Technical Appendix 9.1: Acoustic Terminology

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

$L_{Aeq,T}$ the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

$L_{A10,T}$: the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise',

$L_{A90,T}$: the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

L_{Amax} : the maximum A-weighted level of sound over a period of measurement.

$L_{Ar,T}$ the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

S_{EL} the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period

Technical Appendix 9.2: Baseline Noise and Vibration Measurements

9.2 BASELINE NOISE AND VIBRATION MEASUREMENTS

9.201 Noise and vibration measurements to establish the base line conditions and for validation of the predictive noise models, have been undertaken at the monitoring locations shown at **Plate 1** below:

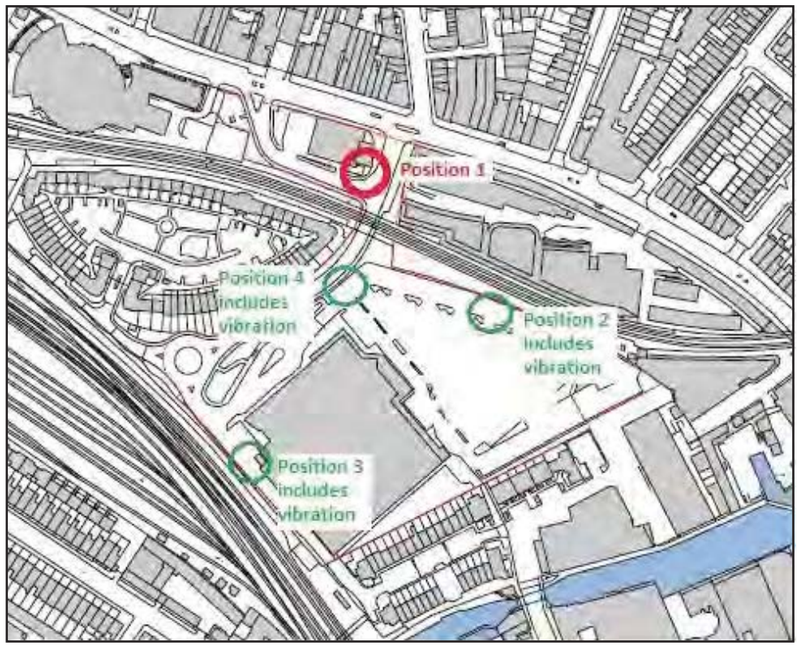


Plate 1: Noise and vibration monitoring locations

9.202 Noise measurements were undertaken at the site between the 6th and 13th July 2016. Measurements were taken continuously at these locations to provide a base reference for the noise assessment. Time history graphs of the noise measurements can be found at the end of this appendix and are summarised in the relevant following chapters.

Measurement Procedures

9.203 To avoid the occurrence of instrument over or under-loading, noise levels were observed prior to measurement to determine the dynamic measurement range for the instrument for each measurement scenario.

9.204 Measurements were undertaken by Clement Acoustics Ltd. Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445* and *CRN* where appropriate.

Instrumentation

9.205 Manually observed noise measurements were taken across the site using a Cirrus Research CR821A – Class 1 Sound Level Meter (SLM).

9.206 Continuous measurements were taken using the following equipment:

- Position 1: Svantek 977 (noise);
- Position 2: Svantek 977 (noise);
- Position 3: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise);
- Position 4: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise).

9.207 All of the sound level meters used are Class 1. GRAS Environmental Microphones were used in conjunction with the meters.

9.208 Measurements for background noise were taken at a height of 1.2m to 1.3m from the ground and would be considered free field.

9.209 All equipment used has been professionally calibrated, and calibration certificates are included at the end of this appendix. Field calibration of the sound level meters was undertaken before and after measurement to ensure no drifting of the calibration signal. Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445*.

Observations

9.210 The following observations were made of the noise climate at each monitoring location. It should be noted that the noise climate can only be described for the moments in time the survey was being set up and collected.

Position 1 – 6th July to 13th July 2016

9.211 Car traffic noise from Chalk Farm Road. During the installation and collection, the rail noise was not considered significant. It is understood that there are some local late night venues in the surrounding area, which is expected to have significantly contributed to the noise climate during the evenings.

Position 2 - 6th July to 13th July 2016

9.212 Rail noise from the adjacent railway was noted to be driving the maximum levels. There were also traffic movements during the installation and collection of equipment from the nearby offices and Morrison's car parks.

Position 3 – 6th July to 13th July 2016

9.213 This was noted to be predominantly railway noise at the time of setting up the equipment. It was also noted that there was some construction works near the lines. It is expected that due to the microphone being in Morrison's yard, some lorry movements and

noise from loading and unloading to the store would have impacted the measurements.

Position 4 – 6th July to 11th July 2016

9.214 This location was dominated by road traffic noise from the road joining Chalk Farm Road and the Morrison's roundabout. Some noise impact from the nearby railway but the road traffic was more significant. Possibly subject to noise from local late night venues throughout the evening/night period.

