
<b>Attended Monitoring Locations</b>	
CBC0304ANML005	On footpath to east of Old Finglas Road / Cremore Villas junction, in line with residential facades approximately 20m from Old Finglas Road edge.
CBC0304ANML006	On footpath to north of Ballymun Road / Church Avenue junction, in line with façades of residential properties at 6m from Ballymun Road edge.
CBC0304ANML007	On footpath to north of Glasnevin Hill / St. Mobhi Drive junction, in line with facades of residential properties at 17m from Glasnevin Hill road edge.
CBC0304ANML008	On footpath to south of R108 Botanic Road / Marguerite Road junction, in line with facades of residential properties at 10m from R108 road edge.
CBC0304ANML009	On footpath to southeast of R108 Botanic Road / Lindsay Road junction, in line with facades of residential properties at 11m from R108 road edge.

### 1.2.2.3 Ballymun Section (Prospect Road, Phibsborough Road from Hart’s Corner to Western Way)

A total of two attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 4.

**Table 4: Noise Monitoring Locations – Prospect Road, Phibsborough Road from Hart’s Corner to Western Way**

Location	Description of Survey Location
<b>Attended Monitoring Locations</b>	
CBC0304ANML010	On footpath to south of R108 Phibsborough Road / Connaught Street junction. Located approximately 12m from R108 road edge.
CBC0304ANML011	On footpath 65m to northeast of R108 Phibsborough Road / Western Way junction in line with residential facades facing onto R108 Phibsborough Road. Located approximately 8m from R108 road edge.

### 1.2.2.4 Ballymun Section (Constitution Hill and Church Street to Arran Quay)

A total of one attended survey location was surveyed within this study area. The location reference and a description of survey position are included in Table 5.

**Table 5: Noise Monitoring Locations – Constitution Hill and Church Street to Arran Quay**

Location	Description of Survey Location
<b>Attended Monitoring Locations</b>	
CBC0304ANML012	On footpath next to Luas tracks to northwest of N1 Church Street / Arran Quay junction, in line with office facades facing onto N1 Church street. Located approximately 7m from N1 road edge.

### 1.2.2.5 Finglas Section (Finglas Road from St. Margaret’s Road to Wellmount Road)

No surveys were carried out within this study area.

### 1.2.2.6 Finglas Section (Finglas Road from Wellmount Road to Ballyboggan Road)

A total of three attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 6.

**Table 6: Noise Monitoring Locations – Finglas Road from Wellmount Road to Ballyboggan Road**

Location	Description of Survey Location
<b>Attended Monitoring Locations</b>	
CBC0304ANML013	Green area to north of Finn Eber Fort residential estate, in line with closest residential facades facing onto R135 Finglas Road. Located approximately 15m from R135 road edge.
CBC0304ANML014	On green area to north of Glenhill Road, in line with residential facades facing onto R135 Finglas Road. Located approximately 55m from R135 road edge.
CBC0304ANML015	On footpath to east of R135 Finglas Road / The Griffith junction, in line with residential apartment facades facing onto R135 Finglas Road. Located approximately 15m from R135 road edge.

### 1.2.2.7 Finglas Section (Ballyboggan Road to Hart's Corner)

A total of one long-term unattended monitoring location and five attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 7.

**Table 7: Noise Monitoring Locations – Ballyboggan Road to Hart's Corner**

Location	Description of Survey Location
<b>Unattended Monitoring Locations</b>	
CBC0304UNML006	Green area in residential rear garden to west of R108 Finglas Road. Located 15m from R108 Finglas Road and 25m to Dalcassian Downs road edges.
<b>Attended Monitoring Locations</b>	
CBC0304ANML016	On footpath in line with Church to southwest of R135 Finglas Road / The Willows junction, in line with closest facades facing onto R135 Finglas Road. Located approximately 10m from R135 road edge.
CBC0304ANML017	Green area to west of Towerview cottages, in line with closest facades facing onto R135 Finglas Road. Located approximately 10m from R135 road edge.
CBC0304ANML018	On hard ground in Secondary School 90m to southwest of R135 Finglas Road / St Philomena's Road junction. In line with School façade facing onto R135 Finglas Road approximately 15m from R135 road edge.
CBC0304ANML019	On footpath to northwest of De Courcy Square residential estate, in line with closest residential properties facing onto R135 Finglas Road. Located approximately 20m from R135 road edge.
CBC0304ANML020	On footpath to southeast of R135 Finglas Road / R108 Prospect Way junction, in line with residential facades facing onto R135 Finglas Road. Located approximately 30m from road edge.

### 1.2.3 Survey Periods

Unattended noise surveys were undertaken between 24 January 2019 and 9 September 2020. The specific survey dates for each location are included in the survey result tables in Section 1.3.

Attended noise surveys were undertaken between 30 June 2020 and 1 October 2020. The specific survey dates and times for each location are included in the survey results tables in Section 1.3.

### 1.2.4 Survey Equipment and Personnel

The unattended surveys were undertaken using RION NL-52 sound level meters. The attended surveys were undertaken using either RION NL-52 and Brüel and Kjær 2250L sound level meters. The specific equipment details are summarised in Table 8.

**Table 8: Noise Monitoring Equipment**

Survey Type	Equipment	Serial Number	Calibration Date
Unattended	Rion NL-52	998411	22/01/2020
		186672	04/05/2020
		1076330	15/08/2018
		586944	16/08/2018
		1076328	15/08/2018
		586940	15/08/2018
Attended	Bruel and Kjaer 2250L	3008402	04/11/2019

Calibration certificate of the monitoring equipment are included within Section 4.

For unattended surveys, a Rion WS-15 Outdoor Microphone Protection System with microphone extension cable and outdoor peli-case was used. An image of the equipment install at each monitoring location is included in Section 5.

The surveys were conducted by Jack Brennan, Alex Ryan and Donal Heavey, acoustic technicians, AWN Consulting.

### 1.2.5 Survey Parameters

The following noise parameters were measured and are discussed within this Report.

**L<sub>Aeq,T</sub>** is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value of the defined measurement period, T.

L<sub>Aeq,16hr</sub> refers to the ambient daytime period between 07:00 and 23:00hrs.

**L<sub>A10,T</sub>** is the A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic. The T is the sample period the parameter is measured over.

L<sub>A10,18hr</sub> is the L<sub>A10</sub> parameter between 06:00 and 00:00hrs as defined within the Calculation of Road Traffic Noise (hereafter referred to as CRTN) (UK Department of Transport 1998).

**L<sub>A90,T</sub>** is the A-weighted sound level that is exceeded for 90% of the sample period; generally used to quantify background noise. The T is the sample period the parameter is measured over.

L<sub>A90,16hr</sub> refers to the background daytime noise level between 07:00 and 23:00hrs

L<sub>A90,8hr</sub> refers to the background night-time noise level between 23:00 and 07:00hrs

The L<sub>den</sub> parameter is also discussed within the report. For long-term survey locations, this parameter is derived from the L<sub>Aeq</sub> data over each 24 hour period as is defined as follows:

**L<sub>den</sub>** is the 24hour noise rating level determined by the averaging of the L<sub>day</sub> with the L<sub>evening</sub> (plus a 5dB penalty) and the L<sub>night</sub> (plus a 10dB penalty). L<sub>den</sub> is calculated using the following formula, as defined within the Environmental Noise Regulations (S.I.140 / 2006):

$$L_{den} = 10 \log \left( \frac{1}{24} \left( 12 * \left( 10^{\frac{L_{day}}{10}} \right) + 4 * \left( 10^{\frac{L_{evening}+5}{10}} \right) + 8 * \left( 10^{\frac{L_{night}+10}{10}} \right) \right) \right)$$

Where:

**L<sub>day</sub>** is the A-weighted long-term average sound level as defined in ISO 1996-2:2017 Part 2: Determination of sound pressure levels (hereafter referred to as ISO 1996-2) (ISO 2017), determined over all the day periods of a year. The 12hr daytime period is between 07:00 to 19:00hrs.

**L<sub>evening</sub>** is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The 4hr evening period is between 19:00 to 23:00hrs.

**L<sub>night</sub>** is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The 8hr night-time period is between 23:00 to 07:00hrs.

## 1.2.6 Survey Procedure

Noise measurements were conducted in general accordance with the guidance contained in ISO 1996-1:2016 Acoustics – Description measurement and assessment and environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as ISO 1996-1) (ISO 2016) and ISO 1996-2 (ISO 2017).

### 1.2.6.1 Unattended Measurements

For unattended noise surveys, the monitoring equipment was installed within the private grounds of properties. For single story buildings, the microphone was installed at the height of ground floor windows (typically 1.5m above ground). For all other locations, the microphone was extended to a height of approximately 3.8m above ground. The equipment was set to log for 15 minute intervals on a continual basis over a 1 week period.

### 1.2.6.2 Attended Measurements

Attended noise surveys were undertaken at public locations at positions representative of the adjacent noise sensitive locations (e.g. on green areas in residential areas, footpaths, parks etc.). For all attended surveys, the microphone was positioned at height of approximately 1.2m above ground.

The attended surveys were undertaken in accordance with the shortened measurement procedure described in CRTN (UK Department of Transport 1998) and Transport Infrastructure Ireland's (TII) document Guidelines for the Treatment of Noise and Vibration on National Road (TII 2004).

