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Appendix A9.1: Baseline Noise and Vibration Surveys



1. Baseline Noise Monitoring

1.1 Introduction

This report includes the relevant survey details and results associated with baseline noise monitoring undertaken as part of the Swords to City Centre Core Bus Corridor (hereafter referred to as the Proposed Scheme). The survey has been undertaken to inform the noise and vibration chapter 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 five geographical zones, as described in Table 1.

Table 1: Description of Noise Sensitive Locations (NSLs) Across the Study Area

Geographical Zone	Description of Study Area
Pinnock Hill Junction to Airside Junction	The key noise sensitive receptors are residential receptors at Boroimhe Willows and Carlton Court. In addition to these estates, there are a small number of detached houses within 50m of the R132. This zone also includes the Premier Inn Dublin Airport hotel and Travelodge Dublin Airport Hotel.
Airside Junction to Northwood Avenue	The key noise sensitive receptors are medium sensitivity commercial properties. There are a low number of high sensitivity residential properties south of the Airside Junction within 10m to 20m of the R132. The study area includes the Tara Winthrop Private Clinic, which is a high sensitivity receptor located to the south of the R132 junction with the L2305 within 100m of the R132.
Northwood Avenue to Shantalla Road	Within this study area the key noise sensitive receptors are predominately residential dwellings which bound the east and west of the R132. A large number of these residential receptors are within 10m of the road edge.
Shantalla Road to Botanic Avenue	Within this study area, the key noise sensitive receptors are predominately residential dwellings which bound the R132 to the east and west. Highfield Hospital, Whitehall Holy Child Church and Plunkett College are sensitive receptors located within 50m of the Proposed Scheme.
Botanic Avenue to Granby Row	Within this study area, the key noise sensitive receptors are predominately residential dwellings in addition to the Rotunda, Mater Private and Temple Street Hospitals which are also within 50m of the Proposed Scheme. St Mary's Primary School is located within 10m of the alignment; Gardiner Street School and Belvedere College are also within 200m of the Proposed Scheme.

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. Both attended and unattended noise surveys were undertaken to inform the assessment:

- Unattended surveys (typically one week in duration) were made at one location; and
- Attended surveys (day-time measurements), were made at a total of nine 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 Pinnock Hill to Airside Junction

One attended survey location was surveyed within this study area. The location reference and a description of survey position are included in Table 2.

Table 2: Noise Monitoring Locations - Pinnock Hill to Airside Roundabout

Location	Description of Survey Location					
Attended Monitoring Locations						
CBC0002ANML001	Green area to west of Carlton Court housing estate, in line with closest residential façade facing onto R132 Swords Road screened by 6ft wall. Located approximately 25m from R132 road edge.					

1.2.2.2 Airside Junction to Northwood Avenue

Three long-term unattended monitoring locations and five attended 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 - Airside Junction to Northwood Avenue

Location	Description of Survey Location
Unattended Monitoring Locati	ons
CBC0002UNML001	In residential front garden approximately 100m southeast of R132 Swords Road / R125 junction.
CBC0002UNML002	In carpark area to side of Private Clinic in Nevinstown West to east of R132 Swords Road. Located approximately 45m from R132 road edge.
CBC0002UNML003	In residential front garden to southeast of R132 Swords Road / Old Airport Road junction. Located approximately 50m from R132 road edge. Closest façade of property approximately 30m from R132 road edge.
Attended Monitoring Location	s
CBC0002ANML002	On footpath to north of Boroimhe Willows positioned to west of R132 Swords Road, in line with closest residential façades facing onto R132 Swords Road. Located approximately 15m from R132 road edge.
CBC0002ANML003	Residential garden in Nevinstown West off R132 Swords Road, opposite Glenmore House. Located approximately 60m from R132 road edge.
CBC0002ANML004	Green verge 160m to south of R132 Swords Road / Naul Road roundabout junction, in line with commercial NSL façade facing onto R132 Swords Road. Located approximately 15m from R132 road edge.
CBC0002ANML005	On footpath 150m to north of R132 Swords Road / Corballis Road South Junction, in line with commercial façade. Located approximately 12m from R132 road edge.
CBC0002ANML006	Green area to north of Carlton Hotel to west of R132 Swords Road, in line with hotel closest façade facing onto R132 Swords Road. Located approximately 18m from R132 road edge.

1.2.2.3 Northwood Avenue to Shantalla Road

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 4.



Table 4: Noise Monitoring Locations - Northwood Avenue to Shantalla Road

Location	Description of Survey Location
Unattended Monitoring Locat	ions
CBC0002UNML004	In residential rear garden of Santry Villas housing estate with a direct line of sight to the R132 Swords Road. Located approximately 45m from R132 road edge.
Attended Monitoring Location	ns
CBC0002ANML007	On hard ground in Morton Stadium to west of R132 Swords Road, in line with closest façade facing R132 Swords Road. Located approximately 30m from R132 road edge.
CBC0002ANML008	On footpath to east of R132 Swords Road, opposite Morton Stadium, in line with closest residential façades facing onto R132 Swords Road. Located approximately 20m from R132 road edge.
CBC0002ANML009	Green area to south of R132 Swords Road / Magenta Crescent junction, in line with closest residential façades facing onto R132 Swords Road. Located approximately 15m from R132 Swords Road.
CBC0002ANML010	Green area to south of Magenta Hall housing estate, in line with closest residential façades facing onto R132 Swords Road. Located approximately 30m from R132 road edge, separated by a wall.
CBC0002ANML011	Footpath to northeast of R132 Swords Road / Shanrath Road junction, in line with residential façades facing onto R132 Swords Road. Located approximately 10m from R132 Swords Road.

1.2.2.4 Shantalla Road to Botanic Avenue

One long-term unattended monitoring location and six attended survey locations were surveyed within this study area. The location reference and a description of survey positions are included in Table 5.

Table 5: Noise Monitoring Locations - Shantalla Road to Botanic Avenue

Location	Description of Survey Location
Unattended Monitoring Locations	
CBC0002UNML005	In rear residential garden in Millmount Place housing estate. Located approximately 5m from River Tolka and 60m from R132 Drumcondra Road Lower.
Attended Monitoring Locations	
CBC0002ANML012	Green area to northeast of R132 Swords Road / R103 Collins Avenue junction, in line with closest residential façades facing onto R132 Swords Road. Located approximately 70m from R132 road edge.
CBC0002ANML013	On footpath to southwest of R132 Swords Road / Iveragh Road junction, in line with commercial façades facing onto R132 Swords Road. Located approximately 7m from R132 road edge.
CBC0002ANML014	Green area to south of Plunkett College, in line with closest façade of school facing onto R132 Swords Road. Located approximately 55m from R132 road edge.
CBC0002ANML015	On footpath to south of Seven Oaks housing estate, in line with residential façades facing into R132 Swords Road. Located approximately 25m from R132 road edge.
CBC0002ANML016	On footpath to southeast of R132 Drumcondra Road Upper / R102 Griffith Avenue junction, in line with closest residential façades facing onto R132 Drumcondra Road Upper. Located approximately 15m from N1 road edge.
CBC0002ANML017	On hard ground to south of Millmount Terrace, in line with residential façades facing onto River Tolka and R132 Drumcondra Road Lower. Located approximately 25m from R132 road edge.