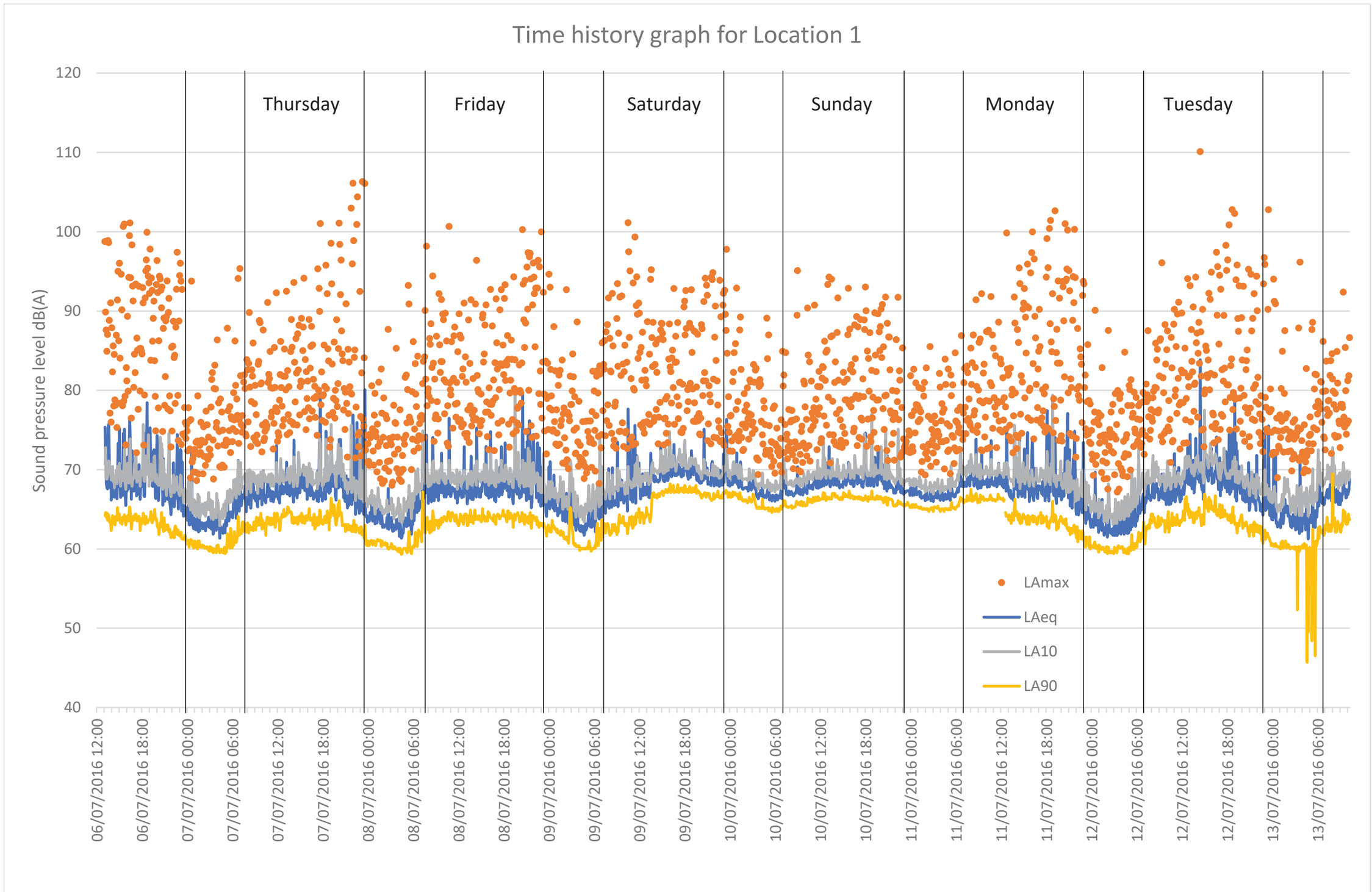
Results

9.215 The L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} acoustic parameters were measured in 15 minute samples throughout the duration of the survey. Measured levels are shown as time histories at the end of this appendix.

9.216 **Table 1** below provides a summary of the measured noise surveys:

	Daytime L_{Aeq} (7am-11pm) dB(A)	Night-time L_{Aeq} (11pm-7am) dB(A)	Representative night-time L_{Amax} dB(A)
Position 1	69.3	66.2	82
Position 2	66.9	68.3	88
Position 3	70.2	63.9	87
Position 4	63.6	58.5	78