This methodology involves a method whereby  $L_{A10(18hour)}$  and  $L_{den}$  values are obtained through a combination of measurement and calculation as follows:

- Noise level measurements are undertaken at the chosen location over three consecutive hours between 10:00 and 17:00hrs;
- Each sample period was measured over a 15 minute duration;
- The  $L_{A10(18hour)}$  for the location is derived by subtracting 1 dB from the arithmetic average of the three hourly sample values, i.e.:

$$L_{A10(18hour)} = ((\sum L_{A10(15\text{ minutes})}) \div 3) - 1 \text{ dB.}$$

- The derived  $L_{den}$  value is calculated from the  $L_{A10(18hour)}$  value, i.e.:

$$L_{den} = 0.86 \times L_{A10(18hr)} + 9.86 \text{ dB.}$$

## 1.3 Survey Results

### 1.3.1 Ballymun Section (Ballymun Road from St. Margaret's Road to Griffith Avenue)

#### 1.3.1.1 Unattended Surveys

The noise survey results recorded during the baseline surveys within this study area are presented in Table 9.



**Table 9: Unattended Noise Survey Results for Ballymun Road from St. Margaret's Road to Griffith Avenue**

Survey Date	Daytime				Evening	Night-Time			L <sub>den</sub>
	L <sub>Aeq,16hr</sub>	L <sub>day</sub>	L <sub>A10,16hr</sub>	L <sub>A90,16hr</sub>	L <sub>evening</sub>	L <sub>night</sub>	L <sub>A10,8hr</sub>	L <sub>A90,8hr</sub>	
<b>CBC0304UNML001</b>									
31/01/2019	59	60	62	53	59	54	57	43	62
01/02/2019	61	61	63	56	61	56	58	48	64
02/02/2019	60	61	62	53	60	54	58	43	63
03/02/2019	59	59	62	51	58	55	56	43	63
04/02/2019	60	61	63	54	60	53	56	41	63
05/02/2019	60	60	63	53	60	54	57	42	63
06/02/2019	59	60	62	53	58	55	58	46	63
<b>Average</b>	<b>60</b>	<b>60</b>	<b>62</b>	<b>53</b>	<b>59</b>	<b>54</b>	<b>57</b>	<b>44</b>	<b>63</b>
<b>CBC0304UNML002</b>									
14/02/2019	56	58	54	46	51	49	50	42	58
15/02/2019	58	60	55	48	52	50	52	41	60
16/02/2019	52	53	54	47	51	46	49	41	55
17/02/2019	54	54	56	48	53	48	50	40	57
18/02/2019	54	55	56	48	52	47	49	40	56
19/02/2019	53	53	55	48	52	49	52	41	57
20/02/2019	53	55	55	47	50	47	49	38	56
<b>Average</b>	<b>55</b>	<b>56</b>	<b>55</b>	<b>47</b>	<b>52</b>	<b>48</b>	<b>50</b>	<b>41</b>	<b>57</b>
<b>CBC0304UNML003</b>									
25/04/2019	69	71	72	58	68	66	68	44	73
26/04/2019	68	69	71	57	66	65	69	52	72
27/04/2019	67	68	71	55	65	63	68	43	71
28/04/2019	67	68	70	53	65	64	65	44	71
29/04/2019	69	69	72	57	68	64	65	44	72
30/04/2019	69	70	72	57	67	64	66	41	72
01/05/2019	67	69	71	55	66	64	66	41	71
<b>Average</b>	<b>68</b>	<b>69</b>	<b>71</b>	<b>56</b>	<b>66</b>	<b>64</b>	<b>67</b>	<b>44</b>	<b>72</b>
<b>CBC0304UNML004</b>									
24/01/2019	61	62	63	54	59	54	57	42	63
25/01/2019	59	60	62	53	58	55	58	43	63
26/01/2019	61	61	63	54	60	57	60	48	64
27/01/2019	59	59	62	51	58	55	57	43	63
28/01/2019	60	61	62	53	59	55	58	43	63
29/01/2019	60	61	63	54	59	54	57	43	63
30/01/2019	60	61	63	54	59	56	59	43	64
<b>Average</b>	<b>60</b>	<b>61</b>	<b>63</b>	<b>53</b>	<b>59</b>	<b>55</b>	<b>58</b>	<b>44</b>	<b>63</b>

Road traffic from R108 Ballymun Road is the dominant noise source at the monitoring positions in the vicinity of the Proposed Scheme. During daytime periods, average ambient noise levels were recorded in range of 55 to 68 dB L<sub>Aeq,16hr</sub>. Average background daytime noise levels were measured in the range of 47 to 56 dB L<sub>A90,16hr</sub>. Highest noise levels are recorded at CBC0304UNML003.

Night-time noise levels at the monitoring locations are dominated by road traffic from R108 Ballymun Road. Average ambient night-time noise levels were measured in the range of 48 to 64 dB  $L_{Aeq,8hr}$ . Average background noise levels during this time period were measured in the range of 41 to 44 dB  $L_{A90,8hr}$ .

The measured  $L_{den}$  values in this study area ranged between 57 and 72 dB  $L_{den}$ .

#### **1.3.1.2 Attended Surveys**

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 10 overleaf.

**Table 10: Attended Noise Survey Results for Ballymun Rd from St Margaret Rd to Griffith Ave**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML001	30/06/2020	10:00	65	68	58	68	Road traffic R108 Ballymun Road, leaf-blower noise.
		11:18	65	69	55		Road traffic R108 Ballymun Road.
		12:21	66	69	56		Road traffic R108 Ballymun Road, loud music from car at 3 mins, loud voices at 6 mins, very loud truck at 10 mins.
CBC0304ANML002	30/06/2020	10:29	59	63	50	63	Road traffic R108 Ballymun Road, birdsong, occasional beeping from pedestrian crossing.
		11:39	59	63	52		Road traffic R108 Ballymun Road, birdsong, occasional beeping from pedestrian crossing, car horn at 5 mins.
		12:42	60	63	50		Road traffic R108 Ballymun Road, birdsong, occasional beeping from pedestrian crossing, hammering and ambulance siren at 2 mins.
CBC0304ANML003	30/06/2020	10:57	65	69	55	68	Road traffic R108 Ballymun Road and R102 Griffith Avenue, occasional beeping from pedestrian crossing, squeak from brakes at 9 mins, car horn at 10 mins, conversation at 14 mins.
		12:00	65	70	57		Road traffic R108 Ballymun Road and R102 Griffith Avenue, occasional beeping from pedestrian crossing, tractor and car horn at 3 mins, loud lorry at 4 and 8 mins, noise from bikes near meter at 13 mins.
		13:04	65	69	56		Road traffic R108 Ballymun Road and R102 Griffith Avenue, occasional beeping from pedestrian crossing, loud voice near meter at 14 mins.
CBC0304ANML004	01/10/2020	09:59	67	70	58	69	Road traffic R108 Ballymun Road and R102 Griffith Avenue, beeping from pedestrian crossing.
		11:10	66	69	59		Road traffic R108 Ballymun Road and R102 Griffith Avenue.
		12:16	66	69	58		

### 1.3.2 Ballymun Section (St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner)

#### 1.3.2.1 Unattended Surveys

The noise survey results recorded during the baseline surveys within this study area are presented in Table 11.

**Table 11: Unattended Noise Survey Results for St. Mobhi Road and Botanic Road from Griffith Avenue to Hart's Corner**

Survey Date	Daytime				Evening	Night-Time			L <sub>den</sub>
	L <sub>Aeq,16hr</sub>	L <sub>day</sub>	L <sub>A10,16hr</sub>	L <sub>A90,16hr</sub>	L <sub>evening</sub>	L <sub>night</sub>	L <sub>A10,8hr</sub>	L <sub>A90,8hr</sub>	
<b>CBC0304UNML005</b>									
03/09/2020	60	61	62	52	59	54	56	46	63
04/09/2020	60	60	63	52	59	54	57	45	63
05/09/2020	60	61	63	51	59	54	57	44	63
06/09/2020	59	61	61	49	58	54	55	43	62
07/09/2020	59	61	62	51	58	53	55	43	62
08/09/2020	60	61	62	51	58	54	55	44	63
<b>Average</b>	<b>60</b>	<b>61</b>	<b>62</b>	<b>51</b>	<b>58</b>	<b>54</b>	<b>56</b>	<b>44</b>	<b>63</b>

Road traffic from R108 St. Mobhi Road is the dominant noise source at the monitoring position in the vicinity of the Proposed Scheme. During daytime periods, average ambient noise levels were recorded in the range of 59 to 60 dB L<sub>Aeq,16hr</sub>. Average background daytime noise levels were measured in the range of 49 to 52 dB L<sub>A90,16hr</sub>.

Night-time noise levels at the monitoring location are dominated by road traffic from R108 St. Mobhi Road. Average ambient night-time noise levels were measured in the range of 53 to 54 dB L<sub>Aeq,8hr</sub>. Average background noise levels during this time period were measured in the range of 43 to 46 dB L<sub>A90,8hr</sub>.

The measured L<sub>den</sub> values in this study area are in the range of 62 to 63 dB L<sub>den</sub>.

#### 1.3.2.2 Attended Surveys

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 12 overleaf.