1.2.2.5 Botanic Avenue to Granby RRow

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 6.

Table 6: Noise Monitoring Locations - Botanic Avenue to Granby Row

Location	Description of Survey Location					
Attended Monitoring Locations						
CBC0002ANML018	On footpath to southeast of R132 Dorset Street Lower / Eccles Street junction, in line with commercial façades facing onto R132 Dorset Street Lower / Upper. Located approximately 3m from R132 road edge.					
CBC0002ANML019	On footpath to west of Parnell Square East / Parnell Square North junction, in line with façades facing onto Frederick Street North. Located approximately 5m from Parnell Square East road edge.					

1.2.3 Survey Periods

Unattended noise surveys were undertaken between 24 January 2019 and 20 September 2020. The specific survey dates for each location are included in the survey result tables in Section 0

Attended noise surveys were undertaken between 22 October 2018 and 7 October 2020. The specific survey dates and times for each location are included in the survey results tables in Section 0.

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 Bruel and Kjær 2250L sound level meters. The specific equipment details are summarised in Table 7.

Table 7: Noise Monitoring Equipment

Survey Type	Equipment	Serial Number	Calibration Date	
Unattended	Rion NL-52	998410	22/01/2020	
		764925	19/08/2020	
		998413	22/01/2020	
		1076328	15/08/2018	
		586940	15/08/2018	
Attended	Bruel and Kjær 2250L	3008402	04/11/2019	
	Rion NL-52	1076330	15/08/2018	
		586944	16/08/2018	

Calibration certificate of the monitoring equipment are included within Section 3.

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 3.9.

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_{Aeq,T} 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_{Aeq,16hr} refers to the ambient daytime period between 07:00 and 23:00hrs.

L_{A10,T} 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_{A10,18hr} is the L_{A10} 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_{A90,T} 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_{A90,16hr}, refers to the background daytime noise level between 07:00 and 23:00hrs

L_{A90.8hr}, refers to the background night-time noise level between 23:00 and 07:00hrs

The L_{den} parameter is also discussed within the report. For long-term survey locations, this parameter is derived from the L_{Aeq} data over each 24 hour period as is defined as follows:

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

$$L_{\text{den}} = 10 log \left(\frac{1}{24}\right) \left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+10}{10}}\right)\right)$$

Where:

L_{day} 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.

Levening 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_{night} 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 (ISO 2016) and ISO 1996-2:2017 Part 2: Determination of sound pressure levels (ISO 2017).

1.2.6.1 Unattended Measurements

For unattended noise surveys, the monitoring equipment was installed within the private grounds of residential 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 one 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 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.
 - $L_{A10(18\text{hour})} = ((\sum L_{A10(15 \text{ minutes})}) \div 3) 1 \text{ dB}.$
- The derived L_{den} value is calculated from the L_{A10(18hour)} value, i.e.
 - $L_{den} = 0.86 \times L_{A10(18hr)} + 9.86 dB.$



1.3 Survey Results

1.3.1 Pinnock Hill to Airside Junction

1.3.1.1 Attended Surveys

The attended noise survey results recorded during the baseline surveys within this study area are presented in Table 8.

Table 8: Attended Noise Survey Results for Pinnock Hill to Airside Junction

Attended Location	Date	Start Time		Measured Noise Levels (dB re.2x10 ⁻⁵ Pa)			Survey Notes
			L _{Aeq}	L _{A10}	L _{A90}		
	22/10/2018	15:03	61	62	57		Road traffic noise from R132 Swords Road dominant noise source,
CBC0002ANML001		16:07	58	59	55	61	
CBC0002ANWL001	22/10/2010	17:12	62	59	55	01	rustling foliage, aircraft flyover, pedestrian conversations.



1.3.2 Airside Junction to Northwood Avenue

1.3.2.1 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 Airside Roundabout to Northwood Avenue

Survey Date	Daytime				Evening	Evening Night-Time			
	L _{Aeq,16hr}	L _{day}	L _{A10,16hr}	L _{A90,16hr}	Levening	L _{night}	L _{A10,8hr}	L _{A90,8hr}	L _{den}
CBC0002UNML00	1				'		'	'	
24/01/2019	62	63	64	58	61	55	58	45	64
25/01/2019	61	62	63	57	60	55	59	47	64
26/01/2019	62	62	64	58	61	59	62	52	66
27/01/2019	61	62	63	56	59	55	58	45	64
28/01/2019	61	62	63	57	60	56	58	45	64
29/01/2019	62	63	64	58	61	55	57	44	64
30/01/2019	62	63	64	58	61	57	59	48	65
Average	62	62	63	57	61	56	59	47	65
CBC0002UNML00	2			•	•				
09/05/2019	61	61	62	57	61	57	59	49	65
10/05/2019	59	60	61	55	58	56	59	49	63
11/05/2019	58	60	60	54	56	56	58	49	63
12/05/2019	58	59	60	54	58	55	57	49	63
13/05/2019	59	60	60	55	58	56	58	48	63
14/05/2019	59	60	61	55	58	55	57	48	63
15/05/2019	59	59	61	56	59	55	57	49	63
Average	59	60	61	55	58	56	58	49	63
CBC0002UNML00	3			•	•				
09/09/2020	57	58	58	50	55	53	54	44	60
10/09/2020	58	59	60	54	57	55	57	49	62
11/09/2020	60	61	61	56	57	54	56	48	62
12/09/2020	59	61	61	55	58	57	60	51	64
13/09/2020	57	58	59	53	56	-	-	-	57
Average	58	59	60	54	57	55	57	48	62

Road traffic from R132 Swords 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 range of 58 to 62 dB L_{Aeq,16hr}. Average background daytime noise levels were measured in the range of 54 to 57 dB L_{A90,16hr}.

Night-time noise levels at the monitoring locations are dominated by road traffic from R132 Swords Road. Average ambient night-time noise levels were measured in the range of 55 to 56 dB L_{Aeq,8hr}. Average background noise levels during this time period were measured in the range of 47 to 49 dB L_{A90,8hr}.

The measured L_{den} values in this geographical section ranged between 62 and 65 dB L_{den}.