Table 1: Site average noise levels for daytime and night-time


Time history graph for Location 1
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
Sound pressure level dB(A)
120
110
100
90
80
70
60
50
40
LAmax
LAeq
LA10
LA90
06/07/2016 12:00
06/07/2016 18:00
07/07/2016 00:00
07/07/2016 06:00
07/07/2016 12:00
07/07/2016 18:00
08/07/2016 00:00
08/07/2016 06:00
08/07/2016 12:00
08/07/2016 18:00
09/07/2016 00:00
09/07/2016 06:00
09/07/2016 12:00
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10/07/2016 12:00
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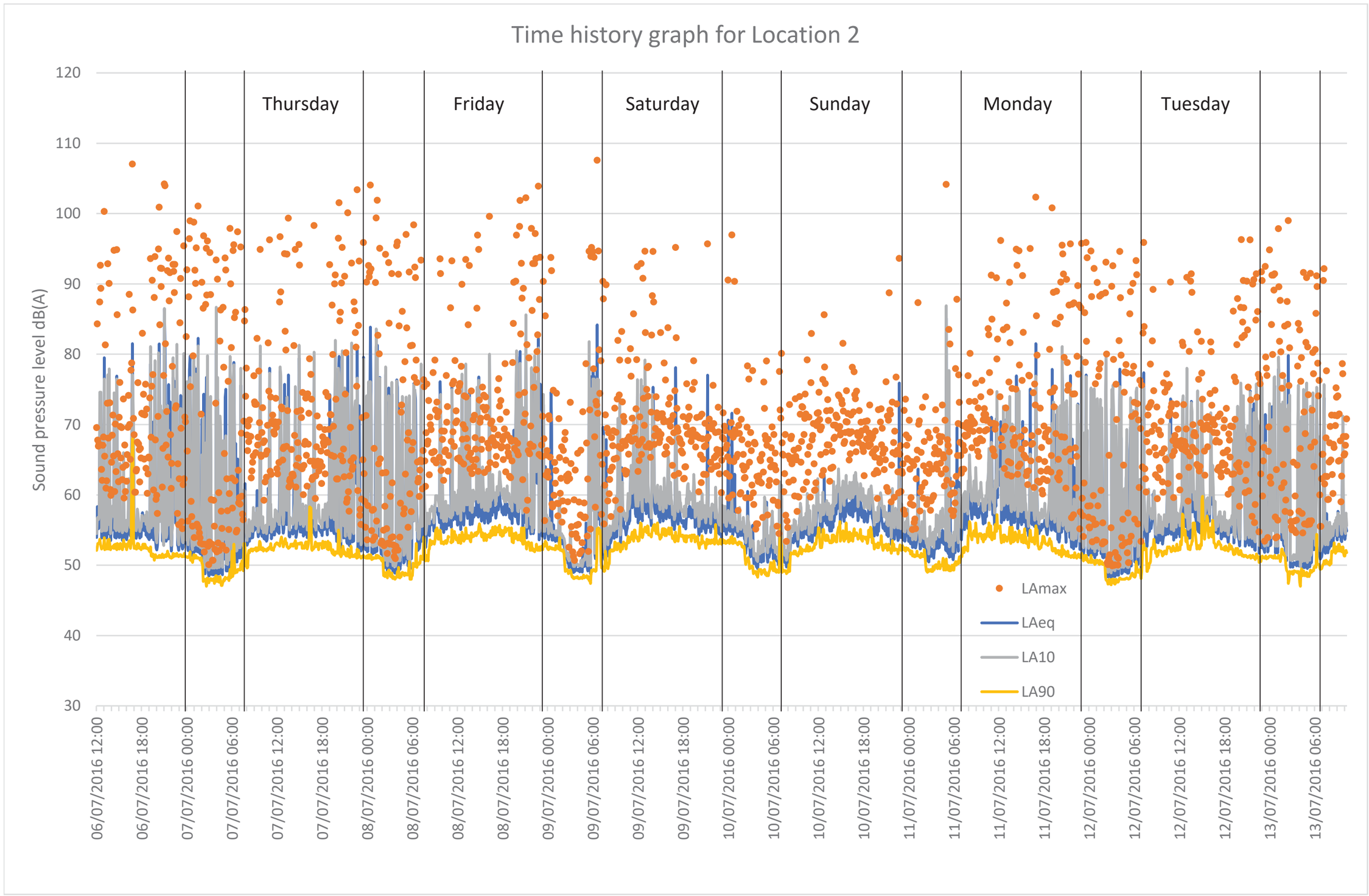
11/07/2016 06:00
11/07/2016 12:00
11/07/2016 18:00
12/07/2016 00:00
12/07/2016 06:00
12/07/2016 12:00
12/07/2016 18:00
13/07/2016 00:00
13/07/2016 06:00