**Table 12: Attended Noise Survey Results for St. Mobhi Road and Botanic Road from Griffith Avenue to Hart’s Corner**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML005	01/10/2020	10:47	63	66	54	66	Road traffic Old Finglas Road and Cremore Villas.
		11:51	64	67	55		
		12:56	63	67	55		
CBC0304ANML006	01/10/2020	10:20	58	63	43	63	Road traffic Ballymun Road, occasional strimmer (paused).
		11:29	57	62	42		Road traffic Ballymun Road.
		12:35	59	64	44		
CBC0304ANML007	30/06/2020	13:27	62	66	50	66	Road traffic R108 Botanic Road, conversation near meter at 8 mins.
		14:41	63	66	53		Road traffic R108 Botanic Road, occasional leaf-blower.
		15:47	63	67	53		Road traffic R108 Botanic Road, lawn mower nearby from 0-3 mins.
CBC0304ANML008	30/06/2020	13:52	64	68	47	68	Road traffic R108 Botanic Road, people using shovels in nearby house.
		15:02	65	68	50		Road traffic R108 Botanic Road.
		16:07	64	68	48		
CBC0304ANML009	02/07/2020	10:01	67	70	59	67	Road traffic R108 Botanic Road and R135 Finglas Road, car horn at 7 mins.
		11:13	64	67	59		Road traffic R108 Botanic Road and R135 Finglas Road, car horn at 11 mins.
		12:27	71 <sup>Note 1</sup>	67	59		Road traffic R108 Botanic Road and R135 Finglas Road, birdsong, loud truck horn at 2 mins.

Note 1: Noise monitoring undertaken at CBC0304ANML009 during the third 15-minute measurement period was elevated due erroneous interference at end of measurement. Average calculated based on first and second measurement periods.

### **1.3.3 Ballymun Section (Prospect Road, Phibsborough Road from Hart's Corner to Western Way)**

#### **1.3.3.1 Attended Surveys**

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 13 overleaf.

**Table 13: Attended Noise Survey Results for Prospect Road, Phibsborough Road: Hart's Corner to Western Way**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML010	02/07/2020	10:25	65	69	57	68	Road traffic R108 Phibsborough Road, occasional beeping from pedestrian crossing, conversation near meter at 6 and 9 mins.
		11:43	66	68	58		Road traffic R108 Phibsborough Road, occasional beeping from pedestrian crossing, bottle bank noise at 1 min.
		12:49	74 <sup>Note 2</sup>	69	57		Road traffic R108 Phibsborough Road, occasional beeping from pedestrian crossing, siren at 5 and 14 mins, bottle bank noise at 11 and 12 mins.
CBC0304ANML011	02/07/2020	13:39	69	73	57	71	Road traffic R108 Phibsborough Road, next to bus stop (buses pulling off).
		14:29	75 <sup>Note 3</sup>	72	59		Road traffic R108 Phibsborough Road, next to bus stop (buses pulling off), siren at 3 mins.
		15:19	68	72	60		Road traffic R108 Phibsborough Road, next to bus stop (buses pulling off), loud music from car at 5 mins, car horn at 6 mins.

Note 2: Noise monitoring undertaken at CBC0304ANML010 during the third 15-minute measurement period was elevated due to erroneous interference at end of measurement. Average calculated based on first and second measurement periods.

Note 3: Noise monitoring undertaken at CBC0304ANML011 during the second 15-minute measurement period was elevated due to erroneous interference at the end of measurement. Average calculated based on first and third measurement periods.

### **1.3.4 Ballymun Section (Constitution Hill and Church Street to Arran Quay)**

#### **1.3.4.1 Attended Surveys**

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 14 overleaf.



**Table 14: Attended Noise Survey Results for Constitution Hill and Church Street to Arran Quay**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML012	02/07/2020	14:04	71	74	58	73	Road traffic R108 Church Street and adjacent to Luas tracks, car horn at 14 mins.
		14:54	71	75	60		Road traffic R108 Church Street and adjacent to Luas tracks, loud trolley at 9 mins.
		15:43	72	74	58		Road traffic R108 Church Street and adjacent to Luas tracks, loud voice next to meter at 3 mins.

### **1.3.5 Finglas Section (Finglas Road from St. Margaret's Road to Wellmount Road)**

No baseline surveys were carried out within this study area.

### **1.3.6 Finglas Section (Finglas Road from Wellmount Road to Ballyboggan Road)**

#### **1.3.6.1 Attended Surveys**

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 15 overleaf.

**Table 15: Attended Noise Survey Results for Finglas Road: Wellmount Road to Ballyboggan Road**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML013	06/07/2020	10:00	66 <sup>Note 4</sup>	62	54	62	Road traffic R135 Finglas Road, dog barking loudly at 0 mins.
		11:11	61	61	54		Road traffic R135 Finglas Road, children's voices at 0 and 1 mins.
		12:14	61	62	53		Road traffic R135 Finglas Road, siren at 13 mins.
CBC0304ANML014	06/07/2020	10:24	59	60	47	61	Road traffic R135 Finglas Road, car horn at 5 mins.
		11:31	57	61	48		Road traffic R135 Finglas Road.
		12:36	57	61	49		
CBC0304ANML015	06/07/2020	10:50	61	64	52	64	Road traffic R135 Finglas Road.
		11:52	61	64	52		Road traffic R135 Finglas Road, conversation at 4 mins, beeping from machine reversing at 5 mins, bin truck at 5 mins, loud motorcycle at 9 mins.
		12:56	61	64	53		Road traffic R135 Finglas Road.

Note 4: Noise monitoring undertaken at CBC0304ANML013 during the first 15-minute measurement period was elevated due erroneous interference at end of measurement. Average calculated based on second and third measurement periods.

### 1.3.7 Finglas Section (Ballyboggan Road to Hart’s Corner)

#### 1.3.7.1 Unattended Surveys

The noise survey results recorded during the baseline surveys within this study area are presented in Table 16.

**Table 16: Unattended Noise Survey Results for Ballyboggan Road to Hart’s Corner**

Survey Date	Daytime				Evening	Night-Time			L <sub>den</sub>
	L <sub>Aeq,16hr</sub>	L <sub>day</sub>	L <sub>A10,16hr</sub>	L <sub>A90,16hr</sub>	L <sub>evening</sub>	L <sub>night</sub>	L <sub>A10,8hr</sub>	L <sub>A90,8hr</sub>	
<b>CBC0304UNML006</b>									
26/08/2020	58	58	60	51	57	53	56	39	61
27/08/2020	60	60	62	51	60	55	58	41	63
28/08/2020	59	61	62	51	57	53	57	42	62
29/08/2020	57	57	60	48	57	53	56	40	61
30/08/2020	56	56	60	47	56	53	55	37	60
31/08/2020	57	58	60	49	56	-	-	-	57
<b>Average</b>	<b>58</b>	<b>59</b>	<b>60</b>	<b>50</b>	<b>58</b>	<b>54</b>	<b>56</b>	<b>40</b>	<b>61</b>

Road traffic from R108 / R135 Finglas Road are the dominant noise sources at the monitoring position in the vicinity of the Proposed Scheme. During daytime periods, average ambient noise levels were recorded in the range of 56 to 60 dB L<sub>Aeq,16hr</sub>. Average background daytime noise levels were measured in the range of 47 to 51 dB L<sub>A90,16hr</sub>.

Night-time noise levels at the monitoring location are dominated by road traffic from R108 / R135 Finglas Road. Average ambient night-time noise levels were measured in the range of 53 to 55 dB L<sub>Aeq,8hr</sub>. Average background noise levels during this time period were measured in the range of 37 to 42 dB L<sub>A90,8hr</sub>.

The measured L<sub>den</sub> values in this study area are in the range of 57 to 63 dB L<sub>den</sub>.

#### 1.3.7.2 Attended Surveys

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 17 overleaf.

**Table 17: Attended Noise Survey Results for Ballyboggan Road to Hart’s Corner**

Attended Location	Date	Start Time	Measured Noise Levels (dB re.2x10 <sup>-5</sup> Pa)			Derived L <sub>den</sub>	Survey Notes
			L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>		
CBC0304ANML016	24/08/2020	14:12	62	66	53	66	Road traffic R135 Finglas Road
		15:10	62	66	52		
		15:29	65	68	51		
CBC0304ANML017	06/07/2020	13:22	64	68	55	67	Road traffic R135 Finglas Road
		14:10	64	67	55		
		14:48	65	68	55		
CBC0304ANML018	24/08/2020	13:52	63	66	55	66	Road traffic R135 Finglas Road, conversation at 6 mins, car horn at 6 mins.
		14:33	63	66	56		Road traffic R135 Finglas Road, conversation at 7 mins.
		14:49	64	66	55		Road traffic R135 Finglas Road, car horn at 4 and 10 mins.
CBC0304ANML019	06/07/2020	13:52	67 <sup>Note 5</sup>	64	53	64	Road traffic R135 Finglas Road, siren at 3 mins.
		14:29	61	64	54		Road traffic R135 Finglas Road
		15:07	60	63	54		
CBC0304ANML020	30/06/2020	14:15	69	72	58	71	Road traffic Prospect Way and R135 Finglas Road, large truck stopped near meter at 1 min, very loud truck at 5 mins, loud motorcycle at 13 mins.
		15:20	69	72	57		Road traffic Prospect Way and R135 Finglas Road, very loud truck at 7 mins.
		16:26	71	72	58		Road traffic Prospect Way and R135 Finglas Road, loud motorcycle at 8 mins, conversation at 12 mins.

Note 5: Noise monitoring undertaken at CBC0304ANML019 during the first 15-minute measurement period was elevated due erroneous interference at end of measurement. Average calculated based on second and third measurement periods.

## 2. Baseline Vibration Monitoring

### 2.1 Introduction

This section includes the relevant survey details and results associated baseline vibration surveys conducted as part of the overall Bus Connects Dublin – Core Bus Corridor Infrastructure Works (hereafter referred to as the CBC Infrastructure Works). Baseline vibration data obtained from this study has been used to information all individual Core Bus Corridor Schemes.

### 2.2 Survey Methodology

#### 2.2.1 Survey Locations

Attended vibration monitoring was undertaken a at sample locations adjacent to existing bus lanes within Dublin City. The surveys were undertaken to obtain typical baseline vibration levels along roads with both mixed vehicular traffic lanes and individual bus lanes. This information has been used to inform the operational vibration impact assessment for the Proposed Works.