1.3.2.2 Attended Surveys

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

Table 10: Attended Noise Survey Results for Airside Junction to Northwood Avenue

Attended Location	Date	Start Time			Levels		Levels		Derived L _{den}	Survey Notes
			L _{Aeq} L _{A10} L _{A90}							
	19/06/2020	14:08	60	62	55		Road traffic noise from R132 Swords Road dominant noise source, rustling leaves, hammering nearby.			
CBC0002ANML002	19/00/2020	15:40	59	62	52	62	Road traffic noise from R132 Swords Road dominant noise source, rustling leaves, pedestrian conversation.			
	24/06/2020	10:00	57	60	46		Road traffic noise from R132 Swords Road dominant noise source, rustling leaves, birdsong, children playing.			
		11:04	57	59	52					
CBC0002ANML003	17/04/2019	12:04	58	60	52	60	Road traffic noise from R132 Swords Road dominant noise source.			
		13:04	58	60	53					
	19/06/2020	14:39	62	64	57		Road traffic noise from R132 Swords Road dominant noise source, rustling leaves.			
CBC0002ANML004		16:04	62	64	57	64	Road traffic noise from R132 Swords Road dominant noise source, rusting leaves, aircraft take off.			
	24/06/2020	10:24	59	63	50		Road traffic noise from R132 Swords Road dominant noise source, rustling leaves, birdsong.			
		13:30	65	68	54					
CBC0002ANML005	07/10/2020	14:30	65	68	54	68	Road traffic noise from R132 Swords Road dominant noise source.			
		15:30	66	70	55					
	19/06/2020	15:11	65	68	55		Road traffic noise from R132 Swords Road dominant noise source, occasional beeping from pedestrian crossing, gate knocking in wind, aircraft take-off and landing occasionally.			
CBC0002ANML006		16:31	65	69	55	68	Road traffic noise from R132 Swords Road dominant noise source, occasional beeping from pedestrian crossing, aircraft landing, pedestrian conversation.			
	24/06/2020	10:50	66	69	54		Road traffic noise from R132 Swords Road dominant noise source, occasional beeping from pedestrian crossing.			

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1.3.3 Northwood Avenue to Shantalla Road

1.3.3.1 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 Northwood Avenue to Shantalla Road

Survey Date	Daytime				Evening Night-Time				L _{den}	
	L _{Aeq,16hr}	L _{day}	L _{A10,16hr}	L _{A90,16hr}	Levening	L _{night}	L _{A10,8hr}	L _{A90,8hr}		
CBC0002UNML004										
14/09/2020	53	54	54	49	51	52	53	45	59	
15/09/2020	53	53	53	48	53	50	50	44	57	
16/09/2020	55	56	56	52	54	50	51	44	58	
17/09/2020	54	55	55	51	53	52	52	45	59	
18/09/2020	57	58	58	54	55	52	53	47	60	
19/09/2020	56	57	57	53	54	50	51	44	58	
20/09/2020	54	55	55	50	53	47	49	39	56	
Average	55	56	55	51	54	50	51	44	58	

Road traffic from R132 Swords 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 order of 55 dB L_{Aeq,16hr}. Average background daytime noise levels were measured in the order of 51 dB L_{A90,16hr}.

Night-time noise levels at the monitoring locations are dominated by road traffic from R132 Swords Road. Average ambient night-time noise levels were measured in the order of 50 dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the order of 44 dB $L_{A90,8hr}$.

The measured L_{den} values in this study area were in the order of 58 dB L_{den} .

1.3.3.2 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 Northwood Avenue to Shantalla Road

Attended Location	Date	Start Time		red Nois 2x10 ⁻⁵ Pa		Derived L _{den}	Survey Notes
			L _{Aeq}	L _{A10}	L _{A90}		
		13:44	59	61	55		Road traffic noise from R132 Swords Road dominant noise source.
CBC0002ANML007	22/09/2020	14:38	58	61	54	61	Road traffic noise from R132 Swords Road dominant noise source, distant construction noise.
		15:30	58	61	54		Road traffic noise from R132 Swords Road dominant noise source.
		11:15	63	66	51		Doed treffic a size from D400 County Doed descined asian trains account binders and action accounts.
CBC0002ANML008	24/06/2020	12:03	63	67	52	66	Road traffic noise from R132 Swords Road dominant noise source, birdsong, pedestrian conversation.
		12:46	63	67	53	1	Road traffic noise from R132 Swords Road dominant noise source, birdsong.
		11:40	64	67	56		Road traffic noise from R132 Swords Road dominant noise source, construction noise, car horn.
CBC0002ANML009	24/06/2020	12:25	64	67	57	67	Deadles (Caracia from D400 Caracia Deadle and a series an
		13:08	64	67	57	1	Road traffic noise from R132 Swords Road dominant noise source, construction noise.
		14:10	56	59	53		
CBC0002ANML010	22/09/2020	15:04	56	58	52	59	Road traffic noise from R132 Swords Road dominant noise source.
		15:57	56	58	52		
		13:32	63	66	53		Road traffic noise from R132 Swords Road dominant noise source, birdsong, beeping from pedestrian crossing, car horn, children playing nearby.
CBC0002ANML011	24/06/2020	14:53	63	66	55	66	Road traffic noise from R132 Swords Road dominant noise source, birdsong, beeping from pedestrian crossing, car horn.
		16:02	63	66	54	1	Road traffic noise from R132 Swords Road dominant noise source, birdsong, beeping from pedestrian crossing, pedestrian conversation.



1.3.4 Shantalla Road to Botanic Avenue

1.3.4.1 Unattended Surveys

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

Table 13: Unattended Noise Survey Results for Shantalla Road to Botanic Avenue

Survey Date	Daytime				Evening	Night-Time			L _{den}
	L _{Aeq,16hr}	L _{day}	L _{A10,16hr}	L _{A90,16hr}	Levening	L _{night}	L _{A10,8hr}	L _{A90,8hr}	
CBC0002UNML005									
26/08/2020	58	58	59	51	58	56	58	49	63
27/08/2020	59	60	61	53	58	58	60	50	64
28/08/2020	59	60	61	54	58	55	58	50	63
29/08/2020	59	58	60	53	60	55	58	49	63
30/08/2020	58	58	60	51	58	56	59	48	63
31/08/2020	59	58	59	50	59	58	61	48	65
01/09/2020	59	59	59	50	59	57	59	47	64
02/09/2020	59	61	60	53	56	56	59	49	63
Average	59	59	60	52	58	57	59	49	64

Road traffic noise from R132 Drumcondra Road Lower is the dominant noise source, with water noise from River Tolka also present at the monitoring position in the vicinity of the Proposed Scheme. During daytime periods, average ambient noise levels were measured in the order of 59 dB L_{Aeq,16hr}. Average background daytime noise levels were measured in the order of 52 dB L_{A90,16hr}.

Night-time noise levels at the monitoring locations are dominated by road traffic from R132 Drumcondra Road Lower is the dominant noise source, with water noise from River Tolka also present. Average ambient night-time noise levels were measured in the order of 57 dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the order of 49 dB $L_{A90,8hr}$.

The measured L_{den} values in this geographical section were in the order of 64 dB L_{den} .