Time history graph for Location 2
Sound pressure level dB(A)
120
110
100
90
80
70
60
50
40
30
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
LAmax
LAeq
LA10
LA90
06/07/2016 12:00
06/07/2016 18:00
07/07/2016 00:00
07/07/2016 06:00
07/07/2016 12:00
07/07/2016 18:00
08/07/2016 00:00
08/07/2016 06:00
08/07/2016 12:00
08/07/2016 18:00
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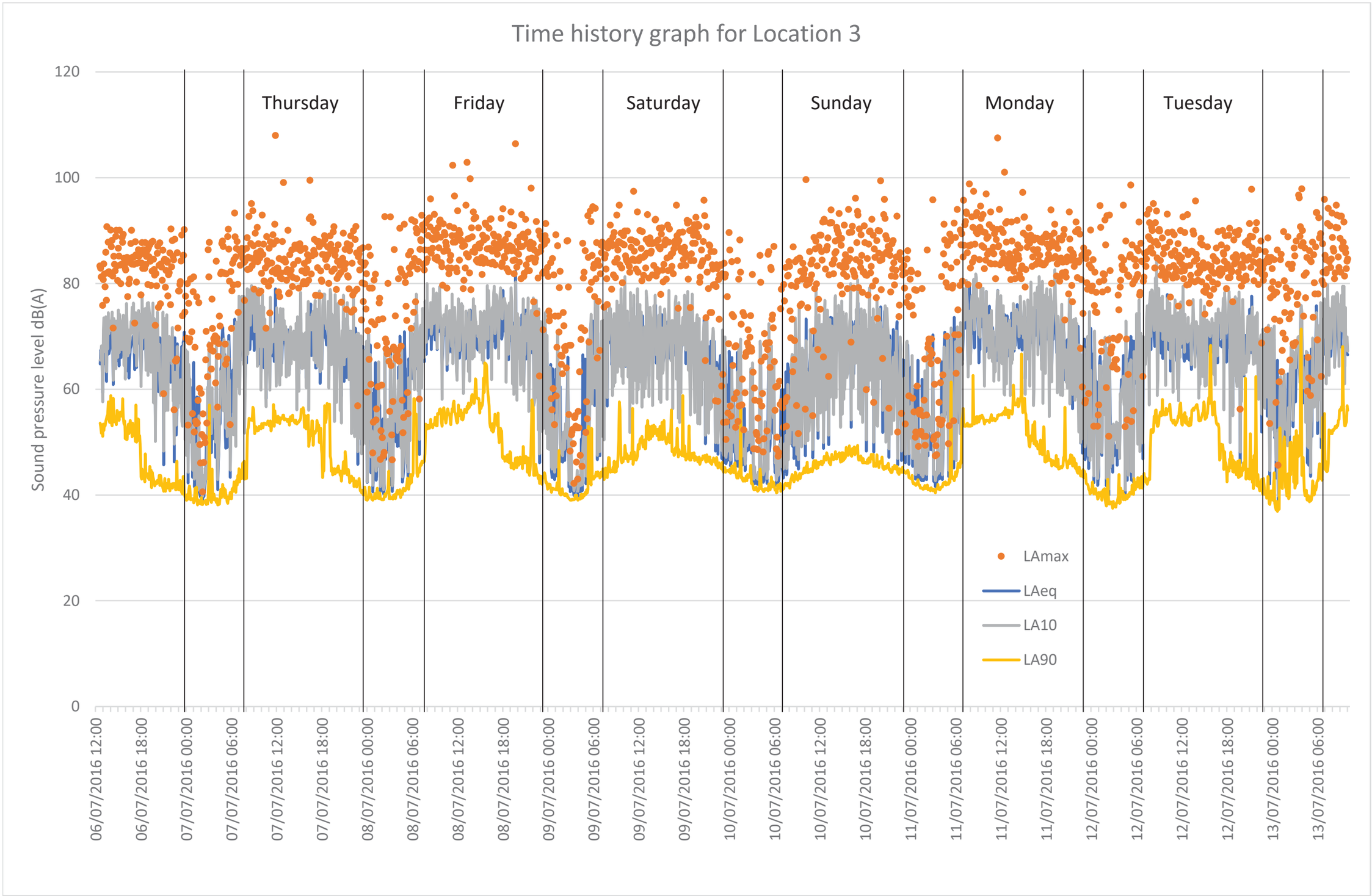
11/07/2016 18:00
12/07/2016 00:00
12/07/2016 06:00
12/07/2016 12:00
12/07/2016 18:00
13/07/2016 00:00
13/07/2016 06:00