Surveys were also undertaken along an access road to the Harristown Bus Depot, Horizon Logistics Park, Swords, Co. Dublin, to obtain a measurement of vibration relating to specific bus drive by in isolation at a controlled sampling location to characterise the specific vibration level associated with buses in the absence of other traffic. A description of the survey locations is set out in Table 18.

**Table 18: Vibration Monitoring Locations**

Vibration Monitoring Locations	Description of Survey Location
AVML001	Harristown – Entrance Road to Bus Depot, midway along inbound road, 5m from road edge
AVML002	Harristown – Roundabout at Bus Depot entrance, buses entering depot, 5m from road edge
AVML003	Harristown – Roundabout at Bus Depot entrance, buses exiting depot, 5m from road edge
AVML004	Harristown – Entrance Road to Bus Depot, midway along outbound road, 5m from road edge
AVML005	Harristown – Entrance Road to Bus Depot, midway along inbound road, 7m from road edge
AVML006	Malahide Road / St. Johns Court – 5m from edge of Inbound Bus Lane
AVML007	Malahide Road / St. Johns Court – 10m from edge of Inbound Bus Lane
AVML008	Malahide Road / Donnycarney Church – 2.5m from edge of Inbound Bus Lane
AVML009	Malahide Road– 2.5m from edge of outbound Bus Lane

The survey locations undertaken along the Harristown Bus Depot entrance are illustrated in Figure 1. The survey locations undertaken along the Malahide Road are illustrated in Figure 2.

Figure 1: Vibration Monitoring Locations Harristown Bus Depot (source Google Earth)



Figure 2: Vibration Monitoring Locations Malahide Road (source Google Earth)



## 2.2.2 Survey Periods

Vibration monitoring was undertaken on the following dates:

- AVML001 - AVML005 : 30th July 2020; and
- AVML005 – AMML009: 13th August 2020

## 2.2.3 Survey Equipment and Personnel

The survey was undertaken using a RION VM-56 vibration meter (S/N 680043) with PV-83D tri-axial accelerometer. Calibration certificate of monitoring equipment are included within Section 4.

The surveys were conducted Alex Ryan and David O'Donoghue, acoustic technicians, AWN Consulting.

## 2.2.4 Survey Procedure

Vibration measurements were conducted in general accordance with the guidance contained in British Standard BS 7385. Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings (1990).

Vibration was measured in the three orthogonal axes. The accelerometer was secured in place with a 5kg sandbag at all monitoring locations.

The equipment was set to log for 1 minute intervals on a continual basis with an instantaneous storage interval of 100ms. Vibration monitoring periods at AVML001 to AVML005 along the entrance road to Harristown Bus Depot were undertaken for a period of 15 minutes at each position. Vibration monitoring periods at AVML006 to AVML009 along the Malahide Road were undertaken for a period of 30 minutes at each position.

## 2.2.5 Survey Parameters

The following vibration parameters are discussed within this Report.

**PPV** Peak Particle Velocity (PPV) is a measure of the velocity of vibration displacement in terms of millimetres per second (mm/s). It is defined as follows within BS 7385: (1990) as:

*'the maximum instantaneous velocity of a particle at a point during a given time interval'*

**VDV** Vibration Dose Value (VDV) is an evaluation of human exposure to vibration in buildings. It defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response. It is defined as follows within British Standard BS 6472: (2008) Guide to evaluation of human exposure to vibration in buildings (2008): Part 1 - Vibration sources other than blasting, as:

*'The VDV is the fourth root of the integral of the fourth power of acceleration after it has been frequency-weighted (as defined in BS6472: 2008). The frequency-weighted acceleration is measured in  $m/s^2$  and the time period over which the VDV is measured is in seconds. This yields VDV in  $m/s^{1.75}$ '*

The frequency weightings used in the BS 6472 (2008) document is Wb weighting for vertical axis and Wd for the horizontal axes.



## 2.3 Survey Results – Harristown Bus Depot

The vibration survey results measured at each location are presented for each pass by event (bus drive by) in terms of the PPV parameter in mm/s and in terms of the VDV parameter in  $m/s^{1.75}$  for each axis.

### 2.3.1 Location AVML001

Table 19 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

**Table 19: Vibration Monitoring Results at ANML001**

Event Time	PPV, mm/s			VDV <sub>b</sub> , $m/s^{1.75}$		
	X	Y	Z	X	Y	Z
14:57	0.05	0.05	0.06	0.0003	0.0003	0.0020
15:01	0.03	0.04	0.04	0.0002	0.0003	0.0016
15:02	0.03	0.03	0.03	0.0002	0.0002	0.0008
15:03	0.02	0.04	0.04	0.0001	0.0002	0.0016
15:04	0.03	0.02	0.06	0.0002	0.0002	0.0022
15:05	0.04	0.05	0.08	0.0002	0.0002	0.0028
15:06	0.03	0.04	0.03	0.0002	0.0002	0.0013
15:07	0.03	0.04	0.05	0.0002	0.0002	0.0018
Minimum event	0.02	0.02	0.03	0.0001	0.0002	0.0008
Maximum event	0.05	0.05	0.08	0.0003	0.0003	0.0028

### 2.3.2 Location AVML002

Table 20 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

**Table 20: Vibration Monitoring Results at ANML002**

Event Time	PPV, mm/s			VDV <sub>b</sub> , $m/s^{1.75}$		
	X	Y	Z	X	Y	Z
15:22	0.03	0.03	0.08	0.0002	0.0002	0.0019
15:26	0.02	0.03	0.03	0.0002	0.0002	0.0012
15:29	0.02	0.07	0.09	0.0002	0.0003	0.0014
15:30	0.02	0.02	0.07	0.0001	0.0002	0.0019
15:31	0.03	0.04	0.06	0.0002	0.0002	0.0024
15:32	0.02	0.03	0.07	0.0002	0.0002	0.0022
15:33	0.03	0.03	0.06	0.0002	0.0002	0.0014
15:34	0.02	0.02	0.04	0.0001	0.0002	0.0016
Minimum event	0.03	0.07	0.09	0.0002	0.0003	0.0024
Maximum event	0.02	0.02	0.03	0.0001	0.0002	0.0012

### 2.3.3 Location AVML003

Table 21 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

**Table 21: Vibration Monitoring Results at ANML003**

Event Time	PPV, mm/s			VDV <sub>b,d</sub> , m/s <sup>1.75</sup>		
	X	Y	Z	X	Y	Z
15:40	0.06	0.06	0.09	0.0003	0.0003	0.0031
15:43	0.07	0.05	0.07	0.0003	0.0003	0.0027
15:44	0.04	0.05	0.06	0.0002	0.0003	0.0021
15:45	0.07	0.05	0.07	0.0003	0.0003	0.0032
15:49	0.03	0.03	0.03	0.0002	0.0002	0.0014
15:50	0.06	0.06	0.05	0.0003	0.0004	0.0027
Minimum event	0.07	0.06	0.09	0.0003	0.0004	0.0032
Maximum event	0.03	0.03	0.03	0.0002	0.0002	0.0014

### 2.3.4 Location AVML004

Table 22 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

**Table 22: Vibration Monitoring Results at ANML004**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>		
	X	Y	Z	X	Y	Z
16:04	0.08	0.12	0.1	0.0006	0.0008	0.0060
16:06	0.09	0.1	0.13	0.0004	0.0006	0.0061
16:08	0.1	0.13	0.11	0.0005	0.0008	0.0049
16:09	0.07	0.1	0.12	0.0005	0.0006	0.0049
16:10	0.11	0.12	0.15	0.0006	0.0007	0.0072
16:11	0.08	0.09	0.1	0.0005	0.0006	0.0046
16:12	0.07	0.08	0.11	0.0004	0.0006	0.0059
16:13	0.07	0.09	0.11	0.0004	0.0005	0.0054
Minimum event	0.11	0.13	0.15	0.0006	0.0008	0.0072
Maximum event	0.07	0.08	0.1	0.0004	0.0005	0.0046

### 2.3.5 Location AVML005

Table 23 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

**Table 23: Vibration Monitoring Results at ANML005**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>		
	X	Y	Z	X	Y	Z
16:36	0.03	0.02	0.03	0.0002	0.0002	0.0013
16:39	0.02	0.03	0.03	0.0002	0.0002	0.0017
16:40	0.03	0.04	0.04	0.0002	0.0003	0.0015
16:44	0.03	0.04	0.06	0.0002	0.0003	0.0021
16:46	0.03	0.03	0.03	0.0002	0.0002	0.0012
16:47	0.03	0.03	0.03	0.0002	0.0002	0.0013
16:48	0.03	0.03	0.04	0.0002	0.0002	0.0012
Minimum event	0.02	0.02	0.03	0.0002	0.0002	0.0012
Maximum event	0.03	0.04	0.06	0.0002	0.0003	0.0021

## 2.4 Survey Results – Malahide Road

### 2.4.1 Location AVML006

Table 24 presents the results of vibration values measured during each 1 minute sample period at this location with periods during a bus or HGV drive by noted.