1.3.4.2 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 Shantalla Road to Botanic Avenue

Attended Location	Date	Start Time	Start Time Measured Noise Levels (dB re.2x10 ⁻⁵ Pa)		Derived L _{den}	Survey Notes	
			L _{Aeq}	L _{A10}	L _{A90}		
		14:02	60	62	56		Road traffic noise from R132 Swords Road dominant noise source, occasional noise from bottle bank nearby, ice cream truck music.
CBC0002ANML012	24/06/2020	15:16	59	62	55	62	Road traffic noise from R132 Swords Road dominant noise source, occasional noise from bottle bank nearby.
		16:21	59	61	55		Road traffic noise from R132 Swords Road dominant noise source, occasional noise from bottle bank nearby, ice cream truck music, loud pedestrian conversation, car horn.
		14:22	66	69	58		Road traffic noise from R132 Swords Road dominant noise source.
CBC0002ANML013	24/06/2020	15:35	66	69	57	68	Road traffic noise from R132 Swords Road dominant noise source, car horn.
		16:41	65 69 57			Road traffic noise from R132 Swords Road dominant noise source.	
		11:36	57	59	52		
CBC0002ANML014 09/09/2020	13:15	53	55	49	58	Road traffic noise from R132 Swords Road dominant noise source, rustling leaves.	
	14:50	55	57	49			
		10:00	58	59	49		Road traffic noise from R132 Swords Road dominant noise source, birdsong, rustling leaves, sirens.
CBC0002ANML015	25/06/2020	11:17	56	59	49	60	Road traffic noise from R132 Swords Road dominant noise source, rustling leaves.
		12:34	59	59	49		Road traffic noise from R132 Swords Road dominant noise source, rustling leaves. birdsong, pedestrian conversation, refuse truck pass-by.
	25/06/2020	10:20	70	71	59		Road traffic noise from R132 Drumcondra Road Upper / R102 Griffith Avenue dominant noise source, intermitten truck horn and car horn.
CBC0002ANML016	4.4/00/0000	14:56	71	70	59	69	Road traffic noise from R132 Drumcondra Road Upper / R102 Griffith Avenue dominant noise source, siren.
	14/09/2020	16:04	68	70	59	1	Road traffic noise from R132 Drumcondra Road Upper / R102 Griffith Avenue dominant noise source, siren.
		10:53	57	60	51		Road traffic noise from R132 Drumcondra Road Lower dominant noise source, water noise from River Tolka.
CBC0002ANML017	25/06/2020	12:09	57	59	50	60	Road traffic noise from R132 Drumcondra Road Lower dominant noise source, water noise from River Tolka, car horn.
		13:20	62	60	51		Road traffic noise from R132 Drumcondra Road Lower dominant noise source, water noise from River Tolka, car horn, siren, pedestrian conversation.



1.3.5 Botanic Avenue to Granby Row

1.3.5.1 Attended Surveys

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

Table 15: Attended Noise Survey Results for Botanic Avenue to Granby Road

Attended Location	Date	Start Time	Leve	Measured Noise Levels (dB re.2x10 ⁻⁵ Pa)		Levels		Levels		Derived L _{den}	Survey Notes
			L_{Aeq}	L _{A10}	L _{A90}						
	14/09/2020	15:29	67	70	60		Road traffic noise from R132 Dorset Street Lower / Eccles Street junction dominant noise source, frequent beeping from pedestrian crossing.				
CBC0002ANML018	25/06/2020	14:45	69	72	62	70	Road traffic noise from R132 Dorset Street Lower / Eccles Street junction dominant noise source, frequent beeping from pedestrian crossing, truck parked in idle.				
	14/09/2020	16:36	68	70	62		Road traffic noise from R132 Dorset Street Lower / Eccles Street junction dominant noise source, frequent beeping from pedestrian crossing.				
		14:16	65	69	57		Road traffic noise from Parnell Square East / Parnell Square North junction dominant noise source, pedestrian conversation, car horn, loud music from car pass-by.				
CBC0002ANML019	25/06/2020	15:08	68	70	56	69	Road traffic noise from Parnell Square East / Parnell Square North junction dominant noise source, pedestrian conversation, siren, bus reversing and street cleaner pass-by.				
		15:54	66	70	58		Road traffic noise from Parnell Square East / Parnell Square North junction dominant noise source, pedestrian conversation.				



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 Proposed Works). Baseline vibration data obtained from this study has been used to information all individual Bus Connects Core Bus Corridor Schemes.

2.2 Survey Methodology

2.2.1 Survey Locations

Attended vibration monitoring was undertaken 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 Scheme.

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 16.

Table 16: 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 3

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/s2 and the time period over which the VDV is measured is in seconds. This yields VDVs in m/s1.75"

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

Table 17: Vibration Monitoring Results at ANML001

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}			
	Х	Υ	Z	Х	Υ	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 18 presents the results of vibration values associated with individual bus drive events by during the monitoring period at this location.

Table 18: Vibration Monitoring Results at ANML002

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}			
	Х	Υ	Z	Х	Υ	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 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 ANML003

Event Time	PPV, mm/s			VDV, _{b,d} , m/s ^{1.75}			
	х	Υ	z	х	Υ	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 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 ANML004

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}			
	Х	Υ	Z	X	Υ	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 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 ANML005

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}		
	х	Υ	z	х	Υ	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 22 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 22: Vibration Monitoring Results at ANML006

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}			Notes
	Х	Υ	Z	Х	Υ	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 23 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 23: Vibration Monitoring Results at ANML007

Event Time	PPV, mm/	/s		VDV, _b , m/s	1.75		Notes
	Х	Y	Z	Х	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 al 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 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 ANML008

Event Time	PPV, mm/	s		VDV, _b , m/s	VDV, _b , m/s ^{1.75}			
	Х	Υ	Z	Х	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 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 ANML009

Event Time	PPV, mm/s			VDV, _b , m/s ^{1.75}	Notes		
	Х	Υ	Z	Х	Υ	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	



2.5 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
- S.I. No. 549/2018 European Communities (Environmental Noise) Regulations 2018



3. CALIBRATION CERTIFICATES FOR MONITORING EQUIPMENT



3.1 Rion NL-52 S/N 998410





CERTIFICATE OF CALIBRATION





Date of Issue: 22 January 2020

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: UCRT20/1096

Page of 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

Type

Identification

Manufacturer

Instrument

Serial No. / Version

Rion

Sound Level Meter

NL-52

00998410

Rion

Firmware

2.0

Rion

Pre Amplifier

NH-25

98624

Rion

Microphone

UC-59

15916

Rion

Calibrator

NC-74 Calibrator adaptor type if applicable

34536109 NC-74-002

Performance Class 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.