Time history graph for Location 3
Sound pressure level dB(A)
120
100
80
60
40
20
0
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
LAmax
LAeq
LA10
LA90
06/07/2016 12:00
06/07/2016 18:00
07/07/2016 00:00
07/07/2016 06:00
07/07/2016 12:00
07/07/2016 18:00
08/07/2016 00:00
08/07/2016 06:00
08/07/2016 12:00
08/07/2016 18:00
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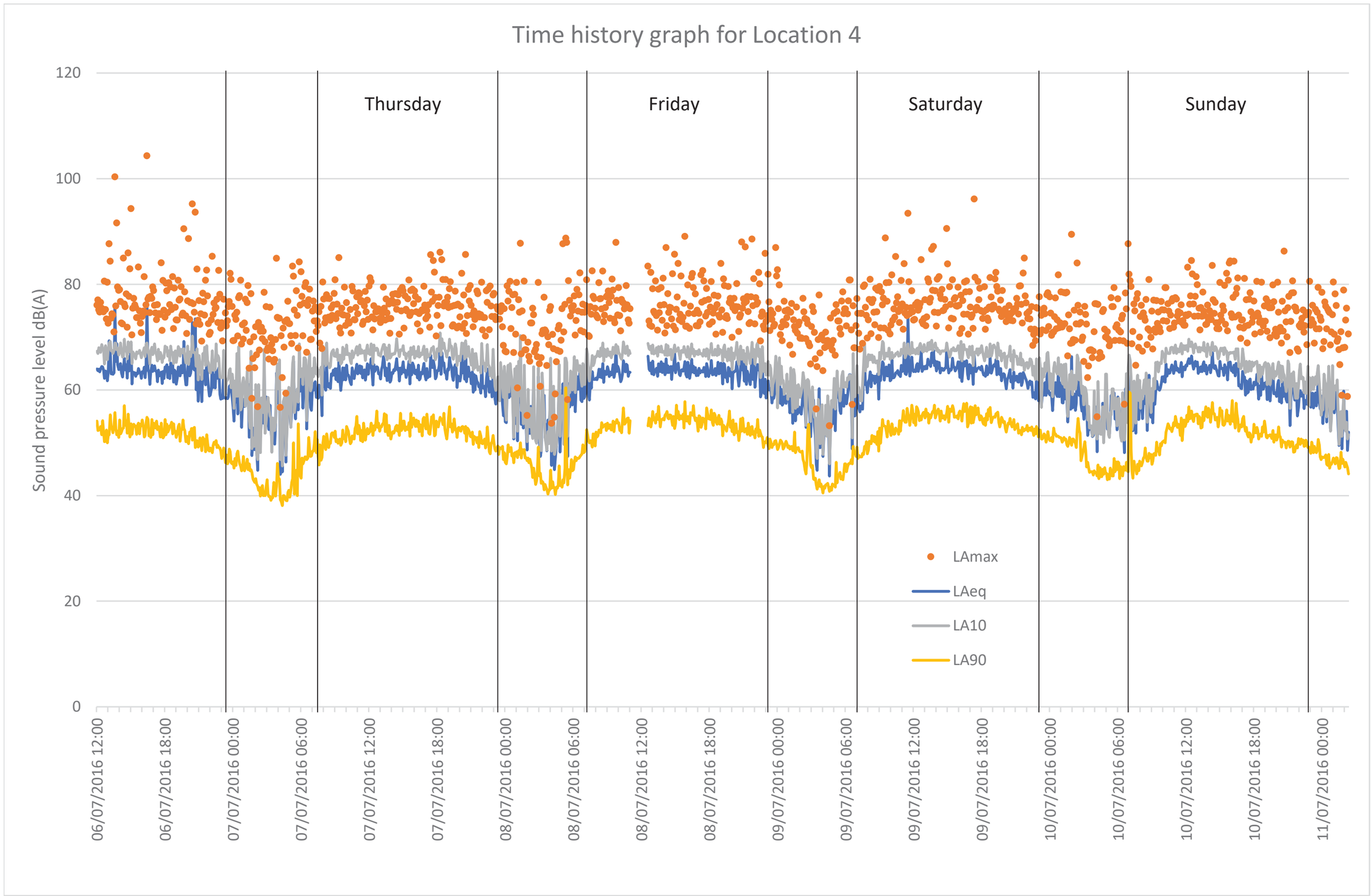
13/07/2016 00:00
13/07/2016 06:00