**Table 24: Vibration Monitoring Results at ANML006**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>			Notes
	X	Y	Z	X	Y	Z	
11:23	0.03	0.03	0.07	0.0002	0.0002	0.0020	
11:24	0.03	0.02	0.06	0.0002	0.0001	0.0018	
11:25	0.03	0.03	0.10	0.0002	0.0002	0.0030	Bus
11:26	0.02	0.02	0.06	0.0002	0.0002	0.0015	HGV
11:27	0.03	0.03	0.07	0.0002	0.0002	0.0030	
11:28	0.02	0.02	0.05	0.0001	0.0001	0.0019	
11:29	0.05	0.03	0.08	0.0002	0.0002	0.0033	Bus
11:30	0.04	0.16	0.17	0.0002	0.0008	0.0027	HGV
11:31	0.02	0.02	0.03	0.0001	0.0001	0.0017	
11:32	0.04	0.05	0.07	0.0002	0.0002	0.0029	HGV
11:33	0.03	0.03	0.05	0.0002	0.0002	0.0020	
11:34	0.02	0.02	0.04	0.0002	0.0001	0.0015	Bus
11:35	0.04	0.04	0.13	0.0002	0.0002	0.0050	HGV
11:36	0.02	0.02	0.04	0.0001	0.0002	0.0015	
11:37	0.02	0.02	0.05	0.0002	0.0002	0.0020	Bus
11:38	0.02	0.02	0.03	0.0001	0.0001	0.0014	
11:39	0.04	0.03	0.10	0.0002	0.0002	0.0037	
11:40	0.03	0.04	0.12	0.0002	0.0002	0.0026	
11:41	0.07	0.06	0.15	0.0003	0.0002	0.0056	
11:42	0.05	0.03	0.11	0.0002	0.0002	0.0040	
11:43	0.04	0.04	0.05	0.0002	0.0002	0.0023	HGV
11:44	0.03	0.08	0.08	0.0002	0.0004	0.0021	
11:45	0.03	0.03	0.05	0.0002	0.0002	0.0025	HGV
11:46	0.04	0.04	0.06	0.0002	0.0002	0.0027	HGV
11:47	0.02	0.03	0.04	0.0001	0.0002	0.0012	
11:48	0.04	0.04	0.10	0.0003	0.0002	0.0036	
11:49	0.06	0.04	0.08	0.0003	0.0002	0.0028	
11:50	0.03	0.02	0.05	0.0002	0.0002	0.0020	
11:51	0.03	0.04	0.05	0.0002	0.0003	0.0021	
11:52	0.04	0.05	0.21	0.0003	0.0003	0.0053	
Maximum all traffic	0.07	0.16	0.17	0.0003	0.0008	0.0056	
Maximum bus	0.05	0.03	0.10	0.0002	0.0002	0.0033	

### 2.4.2 Location AVML007

Table 25 presents the results of vibration values measured during each 1 minute sample period at this location with periods during a bus or HGV drive by noted.

**Table 25: Vibration Monitoring Results at ANML007**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>			Notes
	X	Y	Z	X	Y	Z	
11:55	0.03	0.02	0.04	0.0002	0.0001	0.0011	HGV
11:56	0.03	0.04	0.03	0.0002	0.0002	0.0011	
11:57	0.02	0.06	0.06	0.0002	0.0003	0.0011	
11:58	0.03	0.03	0.02	0.0002	0.0002	0.0004	
11:59	0.02	0.03	0.03	0.0001	0.0002	0.0008	
12:00	0.02	0.02	0.02	0.0001	0.0001	0.0005	
12:01	0.02	0.03	0.02	0.0001	0.0002	0.0005	
12:02	0.03	0.02	0.03	0.0002	0.0002	0.0009	
12:03	0.03	0.03	0.02	0.0002	0.0002	0.0008	
12:04	0.02	0.03	0.02	0.0001	0.0001	0.0004	
12:05	0.02	0.02	0.03	0.0002	0.0002	0.0011	
12:06	0.03	0.03	0.02	0.0002	0.0002	0.0006	Bus
12:07	0.02	0.05	0.05	0.0001	0.0002	0.0008	Bus
12:08	0.02	0.02	0.02	0.0002	0.0001	0.0007	Bus
12:09	0.02	0.02	0.03	0.0001	0.0002	0.0008	
12:10	0.02	0.03	0.02	0.0002	0.0002	0.0005	Bus
12:11	0.02	0.02	0.02	0.0001	0.0002	0.0009	
12:12	0.02	0.02	0.02	0.0001	0.0002	0.0003	
12:13	0.02	0.02	0.02	0.0001	0.0001	0.0007	Bus
12:14	0.02	0.02	0.02	0.0001	0.0002	0.0009	
12:15	0.02	0.02	0.02	0.0001	0.0001	0.0008	
12:16	0.02	0.02	0.02	0.0001	0.0001	0.0005	
12:17	0.02	0.02	0.02	0.0001	0.0001	0.0005	Bus
12:18	0.02	0.03	0.03	0.0002	0.0002	0.0008	
12:19	0.03	0.03	0.03	0.0002	0.0002	0.0010	
12:20	0.02	0.02	0.02	0.0002	0.0002	0.0009	Bus
12:21	0.02	0.02	0.04	0.0001	0.0001	0.0012	
12:22	0.02	0.03	0.03	0.0001	0.0002	0.0010	
Maximum all traffic	0.03	0.06	0.06	0.0002	0.0003	0.0012	
Maximum bus	0.03	0.05	0.05	0.0002	0.0002	0.0009	

### 2.4.3 Location AVML008

Table 26 presents the results of vibration values measured during each 1 minute sample period at this location with periods during a bus or HGV drive by noted.

**Table 26: Vibration Monitoring Results at ANML008**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>			Notes
	X	Y	Z	X	Y	Z	
12:31	0.02	0.02	0.06	0.0001	0.0001	0.0004	Bus
12:32	0.02	0.06	0.08	0.0001	0.0003	0.0009	
12:33	0.02	0.03	0.04	0.0001	0.0002	0.0012	Bus
12:34	0.02	0.02	0.02	0.0001	0.0001	0.0004	HGV
12:35	0.02	0.02	0.04	0.0002	0.0002	0.0010	
12:36	0.02	0.02	0.02	0.0002	0.0002	0.0006	
12:37	0.02	0.02	0.02	0.0001	0.0001	0.0003	
12:38	0.02	0.03	0.03	0.0001	0.0002	0.0005	
12:39	0.02	0.03	0.02	0.0001	0.0002	0.0005	
12:40	0.03	0.03	0.02	0.0002	0.0002	0.0006	
12:41	0.04	0.03	0.02	0.0003	0.0002	0.0005	
12:42	0.03	0.02	0.03	0.0002	0.0001	0.0013	Bus
12:43	0.06	0.07	0.18	0.0003	0.0003	0.0057	
12:44	0.01	0.02	0.02	0.0001	0.0001	0.0004	Bus
12:45	0.02	0.03	0.05	0.0001	0.0002	0.0015	
12:46	0.02	0.02	0.03	0.0001	0.0001	0.0010	
12:47	0.02	0.03	0.03	0.0001	0.0001	0.0007	HGV
12:48	0.02	0.03	0.03	0.0001	0.0002	0.0010	HGV
12:49	0.02	0.02	0.02	0.0001	0.0001	0.0005	
12:50	0.02	0.02	0.02	0.0001	0.0001	0.0004	
12:51	0.02	0.02	0.02	0.0001	0.0002	0.0004	
12:52	0.02	0.02	0.02	0.0001	0.0002	0.0005	Bus
12:53	0.02	0.02	0.03	0.0001	0.0002	0.0009	
12:54	0.02	0.03	0.04	0.0001	0.0002	0.0012	
12:55	0.02	0.02	0.02	0.0001	0.0002	0.0003	
12:56	0.04	0.05	0.23	0.0002	0.0003	0.0056	HGV
12:57	0.02	0.03	0.05	0.0001	0.0002	0.0017	Bus
12:58	0.02	0.02	0.04	0.0001	0.0001	0.0012	
12:59	0.02	0.03	0.02	0.0001	0.0002	0.0006	
Maximum all traffic	0.06	0.07	0.23	0.0003	0.0003	0.0057	
Maximum bus	0.03	0.03	0.06	0.0002	0.0002	0.0017	

#### 2.4.4 Location AVML009

Table 27 presents the results of vibration values measured during each 1 minute sample period at this location with periods during a bus or HGV drive by noted.

**Table 27: Vibration Monitoring Results at ANML009**

Event Time	PPV, mm/s			VDV <sub>b</sub> , m/s <sup>1.75</sup>			Notes
	X	Y	Z	X	Y	Z	
13:05	0.03	0.02	0.05	0.0001	0.0001	0.0012	
13:06	0.02	0.04	0.03	0.0002	0.0001	0.0011	Bus
13:07	0.04	0.05	0.08	0.0002	0.0002	0.0028	HGV
13:08	0.04	0.05	0.06	0.0002	0.0002	0.0019	
13:09	0.04	0.03	0.03	0.0002	0.0002	0.0011	
13:10	0.03	0.04	0.04	0.0002	0.0001	0.0012	
13:11	0.03	0.04	0.04	0.0002	0.0001	0.0011	
13:12	0.02	0.03	0.04	0.0002	0.0001	0.0012	Bus
13:13	0.03	0.06	0.04	0.0002	0.0003	0.0013	
13:14	0.03	0.04	0.03	0.0002	0.0002	0.0012	Bus
13:15	0.04	0.04	0.04	0.0002	0.0003	0.0014	Bus
13:16	0.04	0.04	0.09	0.0002	0.0001	0.0028	HGV
13:17	0.06	0.06	0.05	0.0002	0.0002	0.0016	
13:18	0.03	0.04	0.05	0.0002	0.0002	0.0016	Bus
13:19	0.02	0.03	0.03	0.0001	0.0001	0.0008	
13:20	0.04	0.04	0.03	0.0002	0.0002	0.0011	Bus
13:21	0.03	0.03	0.03	0.0001	0.0001	0.0011	Bus
13:22	0.04	0.04	0.09	0.0002	0.0002	0.0030	
13:23	0.03	0.03	0.03	0.0001	0.0001	0.0013	
13:24	0.02	0.03	0.05	0.0001	0.0002	0.0012	HGV
13:25	0.03	0.03	0.05	0.0002	0.0002	0.0014	
13:26	0.03	0.05	0.05	0.0002	0.0003	0.0015	Bus
13:27	0.03	0.04	0.04	0.0002	0.0002	0.0012	
13:28	0.02	0.04	0.04	0.0001	0.0002	0.0008	Bus
13:29	0.04	0.05	0.04	0.0003	0.0003	0.0022	
13:30	0.03	0.03	0.08	0.0002	0.0002	0.0022	
13:31	0.04	0.04	0.03	0.0002	0.0002	0.0011	
13:32	0.02	0.02	0.04	0.0001	0.0001	0.0011	
13:33	0.02	0.03	0.04	0.0002	0.0002	0.0014	
13:05	0.03	0.02	0.05	0.0001	0.0001	0.0012	
Maximum all traffic	0.06	0.06	0.09	0.0003	0.0003	0.0030	
Maximum bus	0.04	0.05	0.05	0.0002	0.0003	0.0016	