CERTIFICATE OF CALIBRATION	Certificate Number UCRT20/1096						
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages		

				-Australian				
Sound Level Meter Inc	truction manual a	nd data used	to adjust t	he sound lev	ale ind	licated		
Sound Level Meter Ins			42 / NL-52	rie souriu iev	eis iriu	icateu.		
SLM instruction manual r			-03					
SLM instruction manual s		200						
		0.000.000.000.000	acturer					
Internet download date if			/A					
Case corrections available			es					
Uncertainties of case cor	rections		es					
Source of case data			acturer					
Wind screen corrections	and the state of t	10/20	es					
Uncertainties of wind scre		Y	7.7.0					
Source of wind screen da			acturer					
Mic pressure to free field		Y						
Uncertainties of Mic to F.		Ye	7					
Source of Mic to F.F. corr		Manufa	2,70,000	000 11				
Total expanded uncertain				002 Yes				
Specified or equivalent Calibrat		Spec						
Customer or Lab Calibrat	770	Lab Ca						
Calibrator adaptor type if	applicable	NC-7-	3 4 T 3 T 7 T					
Calibrator cal. date		21 Janua	10.000					
Calibrator cert. number		UCRT2						
Calibrator cal cert issued	by	06	53					
Calibrator SPL @ STP		93.98	dB	Calibration r	eferen	ce sound pres	ssure level	
Calibrator frequency		1001.97	7 Hz	Calibration of	check fr	requency		
Reference level range		25 - 130) dB					
Accessories used or corre	ected for during cali	bration -	Extension (Cable & Wind	Shield \	WS-15		
Note - if a pre-amp extens								
Environmental conditions	during tests	Start		End]		_	
	Temperature	22.46		22.19	±	0.30 °C]	
	Humidity	42.2		37.2	±	3.00 %RH		
	Ambient Pressure	102.71		102.74	±	0.03 kPa		
Response to associated C	Calibrator at the env	ironmental cor	ditions abo	ve.				
Initial indicated level	94.0	dB	Adjusted	indicated level		94.0	dB	
The uncertainty of the ass	sociated calibrator s	upplied with the	e sound lev	el meter ±		0.10	dB	
Self Generated Noise	This test is current		3000 1000 100	The state of the s	•		•	
Microphone installed (if re				N/A	dB A	A Weighting		
Uncertainty of the microph				N/A	dB /	Troignang		
						1		
Microphone replaced with		ice - C		r Range indica				
Weighting	A 1.4 dB UR		dB UR		Z IdB	UR		
Uncertainty of the electrical			UB OK	0.12	dB	UK J		
		and the state of the state of		and the second s				
The reported expanded ur								
a coverage probability of a	approximately 95%.	i ne uncertain	ty evaluatio	n nas been ca	irried o	ut in accorda	nce with	
UKAS requirements.		10 100				V 20. 20.	2022	
For the test of the frequen response was used.	cy weightings as pe	er paragraph 12	2. of IEC 61	672-3:2006 the	e actua	Il microphone	free field	
The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out								
using an electrostatic actu	The state of the second se	weighting do p	oci paragra	pii i i oi iLo o	1072 0	.2000 WCIC 0	arried out	
		EN	D					
Calibrated by: A.Escalona R 3								
	The results on this	certificate only	relate to th	e items calibra	ited as	identified abo	ove.	



3.2 Rion NL-52 S/N 764925





CERTIFICATE OF CALIBRATION





Date of Issue: 19 August 2020

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 Pages Approved Signatory K. Mistry

Certificate Number: UCRT20/1788

Customer

AWN Consulting Limited

The Tecpro Building

IDA Business and Technology Park

Clonshaugh Dublin 17 Ireland

Order No.

PO 2062

Description

Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer Instrument Type Serial No. / Version Sound Level Meter NL-52 00764925 Rion Firmware 2.0 Rion 65051 Pre Amplifier NH-25 Rion UC-59 09853 Rion Microphone NC-74 34536109 Rion Calibrator Calibrator adaptor type if applicable NC-74-002

Performance Class

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

19 August 2020

ANV Job No.

UKAS20/08452

Date Calibrated

19 August 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

Certificate No.

Laboratory

22 August 2018

UCRT18/1863

0653

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CERTIFICATE OF CALIBRATION	Certif		Num T20/17		
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages

UKAS Accredi	ted Calibration Labo	pratory No. 06	153		Page	2	OT	2	Pages	3
Sound Level Meter In	nstruction manual a	nd data used	to adjust the	he sound	d leve	ls ind	icated.			
SLM instruction manua			42 / NL-52							
SLM instruction manua	Il ref / issue	11	-03							
SLM instruction manua	al source	Manuf	acturer							
Internet download date	if applicable		/A							
Case corrections availa			es							
Uncertainties of case of	orrections		es							
Source of case data		acturer								
Wind screen correction	es									
Uncertainties of wind s	creen corrections	Y	es							
Source of wind screen	data	Manuf	acturer							
Mic pressure to free fie	ld corrections	Y	es							
Uncertainties of Mic to	F.F. corrections	Y	es							
Source of Mic to F.F. of			acturer							
Total expanded uncerta	ainties within the requ	irements of IEC	61672-1:2	002	Yes					
Specified or equivalent			cified							
Customer or Lab Calibr			librator							
Calibrator adaptor type	if applicable		4-002							
Calibrator cal. date		15 July	y 2020							
Calibrator cert. number		UCRT2	0/1634							
Calibrator cal cert issue	ed by	06	53							
Calibrator SPL @ STP		94.00	dB	Calibra	tion re	feren	ce sound	d pres	sure le	evel
Calibrator frequency		1001.92	2 Hz				requency			
Reference level range		25 - 130) dB	Gambra			oquono,			
Accessories used or co	rrected for during cal	hration -	Extension C	able & V	/ind S	hield \	WS-15			
Note - if a pre-amp exte										
Environmental condition		Start	1	End		p. 0				
Environmental condition	Temperature	23.88		24.01	\rightarrow	±	0.30 °	·C	ı	
	Humidity	51.1		52.1	\rightarrow	±	3.00 %		1	
	Ambient Pressure			99.12	-+	±	0.03 k			
						<u> </u>	0.00 K	ı a	ı	
Response to associated										
Initial indicated lev		dB	Adjusted i				94.0		dB	
The uncertainty of the a	_				<u> </u>		0.10		dB	
Self Generated Noise	This test is current									
Microphone installed (if	requested by custom	er) = Less Tha	an	N/A			A Weight	ting		
Uncertainty of the micro	phone installed self g			N/A		dB				
Microphone replaced wi	ith electrical input dev	ice -	UR = Under	Range i	ndicate	ed	<u></u>			
Weighting	A	C			Z					
	12.9 dB UR		dB UR	22.		dΒ	UR			
Uncertainty of the electr	ical self generated no	ise ±		0.12		dB				
The reported expanded	uncertainty is based	on a standard ι	uncertainty r	nultiplied	by a c	overa	age facto	or <i>k=2</i>	2, provi	ding
a coverage probability of	f approximately 95%.	The uncertain	ty evaluatio	n has be	en cari	ried o	ut in acc	ordar	nce with	h
UKAS requirements.										
For the test of the freque	ency weightings as pe	er paragraph 12	2. of IEC 616	672-3:20	06 the	actua	l microp	hone	free fie	eld
response was used.										
The acoustical frequence	v tests of a frequency	weighting as r	er paragrar	oh 11 of I	EC 61	672-3	:2006 w	еге с	arried c	out
using an electrostatic ac		worghting do p	or paragrap	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		0, 2 0	.2000 11	0,00	211100	,,,,
	END									
Calibrated by: B. C	Silos	EN								 D 4
Calibrated by: B. C Additional Comments	Giles The results on this	certificate only	relate to the	a itame a	alibrat	ad ac	identific	d aba	WA.	R 1
None	The results on this	certificate only	relate to the	e iteilis C	alibial	eu as	dentine	u abc	ve.	
None										