Time history graph for Location 4
Sound pressure level dB(A)
120
100
80
60
40
20
0
Thursday
Friday
Saturday
Sunday
LAmax
LAeq
LA10
LA90
06/07/2016 12:00
06/07/2016 18:00
07/07/2016 00:00
07/07/2016 06:00
07/07/2016 12:00
07/07/2016 18:00
08/07/2016 00:00
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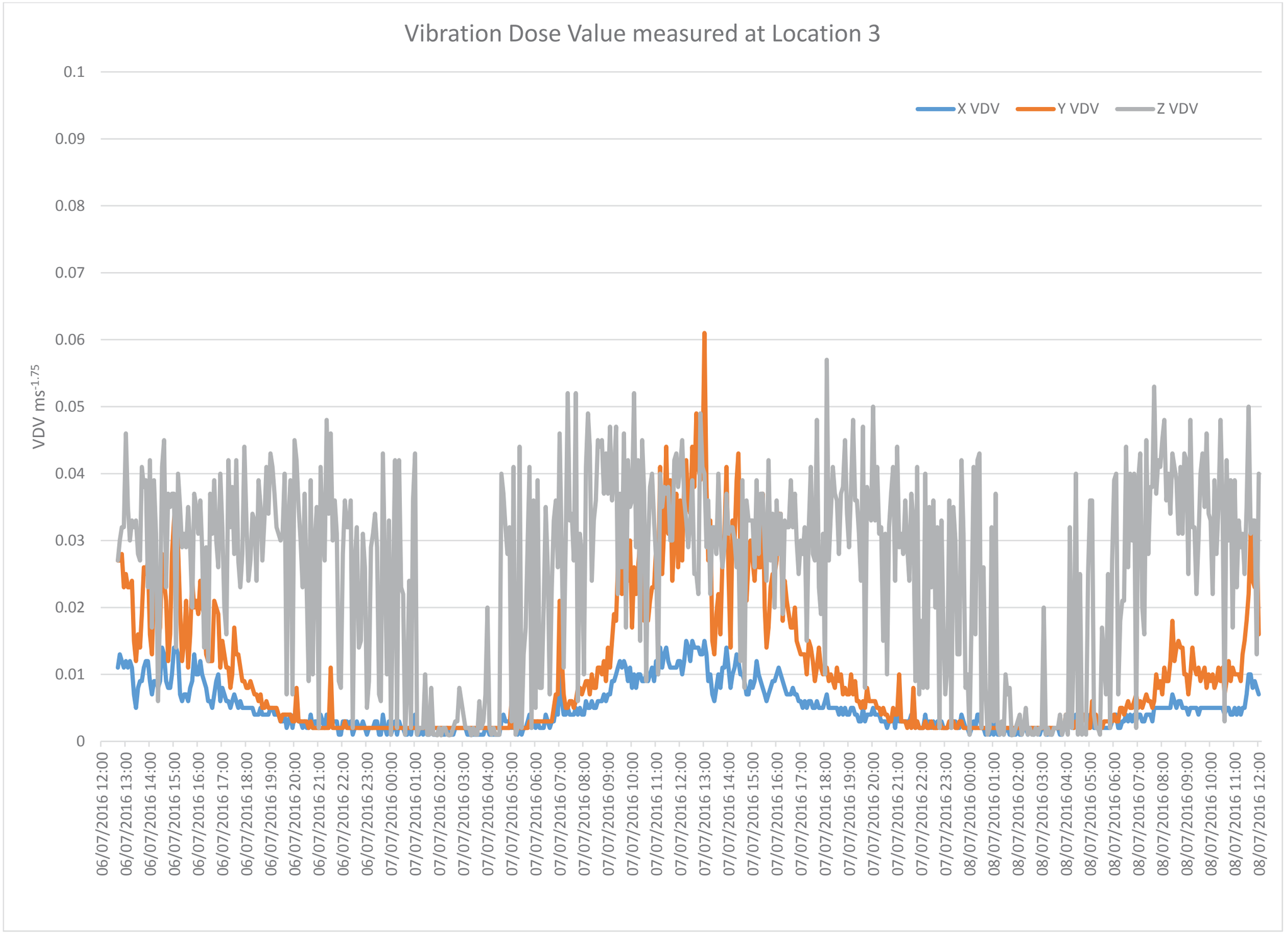
Vibration Dose Value measured at Location 3
X VDV
Y VDV
Z VDV
VDV ms-1.75
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
06/07/2016 12:00
06/07/2016 13:00
06/07/2016 14:00
06/07/2016 15:00
06/07/2016 16:00
06/07/2016 17:00
06/07/2016 18:00
06/07/2016 19:00
06/07/2016 20:00
06/07/2016 21:00
06/07/2016 22:00
06/07/2016 23:00
07/07/2016 00:00
07/07/2016 01:00
07/07/2016 02:00
07/07/2016 03:00
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07/07/2016 17:00
07/07/2016 18:00
07/07/2016 19:00
07/07/2016 20:00
07/07/2016 21:00
07/07/2016 22:00
07/07/2016 23:00
08/07/2016 00:00
08/07/2016 01:00
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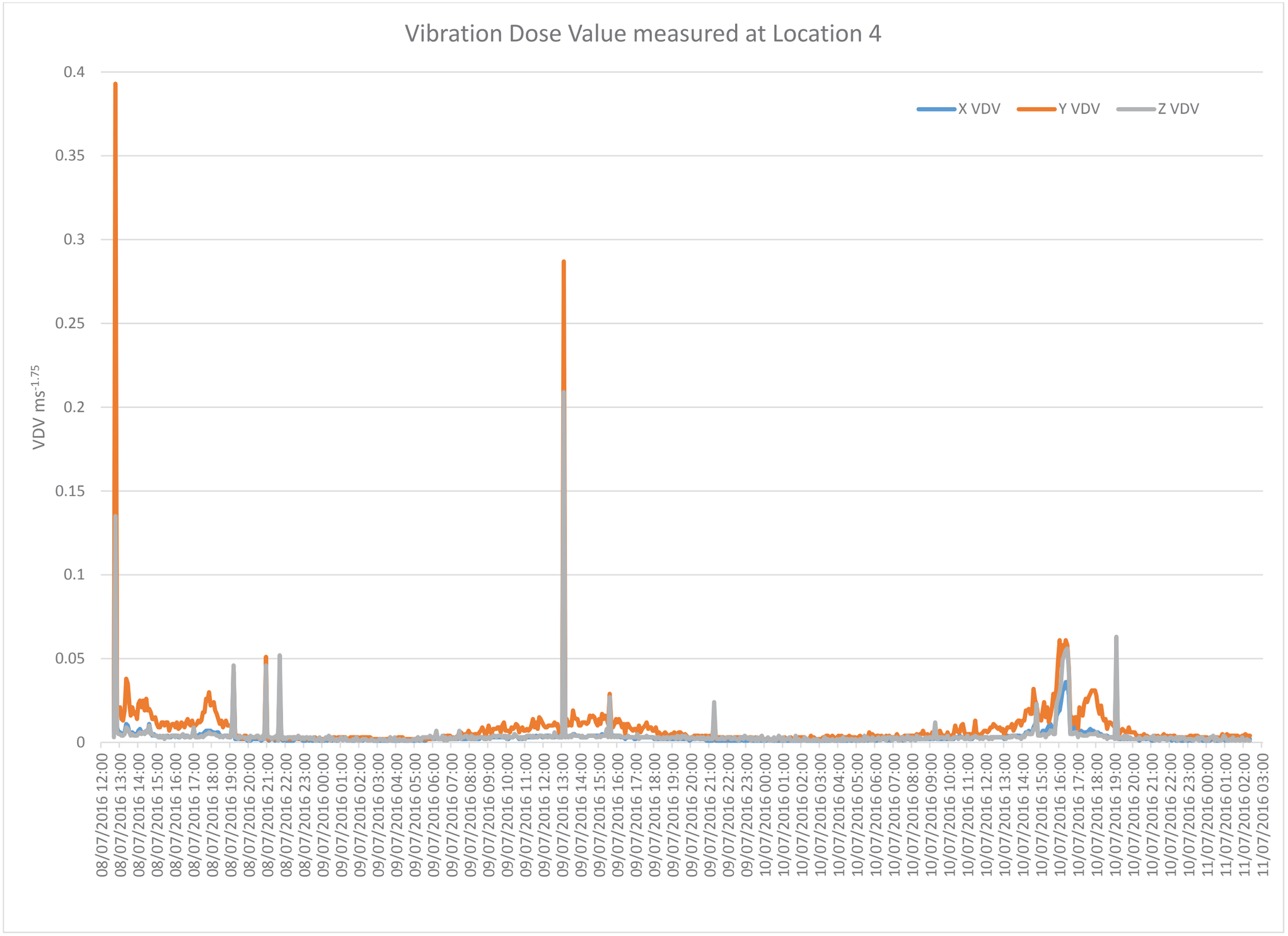
08/07/2016 11:00
08/07/2016 12:00