### **3. References**

ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (ISO 2016)

ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels (ISO 2017)

Transport Infrastructure Ireland (TII) (previously National Roads Authority (NRA)) Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1 (TII 2004)

The UK Department of Transport Calculation of Road Traffic Noise (UK Department of Transport 1998)

British Standard Institute (BSI) British Standard (BS) 7385: 1990: Evaluation and measurement for vibration in buildings. Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings. (BSI 1990)

BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Part 1 Vibration sources other than blasting (BSI 2008)

#### Directives and Legislation

S.I. No. 140/2006 – European Communities (Environmental Noise) Regulations 2006



## **4. Calibration Certificates for Monitoring Equipment**

**4.1 Rion NL-52 S/N 998411**



**CERTIFICATE  
 OF  
 CALIBRATION**



**Date of Issue: 22 January 2020**

**Certificate Number: UCRT20/1094**

Issued by:  
 ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk  
 Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages  
 Approved Signatory  
  
 K. Mistry

**Customer**                      AWN Consulting  
   The Tecpro Building  
   IDA Business and Technology Park  
   Clonshaugh  
   Dublin 17

**Order No.**                      AWNC150120QTE  
**Description**                 Sound Level Meter / Pre-amp / Microphone / Associated Calibrator  
**Identification**

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00998411
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	98625
Rion	Microphone	UC-59	15917
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

**Performance Class**         1  
**Test Procedure**             TP 2.SLM 61672-3 TPS-49  
   *Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*  
**Type Approved to IEC 61672-1:2002**    **YES**    Approval Number    21.21 / 13.02  
   *If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*  
**Date Received**             17 January 2020                      ANV Job No.    UKAS20/01036  
**Date Calibrated**           22 January 2020

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	Initial Calibration		

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> UCRT20/1094
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable		N/A
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	21 January 2020	
Calibrator cert. number	UCRT20/1082	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	93.98	dB Calibration reference sound pressure level
Calibrator frequency	1001.97	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15  
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.12	22.24	± 0.30 °C
Humidity	42.0	39.0	± 3.00 %RH
Ambient Pressure	102.70	102.72	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	93.9	dB	Adjusted indicated level	94.0	dB	
The uncertainty of the associated calibrator supplied with the sound level meter ±			0.10			dB

Self Generated Noise This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A	C	Z
	11.4	15.8	22.3
	dB	dB	dB
	UR	UR	UR

Uncertainty of the electrical self generated noise ± 0.12 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: B. Bogdan

R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.  
 None

**4.2 Rion NL-52 S/N 186672**




**CERTIFICATE  
 OF  
 CALIBRATION**



**Date of Issue: 04 May 2020**

**Certificate Number: UCRT20/1388**

Issued by:  
 ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk  
 Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages
Approved Signatory
 K. Mistry

**Customer**                      AWN Consulting  
 The Tecpro Building  
 IDA Business and Technology Park  
 Clonshaugh  
 Dublin 17

**Order No.**                      RM/20/Cal019  
**Description**                      Sound Level Meter / Pre-amp / Microphone / Associated Calibrator  
**Identification**

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00186672
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76822
Rion	Microphone	UC-59	12818
Brüel & Kjær	Calibrator	4231	2205805
	Calibrator adaptor type if applicable		UC 0210

**Performance Class**            1  
**Test Procedure**                TP 2.SLM 61672-3 TPS-49  
*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*  
**Type Approved to IEC 61672-1:2002**    YES            Approval Number    21.21 / 13.02  
*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*  
**Date Received**                30 April 2020                      ANV Job No.    UKAS20/04240  
**Date Calibrated**                04 May 2020

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	20 April 2018	UCRT18/1439	0653

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<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> <b>UCRT20/1388</b>
	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.			
SLM instruction manual title	Sound Level Meter	NL-42 / NL-52	
SLM instruction manual ref / issue		11-03	
SLM instruction manual source		Manufacturer	
Internet download date if applicable		N/A	
Case corrections available		Yes	
Uncertainties of case corrections		Yes	
Source of case data		Manufacturer	
Wind screen corrections available		Yes	
Uncertainties of wind screen corrections		Yes	
Source of wind screen data		Manufacturer	
Mic pressure to free field corrections		Yes	
Uncertainties of Mic to F.F. corrections		Yes	
Source of Mic to F.F. corrections		Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator		Specified	
Customer or Lab Calibrator		Customers Calibrator	
Calibrator adaptor type if applicable		UC 0210	
Calibrator cal. date		06 December 2019	
Calibrator cert. number		UCRT19/2333	
Calibrator cal cert issued by		0653	
Calibrator SPL @ STP	93.95	dB	Calibration reference sound pressure level
Calibrator frequency	999.97	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15  
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.56	22.99	± 0.30 °C
Humidity	38.4	39.3	± 3.00 %RH
Ambient Pressure	101.05	101.04	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.			
Initial indicated level	94.2	dB	Adjusted indicated level
			93.9
			dB
The uncertainty of the associated calibrator supplied with the sound level meter ±			0.10
			dB

Self Generated Noise This test is currently not performed by this Lab.  
 Microphone installed (if requested by customer) = Less Than N/A dB A Weighting  
 Uncertainty of the microphone installed self generated noise ± N/A dB

Microphone replaced with electrical input device -		UR = Under Range indicated	
Weighting	A	C	Z
	12.5	16.0	21.7
	dB	dB	dB
	UR	UR	UR
Uncertainty of the electrical self generated noise ±		0.12	dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Giles R 2  
Additional Comments The results on this certificate only relate to the items calibrated as identified above.  
 None

### 4.3 Rion NL-52 S/N 1076330



## CERTIFICATE OF CALIBRATION



0653

**Date of Issue: 15 August 2018**

**Certificate Number: UCRT18/1834**

Issued by:

ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages
Approved Signatory
J. Harriman

**Customer**                      AWN Consulting Limited  
 The Tecpro Building  
 IDA Business and Technology Park  
 Dublin 17  
 Ireland

**Order No.**                      1869  
**Description**                  Sound Level Meter / Pre-amp / Microphone / Associated Calibrator  
**Identification**

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	01076330
Rion	Firmware		1.9
Rion	Pre Amplifier	NH-25	76547
Rion	Microphone	UC-59	12273
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

**Performance Class**        1  
**Test Procedure**              TP 2.SLM 61672-3 TPS-49  
*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*  
**Type Approved to IEC 61672-1:2002**    **YES**            **Approval Number**    21.21 / 13.02  
*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*  
**Date Received**              13 August 2018                      **ANV Job No.**        UKAS18/08513  
**Date Calibrated**             15 August 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
			Initial Calibration

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<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> UCRT18/1834
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable		N/A
Case corrections available		Yes
Uncertainties of case corrections		Yes
Source of case data	Manufacturer	
Wind screen corrections available		Yes
Uncertainties of wind screen corrections		Yes
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections		Yes
Uncertainties of Mic to F.F. corrections		Yes
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002		Yes
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	06 August 2018	
Calibrator cert. number	UCRT18/1784	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	93.99	dB Calibration reference sound pressure level
Calibrator frequency	1001.97	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15  
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.73	22.92	± 0.30 °C
Humidity	52.2	50.8	± 3.00 %RH
Ambient Pressure	100.66	100.65	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.			
Initial indicated level	94.0	dB	Adjusted indicated level
			94.0 dB
The uncertainty of the associated calibrator supplied with the sound level meter ±			0.10 dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device -	UR = Under Range indicated					
Weighting	A		C		Z	
	11.5	dB UR	15.4	dB UR	21.6	dB UR
Uncertainty of the electrical self generated noise ±				0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END


Calibrated by: A Patel

R 1


Additional Comments

None

**4.4 Rion NL-52 S/N 586944**



**CERTIFICATE  
OF CALIBRATION**



---

**Date of Issue: 16 August 2018**

Issued by:  
 ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk  
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

**Certificate Number: UCRT18/1839**

---

**Customer**                    **AWN Consulting Limited**  
 The Tecpro Building  
 IDA Business and Technology Park  
 Dublin 17  
 Ireland

Page 1 of 2 Pages

Approved Signatory

*J. Harriman*

J. Harriman

---

<b>Order No.</b>	1869		
<b>Description</b>	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator		
<b>Identification</b>	<i>Manufacturer</i>	<i>Instrument</i>	<i>Type</i>
	Rion	Sound Level Meter	NL-52
	Rion	Firmware	1.9
	Rion	Pre Amplifier	NH-25
	Rion	Microphone	UC-59
	Rion	Calibrator	NC-74
		Calibrator adaptor type if applicable	NC-74-002