3.3 Rion NL-52 S/N 998413









Date of Issue: 22 January 2020

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: UCRT20/1095

	Page	1	of	2	Pages
Approved S	Signatory		1		
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		/			
K. Mistry		/		1	
A. IVIISU y					

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 Serial No. / Version Type Sound Level Meter 00998413 Rion NL-52 Rion Firmware 2.0 Pre Amplifier NH-25 98627 Rion Rion Microphone UC-59 15920 Rion Calibrator NC-74 34536109

> Calibrator adaptor type if applicable NC-74-002

Performance Class

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.



CERTIFICATE OF CALIBRATION	Certif		Num T20/10		d.
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages

O		1 1-1		0	.1- !	D1d	
Sound Level Meter Inst				the sound leve	els inc	licated.	
SLM instruction manual ti	[17] [17] [17] [17] [17] [17] [17] [17]		-42 / NL-52				
SLM instruction manual re		3000	1-03				
SLM instruction manual s			ıfacturer				
Internet download date if			N/A				
Case corrections available	е	87	Yes				
Uncertainties of case corr	rections		Yes				
Source of case data			ıfacturer				
Wind screen corrections a			Yes				
Uncertainties of wind screen corrections Yes							
Source of wind screen data Manufacturer							
Mic pressure to free field			Yes .				
Uncertainties of Mic to F.I			Yes				
Source of Mic to F.F. corr			ıfacturer				
Total expanded uncertain				2002 Yes			
Specified or equivalent Ca		70 000000	ecified				
Customer or Lab Calibrate			alibrator				
Calibrator adaptor type if	applicable		74-002				
Calibrator cal. date			uary 2020				
Calibrator cert. number		UCRI	20/1082				
Calibrator cal cert issued	by	0	653				
Calibrator SPL @ STP		93.9	B dB	Calibration re	eferen	ce sound pres	sure level
Calibrator frequency		1001.	97 Hz	Calibration of	heck f	requency	
Reference level range		25 - 1	30 dB				
Accessories used or corre	cted for during calib	ration -	Extension (Cable & Wind S	Shield '	WS-15	
Note - if a pre-amp extens							
					1	amp.	
Environmental conditions		Star		End	1000	1	
	Temperature	22.18		22.19	±	0.30 °C	
	Humidity	38.7		37.6	±	3.00 %RH	
	Ambient Pressure	102.7	2	102.74	±	0.03 kPa	
Response to associated C	alibrator at the envir	ronmental co	onditions abo	ove.			
Initial indicated level		dB		indicated level		94.0	dB
The uncertainty of the ass	ociated calibrator su	pplied with t	he sound lev	el meter ±		0.10	dB
Self Generated Noise	This test is currently	not perform	ed by this La	ah			
Microphone installed (if re				N/A	dB /	A Weighting	
Uncertainty of the microph				N/A	dB .	1 Troighting	
					lad.	i	
Microphone replaced with		ce -	C = Unde	r Range indica	z Z		
Weighting	A Ido Iuo	10.0	dB UR			lup	
	.7 dB UR		IOP OK	-		UR	
Uncertainty of the electrica				0.12	dB		
The reported expanded ur							
a coverage probability of a	pproximately 95%.	The uncerta	inty evaluatio	on has been ca	rried o	ut in accordan	ce with
UKAS requirements.							
For the test of the frequent response was used.	cy weightings as per	paragraph	12. of IEC 61	672-3:2006 the	e actua	Il microphone	free field
The acoustical frequency tusing an electrostatic actual		weighting as	per paragra	ph 11 of IEC 6	1672-3	:2006 were ca	arried out
		F	ND				
Calibrated by: B. Bo							R 2
[2] 이글 마이터를 잃었다면 하다는 '아이를 살았다'다 () [2] [2] [2] [2] [2] [2] [2] [2] [2] [2]	guari The results on this c	ertificate on	v relate to th	e items calibra	ted as	identified abo	
None	THE TESURE OF URS C	o unoate on	y relate to th	ie itemia calibra	icu as	identified abo	vo.
VOLIG							



3.4 Rion NL-52 S/N 1076328



CERTIFICATE OF CALIBRATION



Date of Issue: 15 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: UCRT18/1836 Page

Approved Signatory 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

Sound Level Meter NL-52 01076328 Rion Rion Firmware 1.9 76545 Rion Pre Amplifier NH-25 UC-59 Rion Microphone 12271 34536109 Rion Calibrator NC-74 Calibrator adaptor type if applicable

NC-74-002

Performance Class

Test Procedure

TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

21.21 / 13.02 Type Approved to IEC 61672-1:2002 YES Approval Number

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

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	Certi		Num T18/18		
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages

Sound Level Meter Ins			l to adjust t	he sound leve	ls ind	icated.		
SLM instruction manual ti			-42 / NL-52					
SLM instruction manual re			1-03					
SLM instruction manual s			facturer					
Internet download date if			V/A					
Case corrections available			es es					
Uncertainties of case con	ections		es .					
Source of case data	7.11		facturer					
Wind screen corrections and Uncertainties of wind screen			es .					
Source of wind screen da		navance i	es feeturer					
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. corr		0.0000	facturer					
Total expanded uncertain				002 Yes				
Specified or equivalent Ca			cified					
Customer or Lab Calibrat	or	Lab C	alibrator					
Calibrator adaptor type if	applicable	NC-	74-002					
Calibrator cal. date		06 Aug	ust 2018					
Calibrator cert. number		UCRT	18/1784					
Calibrator cal cert issued	by	0	653					
Calibrator SPL @ STP		93.99	dB	Calibration re	eference	ce sound pres	ssure level	
Calibrator frequency		1001.9	97 Hz	Calibration cl	neck fr	equency		
Reference level range		25 - 13	30 dB					
Accessories used or corre	ected for during calib	ration -	Extension (Cable & Wind S	hield \	WS-15		
Note - if a pre-amp extens	sion cable is listed th	en it was use	ed between t	the SLM and the	e pre-a	amp.		
Environmental conditions	during tests	Start		End				
	Temperature	22.84		22.87	±	0.30 °C	1	
	Humidity	49.8		49.7	±	3.00 %RH	1	
	Ambient Pressure	100.6	7	100.63	±	0.03 kPa]	
Response to associated (Calibrator at the envir	ronmental co	nditions abo	ive.			•	
Initial indicated level		dB		indicated level		94.0	dB	
The uncertainty of the ass						0.10	dB	
Self Generated Noise	This test is currently		10.00					
Microphone installed (if re					dB A	A Weighting		
Uncertainty of the microph					dB	l l		
Microphone replaced with				r Range indicat	ed	i		
Weighting	A		C		7			
	1.5 dB lur	15.5	dB IUR		dB	UR		
Uncertainty of the electric					dB			
The reported expanded u	ncertainty is based o	n a standard	uncertainty	multiplied by a	covera	ge factor k=:	2 providina	
a coverage probability of a								
UKAS requirements.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,					
For the test of the frequen	cv weightings as per	naragraph '	12. of IEC 61	672-3:2006 the	actua	l microphone	free field	
response was used.	ey meightinge the per	herred service		0.2 0.2000				
The acoustical frequency	tests of a frequency	weighting as	per paragra	ph 11 of IEC 61	1672-3	:2006 were c	arried out	
using an electrostatic actu		rroigriii ig ao	per paragra	pii 11 01 120 0				
		_	ND					
Calibrated by: A Pat	۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰						R1	
Additional Comments	CI CI						K	
None								



3.5 Rion NL-52 S/N 586940



CERTIFICATE OF CALIBRATION

Certificate Number: UCRT18/1831

Page

Approved Signatory

Harriman



Pages

Date of Issue: 15 August 2018

Issued by:

Customer

ANV Measurement Systems

Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL

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Acoustics Noise and Vibration Ltd trading as ANV Measurement System

AWN Consulting Limited

The Tecpro Building

IDA Business and Technology Park

Dublin 17 Ireland

Order No.

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

IdentificationManufacturerInstrumentTypeSerial No. / VersionRionSound Level MeterNL-5200586940

Firmware Rion 1.9 Rion Pre Amplifier NH-25 87059 Rion Microphone UC-59 13402 34536109 Rion Calibrator NC-74 NC-74-002 Calibrator adaptor type if applicable

Performance Class

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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CERTIFICATE OF CALIBRATION	Certi		Num T18/18		
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages

Sound Level Meter Inst				he sound	levels ind	icated.		
SLM instruction manual tit			42 / NL-52					
SLM instruction manual re		1	1-03					
SLM instruction manual se			ufacturer					
Internet download date if			N/A					
Case corrections available	9		Yes					
Uncertainties of case corr	ections	Maria de la Compania del Compania de la Compania de la Compania del Compania de la Compania de l	Yes					
Source of case data			ufacturer					
Wind screen corrections a			Yes					
Uncertainties of wind scre			Yes					
Source of wind screen data Manufacturer								
Mic pressure to free field corrections Uncertainties of Mic to F.F. corrections Yes Yes								
			Yes					
Source of Mic to F.F. corrections Total expanded uncertainty			ufacturer	002 1	/00			
Specified or equivalent Ca			ecified	002	Yes			
Customer or Lab Calibrate			Calibrator					
Calibrator adaptor type if a			74-002					
Calibrator cal. date	аррисавіс		gust 2018					
Calibrator cert, number			Γ18/1784					
Calibrator cal cert issued)653					
	Э			0 11 11				
Calibrator SPL @ STP		93.9				ce sound pres	sure level	
Calibrator frequency		1001.		Calibrati	on check f	requency		
Reference level range		25 - 1		-				
Accessories used or corre			Extension (
Note - if a pre-amp extens	ion cable is listed th	en it was us	ed between t	he SLM an	d the pre-	amp.		
Environmental conditions		Star		End				
0.40	Temperature	21.8		22.52	±	0.30 °C		
	Humidity	61.4		53.7	±	3.00 %RH		
	Ambient Pressure	100.7	71	100.68	±	0.03 kPa		
Response to associated C	alibrator at the envi	onmental c	onditions abo	ve.				
Initial indicated level	94.0	dB	Adjusted	indicated le	evel	94.0	dB	
The uncertainty of the ass	ociated calibrator su	pplied with	the sound lev	el meter ±		0.10	dB	
Self Generated Noise	This test is currently	not perform	ned by this La	ab.				
Microphone installed (if re				N/A	dB /	A Weighting		
Uncertainty of the microph				N/A	dB	1		
Microphone replaced with	electrical input device	·	UR = Unde	r Range in	dicated	í		
Weighting	A	,	C	Trange in	Z	_		
	.4 dB UR	15.5	IdB IUR	21.5		UR		
Uncertainty of the electrical			100 1011	0.12	dB			
The reported expanded ur	certainty is based o	n a etandar	d uncertainty	multiplied b	hy a cover	age factor k='	providing	
a coverage probability of a								
UKAS requirements.	pproximatory 50%.	The dilectic	inty evaluation	ii iido bee	ii cairica c	at iii accordai	ioc with	
For the test of the frequent	rv weightings as ner	naragraph	12 of IEC 61	672-3-200	6 the actus	l microphone	free field	
response was used.	cy weightings as per	paragraph	12. 01 ILC 01	012-0.200	o trie actue	ii microphone	nee neid	
The acoustical frequency t	ests of a frequency	weighting as	s per paragra	ph 11 of IF	C 61672-3	3:2006 were ca	arried out	
using an electrostatic actu			- per pensagran					
		-	ND					
Calibrated by: A Pate							R 1	
Additional Comments	.						1 1	
None								
117.57								



3.6 Rion NL-52 S/N 1076330



CERTIFICATE OF CALIBRATION

Approved Signatory

Harriman



Date of Issue: 15 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

AWN Consulting Limited Customer 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 Rion

Instrument Type Serial No. / Version Sound Level Meter NL-52 01076330 Firmware 1.9

Certificate Number: UCRT18/1834

Rion Rion Pre Amplifier NH-25 76547 Microphone UC-59 12273 Rion Rion Calibrator NC-74 34536109 NC-74-002 Calibrator adaptor type if applicable

Performance Class

Test Procedure

TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests. YES

Type Approved to IEC 61672-1:2002

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 Date Calibrated 13 August 2018 15 August 2018 ANV Job No.