Vibration Dose Value measured at Location 4
X VDV
Y VDV
Z VDV
VDV ms-1.75
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
08/07/2016 12:00
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11/07/2016 01:00
11/07/2016 02:00
11/07/2016 03:00

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 26 January 2012 Certificate N° 1201027

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Signed
R.G.Tyler

CLIENT	Practical Acoustics Ltd 202 Uxbridge Road London W12 7JP
F.A.O.	Florian Clement
REF.	Job N° TRAC12/01018/03
DATE OF RECEIPT	24 January 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 19
IDENTIFICATION	Sound level meter Svantek type SVAN 957 [serial no. 15381] connected via a preamplifier type SV 12L [serial no. 18740] to a half-inch microphone type 7052H [serial no. 40822] fitted with a foam windshield type SA 22.
CALIBRATED ON	26 January 2012
PREVIOUS CALIBRATION	None known

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

The sound level meter was set up using a type 4231 sound calibrator supplied by this laboratory; it was set to frequency weighting A, and initially read 94.8 dB. It was then adjusted to read 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure). This reading was derived from the certified output level of the calibrator and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The resulting calibration factor was 7.28; the calibration check frequency was 1 kHz.

The sound level meter was tested, and its overall sensitivity adjusted, in accordance with selected sections of IEC 61672-3:2006.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests carried out, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) and because the periodic tests carried out cover only a limited subset of the specifications in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003).

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

12.0 dB (A) ; 12.0 dB (C) ; 12.0 dB(Z) (Under-range)

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

Start: 24 to 25 °C, 38.9 to 48.9 %RH and 99.9 to 100.0 kPa
End: 24 to 25 °C, 31.6 to 41.6 %RH and 100.0 to 100.1 kPa

All measurement data are held at AV Calibration for a period of at least six years.

Technical information including adjustment data specified in the manufacturers' Instruction Manual has been used to carry out this verification. Additional information was obtained by analogy with similar instruments from the same manufacturer. No information on the uncertainty of measurement of the adjustment data given in the instruction manual was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of these adjustment data has therefore been assumed to be numerically zero for the purposes of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the sound level meter may not meet the requirements of IEC 61672-1:2002 (BS EN 61672-1:2003).

No publicly-available evidence has been found that the SVAN 957 sound level meter design has undergone pattern evaluation in accordance with IEC-61672-2:2002 (BS EN 61672-2:2003) by any independent testing organization responsible for pattern approvals. In the absence of this information, the instrument has been assessed as a Class 1 meter in accordance with the manufacturers' claims.

LABORATORY MEASUREMENT UNCERTAINTIES

The measured errors obtained during testing have been extended by the laboratory's expanded measurement uncertainty before assessing conformance to the standard, and it is these extended errors which are quoted in the following pages. In accordance with convention, positive measured errors have been extended by the positive value of expanded uncertainty, and negative measured errors by the negative value. Where a bilateral extended error (± n.n dB) is given, this implies that the measured error was numerically zero.

The laboratory's expanded measurement uncertainties, including contributions from manufacturer-specified corrections where appropriate, are as follows:

Test ①: ± 0.23 dB @ 125 Hz; ± 0.23 dB @ 8 kHz
Tests ②⑧: (± dB) 0.23 @ 31.5 Hz; 0.23 @ 63 Hz; 0.23 @ 125 Hz; 0.23 @ 250 Hz; 0.23 @ 500 Hz; 0.23 @ 1kHz; 0.23 @ 2 kHz; 0.23 @ 4 kHz; 0.23 @ 8kHz; 0.23 @ 16kHz
Test ③: ± 0.13 dB
Tests ④⑤: ± 0.20 dB
Test ⑥: ± 0.27 dB
Test ⑦: ± 0.23 dB
Sound calibrator: ± 0.22 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k*=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the *Guide to the Expression of Uncertainty in Measurement* published by the International Organisation for Standardisation (ISO).