**Performance Class**            1

**Test Procedure**                TP 2.SLM 61672-3 TPS-49  
*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*

**Type Approved to IEC 61672-1:2002**    **YES**            **Approval Number**    21.21 / 13.02  
*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*

**Date Received**                15 August 2018                            **ANV Job No.**    UKAS18/08525

**Date Calibrated**              16 August 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	Initial Calibration		

---

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<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> UCRT18/1839
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL 42 / NL 52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable		N/A
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	06 August 2018	
Calibrator cert. number	UCRT18/1784	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	93.99	dB Calibration reference sound pressure level
Calibrator frequency	1001.97	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15

Note - if a pre amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	21.53	22.10	± 0.30 °C
Humidity	60.5	62.5	± 3.00 %RH
Ambient Pressure	100.16	100.15	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB	
The uncertainty of the associated calibrator supplied with the sound level meter ±			0.10			dB

Self Generated Noise This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A	C	Z
	11.3	15.3	21.4
	dB	dB	dB
	UR	UR	UR
Uncertainty of the electrical self generated noise ±	0.12		dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel

R 1

Additional Comments

None

**4.5 Rion NL-52 S/N 1076328**



**CERTIFICATE  
 OF CALIBRATION**



**Date of Issue: 15 August 2018**

**Certificate Number: UCRT18/1836**

Issued by:  
 ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk  
Acoustic Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages  
 Approved Signatory  
  
 J. Harriman

**Customer**                      **AWN Consulting Limited**  
 The Tecpro Building  
 IDA Business and Technology Park  
 Dublin 17  
 Ireland

**Order No.**                      1869  
**Description**                  Sound Level Meter / Pre-amp / Microphone / Associated Calibrator  
**Identification**

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	01076328
Rion	Firmware		1.9
Rion	Pre Amplifier	NH-25	76545
Rion	Microphone	UC-59	12271
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

**Performance Class**            1  
**Test Procedure**                TP 2.SLM 61672-3 TPS-49  
*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*  
**Type Approved to IEC 61672-1:2002**    YES            **Approval Number**            21.21 / 13.02  
*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*  
**Date Received**                13 August 2018                      **ANV Job No.**            UKAS18/08513  
**Date Calibrated**               15 August 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	Initial Calibration		

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<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> UCRT18/1836
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable	N/A	
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	06 August 2018	
Calibrator cert. number	UCRT18/1784	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	93.99	dB Calibration reference sound pressure level
Calibrator frequency	1001.97	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15  
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.84	22.87	± 0.30 °C
Humidity	49.8	49.7	± 3.00 %RH
Ambient Pressure	100.67	100.63	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	93.9	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A	C	Z
	11.5	15.5	21.4
	dB UR	dB UR	dB UR

Uncertainty of the electrical self generated noise ± 0.12 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel

R 1

Additional Comments

None

**4.6 Rion NL-52 S/N 586940**



**CERTIFICATE  
 OF CALIBRATION**



**Date of Issue: 15 August 2018**

**Certificate Number: UCRT18/1831**

Issued by:

ANV Measurement Systems  
 Beaufort Court  
 17 Roebuck Way  
 Milton Keynes MK5 8HL  
 Telephone 01908 642846 Fax 01908 642814  
 E-Mail: info@noise-and-vibration.co.uk  
 Web: www.noise-and-vibration.co.uk

Page 1 of 2 Pages
Approved Signatory
J. Harriman

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

**Customer**                      AWN Consulting Limited  
 The Tecpro Building  
 IDA Business and Technology Park  
 Dublin 17  
 Ireland

**Order No.**                      1869  
**Description**                  Sound Level Meter / Pre-amp / Microphone / Associated Calibrator  
**Identification**

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00586940
Rion	Firmware		1.9
Rion	Pre Amplifier	NH-25	87059
Rion	Microphone	UC-59	13402
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

**Performance Class**            1  
**Test Procedure**                TP 2.SLM 61672-3 TPS-49  
*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*  
**Type Approved to IEC 61672-1:2002**    YES            Approval Number    21.21 / 13.02  
*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*  
**Date Received**                13 August 2018                      ANV Job No.    UKAS18/08513  
**Date Calibrated**              15 August 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	Initial Calibration		

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<b>CERTIFICATE OF CALIBRATION</b>	<b>Certificate Number</b> UCRT18/1831
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

**Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.**

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable		N/A
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	06 August 2018	
Calibrator cert. number	UCRT18/1784	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	93.99	dB Calibration reference sound pressure level
Calibrator frequency	1001.97	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15  
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	21.89	22.52	± 0.30 °C
Humidity	61.4	53.7	± 3.00 %RH
Ambient Pressure	100.71	100.68	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.			
Initial indicated level	94.0	dB	Adjusted indicated level
			94.0 dB
The uncertainty of the associated calibrator supplied with the sound level meter ±			0.10 dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated									
Weighting	A			C			Z		
	11.4	dB	UR	15.5	dB	UR	21.5	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: A Patel R 1  
 Additional Comments  
 None

## 4.7 Bruel and Kjaer 2250L



### CERTIFICATE OF CALIBRATION



**Date of Issue: 04 November 2019**

Issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL


Telephone 01908 642846 Fax 01908 642814

E-Mail: [info@noise-and-vibration.co.uk](mailto:info@noise-and-vibration.co.uk)

Web: [www.noise-and-vibration.co.uk](http://www.noise-and-vibration.co.uk)

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

**Certificate Number: UCRT19/2218**

Page 1 of 3 Pages
Approved Signatory  K. Mistry

**CUSTOMER**      AWN Consulting Limited  
The Tecpro Building  
IDA Business and Technology Park  
Clonshaugh  
Dublin 17  
Ireland

**ORDER No**      DOD/19/Cal013      Job No      UKAS19/11718

**DATE OF RECEIPT**      01 November 2019

**PROCEDURE**      Calibration Engineer's Handbook, section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 Edition 2:June 2009

**IDENTIFICATION**      Sound level meter Brüel & Kjær type 2250-L serial No 3008402 connected via a preamplifier type ZC 0032 serial No 22882 to a half-inch microphone type 4950 serial No 3016830. Associated calibrator Brüel & Kjær type 4231 serial No 2263026 with a one-inch housing and adapter type UC 0210 for half-inch microphone.

**CALIBRATED ON**      04 November 2019

**PREVIOUS CALIBRATION**      Calibrated on 16 October 2017, Certificate No. UCRT17/1897 issued by this laboratory.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

## CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate No UCRT19/2218

Page 2 of 3 Pages

The sound level meter was set up using the type 4231 sound calibrator supplied; it was set to frequency weighting A, and initially read 94.1 dB. It was then adjusted to read 93.9 dB (corresponding to 93.9 dB at standard atmospheric pressure). This reading was derived from Calibration Certificate no. UCRT19/2217 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter. The calibration check frequency was 1kHz. The final microphone sensitivity calculated and stored by the instrument was 45.25 mV/Pa.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 Edition 2:June 2009 were used to perform the periodic tests.

### RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006 (BS EN 61672-3:2006), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2 : 2003 (BS EN 61672-2 : 2003), to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1 : 2002 (BS EN 61672-1 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

13.4 dB (A)    13.8 dB (C)    19.5 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 23 to 24 °C, 31 to 41 %RH and 97.2 to 97.3 kPa

End: 24 to 25 °C, 34 to 44 %RH and 97.2 to 97.3 kPa

Technical information including adjustment data specified in the manufacturers' Instruction Manual BE 1774-11 (2007) and User Manual BE 1766 has been used to carry out this verification. These data include manufacturer-specified uncertainties.

Publicly-available evidence has been found that the B&K 2250-L sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

**The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.**

**CERTIFICATE OF CALIBRATION**  
 UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate No UCRT19/2218  
 Page 3 of 3 Pages

**NOTES**

*Any opinions or interpretations which may be expressed in the following notes are not UKAS Accredited.*

- 1 All tests were carried out in "Broad Band".
- 2 Windscreen correction was set to "None", soundfield to "Free-field" and microphone to "4950".
- 3 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS Accredited.
- 4 It was noted that in order to obtain the correct A-weighted response to the sound calibrator, the relevant software setting in the meter had to be changed from '4231' to 'custom' with the appropriate calibration level entered.
- 5 The electrical tests have been carried out with the instrument set for the nominal microphone sensitivity, as specified in the Instruction Manual. This may mean that the instrument has a slightly different linearity range when in normal use.
- 6 Typical case reflection factors specified by the manufacturer have been used for this verification.

The instrument was running on hardware version 4.0

The instrument firmware settings were:

Module i.d.	Function	Version	Active?	Licenced?	Template used?
BZ 7130	SLM	4.7.5	Y	Y	Y
BZ 7131	Octave analysis	4.7.5	Y	N	N/A
BZ 7132	1/3-oct analysis	4.7.5	Y	Y	N/A
BZ 7133	Logging	4.7.5	Y	Y	N/A
BZ 7226	Signal Recording Option	4.7.5	Y	N	N/A
BZ 7231	Tone Assessment	4.7.5	Y	N	N/A
BZ 7232	Noise Monitoring Software	4.7.5	Y	N	N/A
BZ	N/A	N/A	N/A	N/A	N/A
BZ	N/A	N/A	N/A	N/A	N/A
BZ	N/A	N/A	N/A	N/A	N/A

The results on this certificate only relate to the items calibrated as identified above.