UKAS18/08513

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 Certificate No. Dated Laboratory Initial Calibration

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CERTIFICATE OF CALIBRATION	Certif		Num F18/18		
UKAS Accredited Calibration Laboratory No. 0653	Page	2	of	2	Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated. SLM instruction manual et/ issue SLM instruction manual et/ issue 11-03 SLM instruction manual et/ issue Manufacturer Internet download date if applicable N/A Case corrections available Yes Uncertainties of case corrections Ves Source of or dase data Manufacturer Wind screen corrections available Yes Uncertainties of wind screen corrections Yes Source of wind screen data Manufacturer Wind screen of wind screen data Manufacturer Total expanded uncertainties within the requirements of IEC 61672-12002 Yes Specified or equivalent Calibrator Calibrator adaptor type if applicable Calibrator cal, date 06 August 2018 Calibrator cal, date 06 August 2018 Calibrator cert, number UCRT18/1784 Calibrator cert, number UCRT18/1784 Calibrator oret, number UCRT18/1784 Calibrator oreterde ore uncerted for during calibrator Reference level range 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 Sart Femperature 22-73 22-92 ± 0.30 °C Humidity 50-82 Environmental conditions during tests Femperature 22-73 22-82 ± 0.30 °C Humidity 10-84 Additional contrelative oretain page date with the sound level meter ± 0.10 dB Microphone installed (if requeste												
SLM instruction manual ref / issue				CONTRACTOR OF THE CONTRACTOR		e sour	nd leve	ls ind	icated.			
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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 Uncertainty of the electrical self generated noise ± 0.12 dB 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 Additional Comments	Calibrator frequency		10	01.97	Hz	Calibr	ation cl	neck f	requenc	y		
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.	Reference level range		25	- 130	dB				- 25 25			
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.	Accessories used or corre	cted for during calib	ration -	Exten	sion Ca	able &	Wind S	hield	WS-15			
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 UR = Under Range indicated Weighting A C Z 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 Additional Comments				s used betw	een the	SLM	and the	e pre-a	amp.			
Temperature	Environmental conditions	during tests		Start		End	-					
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Response to associated Calibrator at the environmental conditions above. Initial indicated level		Humidity		52.2		50.8		±	3.00	%RH		
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 Additional Comments		Ambient Pressure	1	00.66		100.65	5	±	0.03	кРа		
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Additional Comments	Calibrated by: A Pat	el	M.S.									R 1
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3.7 Rion NI-52 S/N 586944



CERTIFICATE OF CALIBRATION

Harriman

Certificate Number: UCRT18/1839



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

Accustics 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 00586944 Rion Sound Level Meter NL-52 Rion Firmware 1.9 NH-25 87063 Rion Pre Amplifier 13407 Rion Microphone UC-59 Rion

Calibrator NC-74 34536109
Calibrator adaptor type if applicable NC-74-002

Performance Class

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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SLM instruction manual	CONTRACTOR OF THE PARTY OF THE	ne	11-0	3					
SLM instruction manual	source		Manufac	cturer					
Internet download date	f applica	ible	N/A						
Case corrections availal	ble		Yes						
Uncertainties of case co	rrections	S	Yes						
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Wind screen corrections			Yes						
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Calibrator adaptor type i	f applica	ible	NC-74-						
Calibrator cal. date			06 Augus	t 2018					
Calibrator cert. number			UCRT18	/1784					
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3.8 Bruel and Kjaer 2250L









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 Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Certificate Number: UCRT19/2218

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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 Calibrated on 16 October 2017, Certificate No. UCRT17/1897 issued

CALIBRATION 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.



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.



UKAS ACCREDITED CALIBRATION LABORATORY No 0653

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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	Υ	Y	Υ
BZ 7131	Octave analysis	4.7.5	Υ	N	N/A
BZ 7132	1/3-oct analysis	4.7.5	Υ	Y	N/A
BZ 7133	Logging	4.7.5	Υ	Y	N/A
BZ 7226	Signal Recording Option	4.7.5	Υ	N	N/A
BZ 7231	Tone Assessment	4.7.5	Υ	N	N/A
BZ 7232	Noise Monitoring Software	4.7.5	Υ	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.



3.9 Rion VM-56 (S/N 680043)



Date of Issue: 01 November 2019

Issued by:

ANV Measurement Systems

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Milton Keynes MK5 8HL

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Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Certificate Number: TCRT19/1825

Page

Approved Signatory

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of

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K. Mistry

Client

AWN Consulting Limited

The Tecpro Building, IDA Business & Technology Park, Clonshaugh

Dublin 1 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 Kit Number 6

Calibration Status

Passed Calibration

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 Number TCRT19/1825

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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.	Actual Vel.	Indicated (X)	Error (X)	Indicated (Y)	Error (Y)	Indicated (Z)	Error (Z)
mm/s	mm/s	mm/s	%	mm/s	%	mm/s	%
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/s2" is actual reading in m/s2.

1 m/s² Range

Level dB	Error (X) dB	m/s² (X)	Error (Y) dB	m/s² (Y)	Error (Z) dB	m/s² (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/s² Range

Level dB	Error (X) dB	m/s² (X)	Error (Y) dB	m/s² (Y)	Error (Z) dB	m/s² (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.



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3 Pages

Frequency Responses For Complete System

Measured on the 1 m/s² range with weightings as indicated in the table and PV-83CW serial No.

Frequency Hz	Applied Acc. m/s ²	X (Wd) rms m/s ²	Error X %	VDV (X) m/s ^{1.75}	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 ²	Y (Wd) rms m/s ²	Error Y %	VDV (Y) m/s ^{1.75}	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 ²	Z (Wb) rms m/s ²	Error Z %	VDV (Z) m/s ^{1.75}	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 to 63 Hz +12%/-11%; @ 80 Hz +26%/-21%

All results meet the manufacturer's specification.

END OF CALIBRATION

CALIBRATED BY :- A. Lloyd



4. Unattended Monitoring Equipment Set Up

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Location

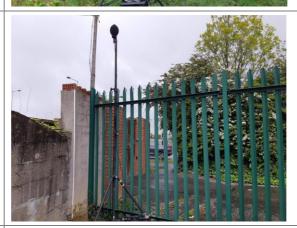
CBC0002UNML001

In residential front garden approximately 100m southeast of R132 Swords Road / R125 junction.



CBC0002UNML002

In carpark area to side of Private Clinic in Nevinstown West to east of R132 Swords Road. Located approximately 45m from R132 road edge.



CBC0002UNML003

In residential front garden to southeast of R132 Swords Road / Old Airport Road junction. Located approximately 50m from R132 road edge. Closest façade of property approximately 30m from R132 road edge.



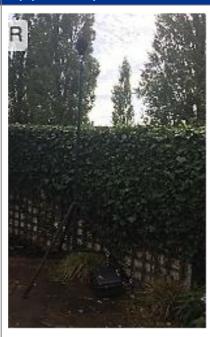
CBC0002UNML004



Location

In residential rear garden of Santry Villas housing estate with a direct line of sight to the R132 Swords Road. Located approximately 45m from R132 road edge.

Equipment Set up



CBC0002UNML005

In rear residential garden in Millmount Place housing estate. Located approximately 5m from River Tolka and 60m from R132 Drumcondra Road Lower.