END

R 3



## **4.8 Rion VM-56 (S/N 680043)**



## CERTIFICATE OF CALIBRATION

**Date of Issue: 01 November 2019**

**Certificate Number: TCRT19/1825**

Issued by:

ANV Measurement Systems  
Beaufort Court  
17 Roebuck Way  
Milton Keynes MK5 8HL  
Telephone 01908 642846 Fax 01908 642814  
E-Mail: [info@noise-and-vibration.co.uk](mailto:info@noise-and-vibration.co.uk)  
Web: [www.noise-and-vibration.co.uk](http://www.noise-and-vibration.co.uk)

Page 1 of 3 Pages  
Approved Signatory

K. Mistry

A handwritten signature in blue ink, appearing to read 'K. Mistry', is written over a horizontal line.

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Client	AWN Consulting Limited The Tecpro Building, IDA Business & Technology Park, Clonshaugh Dublin 17 Ireland
Purchase Order No.	DOD/19/Cal03
Instrument	Rion VM-56 Tri-Axial Vibration Meter
Serial No.	00680043
Accelerometer Type	VM-56
Accelerometer Serial No.	80047
Program	2.0
Client Asset No.	N/A
Procedure ID.	VM-56 Issue 1
Job Number	TRAC19/11477
Date of Calibration	01 Nov 2019
Previous Cert. number	N/A
Date of Previous Cert.	N/A
Rig Number	6
Kit Number	24
Calibration Status	<b>Passed Calibration</b>

This calibration is traceable to National Standards. ANV Measurement Systems sources used to perform calibrations are calibrated at the National Physical Laboratory or by UKAS laboratories accredited for the purpose.

The performance of the system (the meter, accelerometer) was found to be within the manufacturer's specification.

### **Comment**

This certificate reports recorded values for the instrument 'As Received'.

**CERTIFICATE OF CALIBRATION**



Certificate Number

TCRT19/1825

Page 2 of 3 Pages

**Environment**

The ambient environmental conditions at the time of the calibration were;  
 Temperature: 22.9 ± 1°C, Humidity: 40 ± 5%RH, Atmospheric pressure 98.2 ± 1 kPa

**Test results**

Each accelerometer axis was mounted co-axially with a Rion LS-10C servo accelerometer, and tests conducted for the dynamic range, PPV linearity and frequency response of the complete system. Additional electrical tests were carried out on the amplitude linearity of the instrument.

**PPV linearity** response for the complete system at 16 Hz

With PV-83CW serial No. 80047

Weightings for all channels turned OFF

Target Vel. mm/s	Actual Vel. mm/s	Indicated (X) mm/s	Error (X) %	Indicated (Y) mm/s	Error (Y) %	Indicated (Z) mm/s	Error (Z) %
0.50	0.51	0.57	11.56	0.55	7.65	0.54	5.69
1.00	1.02	1.09	6.67	1.08	5.69	1.06	3.73
2.50	2.55	2.67	4.51	2.66	4.12	2.60	1.77
5.00	5.11	5.31	3.93	5.30	3.73	5.18	1.38
10.00	10.13	10.59	4.50	10.43	2.92	10.35	2.13
20.00	20.27	21.24	4.80	21.03	3.76	20.61	1.69

Permitted tolerance ± 10% ± 1 LSD (Least Significant Digit).

**Linearity errors** in dB measured electrically at 40 Hz

Weightings for all channels turned OFF

Level changes in dB; reading error in dB given for each axis. "m/s<sup>2</sup>" is actual reading in m/s<sup>2</sup>.

**1 m/s<sup>2</sup> Range**

Level dB	Error (X) dB	m/s <sup>2</sup> (X)	Error (Y) dB	m/s <sup>2</sup> (Y)	Error (Z) dB	m/s <sup>2</sup> (Z)
0	REF	0.98154	REF	0.98129	REF	0.98130
-20	-0.01	0.09805	-0.01	0.09802	-0.01	0.09803
-40	-0.02	0.00979	-0.02	0.00979	-0.02	0.00979
-60	-0.10	0.00097	-0.10	0.00097	-0.10	0.00097
-66	-0.03	0.00049	-0.21	0.00048	-0.03	0.00049
-72	-0.23	0.00024	-0.23	0.00024	-0.23	0.00024

Permitted tolerance ±1.0 dB.

**10 m/s<sup>2</sup> Range**

Level dB	Error (X) dB	m/s <sup>2</sup> (X)	Error (Y) dB	m/s <sup>2</sup> (Y)	Error (Z) dB	m/s <sup>2</sup> (Z)
20	-0.03	9.79122	-0.03	9.75526	-0.03	9.73534
0	REF	0.98208	REF	0.97857	REF	0.97679
-20	-0.01	0.09808	-0.01	0.09775	-0.01	0.09758
-30	-0.01	0.03102	-0.03	0.03085	-0.06	0.03067
-40	0.04	0.00987	-0.02	0.00976	0.02	0.00979
-52	-0.31	0.00238	0.69	0.00266	-0.01	0.00245

Permitted tolerance ±1.0 dB.

## CERTIFICATE OF CALIBRATION



Certificate Number

TCRT19/1825

Page 3 of 3 Pages

### Frequency Responses For Complete System

Measured on the 1 m/s<sup>2</sup> range with weightings as indicated in the table and PV-83CW serial No. 80047

Frequency Hz	Applied Acc. m/s <sup>2</sup>	X (Wd) rms m/s <sup>2</sup>	Error X %	VDV (X) m/s <sup>1.75</sup>	Error X %
3.981	0.285	0.15654	5.4	0.30765	5.3
5.012	0.355	0.15445	5.2	0.30359	5.1
6.310	0.355	0.12187	5.1	0.23974	5.0
7.943	0.355	0.09586	4.5	0.18849	4.4
10.00	0.355	0.07622	4.9	0.14987	4.8
12.59	0.355	0.06052	5.3	0.11912	5.3
15.85	0.355	0.04836	6.2	0.09515	6.2
19.95	0.550	0.06014	7.3	0.11834	7.3

Frequency Hz	Applied Acc. m/s <sup>2</sup>	Y (Wd) rms m/s <sup>2</sup>	Error Y %	VDV (Y) m/s <sup>1.75</sup>	Error Y %
3.981	0.285	0.15640	5.3	0.30743	5.2
5.012	0.355	0.15372	4.7	0.30199	4.5
6.310	0.355	0.12149	4.7	0.23878	4.6
7.943	0.355	0.09627	5.0	0.18928	4.9
10.00	0.355	0.07622	4.9	0.14987	4.8
12.59	0.355	0.06054	5.3	0.11907	5.3
15.85	0.355	0.04850	6.5	0.09539	6.5
19.95	0.550	0.06064	8.2	0.11932	8.2

Frequency Hz	Applied Acc. m/s <sup>2</sup>	Z (Wb) rms m/s <sup>2</sup>	Error Z %	VDV (Z) m/s <sup>1.75</sup>	Error Z %
3.981	0.285	0.26307	3.0	0.52192	3.8
5.012	0.355	0.37779	2.4	0.74853	3.1
6.310	0.355	0.38731	2.1	0.76723	2.7
7.943	0.355	0.37632	2.0	0.74338	2.4
10.00	0.355	0.35641	1.6	0.70262	1.7
12.59	0.355	0.32928	1.2	0.64883	1.3
15.85	0.355	0.29668	1.3	0.58400	1.3
19.95	0.550	0.39872	0.8	0.78497	0.8
25.12	0.550	0.33640	3.3	0.66184	3.3
31.62	0.550	0.27597	2.9	0.54310	2.9
39.81	0.550	0.21843	1.0	0.42982	1.0
50.12	0.550	0.17703	3.4	0.34836	3.3
63.10	0.550	0.13695	3.8	0.26950	3.8
79.43	0.550	0.10077	4.1	0.19832	4.1



Tolerance required @ 4 Hz +12%/-11% ; @ 80 Hz +26%/-21%

All results meet the manufacturer's specification.

END OF CALIBRATION

CALIBRATED BY :- A. Lloyd

## 5. Unattended Monitoring Equipment Set Up

Location	Equipment Set up
<p>CBC0304UNML001</p> <p>Rear garden to northeast of Shanliss Road, to south of Secondary Education building off R108 Ballymun Road. Located approximately 45m from R108 road edge.</p>	 A black tripod-mounted monitoring station with a spherical sensor is positioned in a garden area. The station is situated behind a silver metal fence with pointed tops. A black equipment case lies on the ground at the base of the tripod. The background shows a residential building and some overgrown vegetation.
<p>CBC0304UNML002</p> <p>Carpark area to northern side of Church in Whitehall, to southeast of R108 Ballymun Road / R103 Collins Avenue junction. Located approximately 85m from R108 road edge.</p>	 A black tripod-mounted monitoring station with a spherical sensor is placed on a concrete base in a carpark area. The station is located next to a black metal fence. In the background, there is a brick building, a paved road with yellow markings, and a row of tall, bare trees under a cloudy sky.

Location	Equipment Set up
<p>CBC0304UNML003</p> <p>Paved area to front of residential property, 22m to south of R108 Ballymun / St Candice Road junction. Located approximately 15m from R108 road edge.</p>	
<p>CBC0304UNML004</p> <p>Green area within grounds of Special Education building off R108 Ballymun Road in Ballygall. Located approximately 30m from R108 road edge.</p>	
<p>CBC0304UNML005</p> <p>On grass in front garden, adjacent to St. Mobhi Drive, large tree blocking view of R108.</p>	

Location	Equipment Set up
<p>CBC0304UNML006</p> <p>On grass, in line with façade of house facing Finglas Road, direct line of sight to Finglas Road, 4 m from Finglas Road.</p>	