Measurement data - Test ① : Acoustical signal test of frequency weighting C (electrostatic actuator method)

Frequency,	Extended error, dB	Tolerance, dB
125 Hz	-0.29	± 1.5
8000.0	-0.96	+2.1, -3.1

The above data include manufacturer-specified corrections for case reflections

Measurement data - Test ② : Electrical signal tests of frequency weightings

Frequency, Hz	Extended error in A-weighting, dB		Extended error in C-weighting, dB		Extended error in Z-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
31.5	0.15	-0.31	0.25	-0.21	0.35	-0.11	± 2.0
63.0	0.15	-0.31	0.15	-0.31	0.25	-0.21	± 1.5
125.0	0.05	-0.41	0.15	-0.31	0.15	-0.31	± 1.5
250.0	-0.09	-0.55	0.01	-0.45	0.01	-0.45	± 1.4
500.0	0.03	-0.43	0.13	-0.33	0.13	-0.33	± 1.4
1000.0	REF	REF	REF	REF	REF	REF	REF
2000.0	0.31	-0.15	0.31	-0.15	0.21	-0.25	± 1.6
4000.0	-0.16	-0.62	-0.16	-0.62	-0.16	-0.62	± 1.6
8000.0	-0.43	-0.89	-0.43	-0.89	-0.53	-0.99	+2.1, -3.1
16000.0	-1.50	-1.96	-1.50	-1.96	-1.10	-1.56	+3.5, -17.0

The above data include manufacturer-specified corrections for the **measured** microphone response, and case reflections

Measurement data - Test ③ : Frequency and time weightings at 1 kHz

Parameter measured	Extended error, dB	Tolerance, dB
LAF	REF	REF
LCF	± 0.13	± 0.4
LZF	± 0.13	± 0.4
LAS	± 0.13	± 0.3
LAeq	± 0.13	± 0.3

Measurement data - Test ④: Level linearity on the reference level range (at 8 kHz, ref 94.0 dB); and also including the level range control (at 1 kHz, ref 114.0 dB on the reference range).

Reference range (High)		
Nominal reading, dB	Extended error, dB	Warning flags
35.0	U/R	U/R
36.0	0.60	¤
37.0	0.60	¤
38.0	0.50	¤
39.0	0.50	¤
40.0	0.50	¤
41.0	0.40	¤
44.0	0.30	¤
49.0	± 0.20	¤
54.0	± 0.20	¤
59.0	± 0.20	¤
64.0	± 0.20	¤
69.0	± 0.20	¤
74.0	± 0.20	¤
79.0	± 0.20	¤
84.0	± 0.20	¤
89.0	± 0.20	¤
94.0	Ref	¤
99.0	± 0.20	¤
104.0	± 0.20	¤
109.0	± 0.20	¤
114.0	± 0.20	¤
119.0	± 0.20	¤
124.0	± 0.20	¤
129.0	± 0.20	¤
131.0	± 0.20	¤
132.0	± 0.20	¤
133.0	± 0.20	¤

Reference range (High)		
Nominal reading, dB	Extended error, dB	Warning flags
134.0	± 0.20	¤
135.0	± 0.20	¤
136.0	± 0.20	¤
137.0	± 0.20	¤
138.0	± 0.20	¤
139.0	± 0.20	¤
140.0	± 0.20	¤
141.0	± 0.20	¤
142.0	± 0.20	¤
143.0	± 0.20	¤
144.0	O/L	O/L

Linearity including range control		
Instrument reading, dB	Range	Extended error, dB
41.0	Low	± 0.20

Linearity tolerances, dB	± 1.1

Measurement data - Test ⑤ Toneburst response

Parameter	Burst length ms	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
LAFmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	-0.30	-0.30	-0.30	+1.3, -3.3
LASmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -3.3
LAE	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	-0.40	-0.30	-0.40	+1.3, -3.3

Measurement data - Test ⑥ : Peak C sound level

Frequency, Hz	Burst length cycles	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
8000	1	± 0.27	-0.87	± 0.27	± 2.4
500	+ ½	-0.37	-0.37	-0.37	± 1.4
	- ½	-0.47	-0.47	-0.47	± 1.4

Measurement data - Test ⑦ : Overload indication

Extended error in level of negative pulse required to trigger overload, relative to level of positive pulse required: 0.33 dB (tolerance ± 1.8 dB)

NOTES

1 The FF compensation filter only was switched on for all acoustic tests. All the compensation filters were switched off throughout the electrical tests.

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method.

3 The instrument was running the following firmware version: 6.12.5

4 The overload indicator was triggered for a reading of 143.9 dB on the reference range.

5 The level displayed on the HIGH range for the calibrator supplied, B&K 4231 serial no.1897774 was 93.6 with the FF filter ON, 93.9 with it switched OFF.

6 As supplied, the Outdoor Environmental compensation filter was selected, and the calibrator level was set to 114 dB. These were changed to FF and 94 dB respectively prior to this verification.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 06 Apr 2016 Certificate N° 1604163

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Approved Signatory

G. Parry [ ] B. Baker [√]

Client	Clement Acoustics Ltd 202 Uxbridge Road London W12 7JP
Purchase Order No.	N/A
Instrument	Svantek SVAN958 Vibration Meter
Serial No.	15844 (Accelerometer used with channels 1 to 3)
Accelerometer Type	Dytran 3233A
Accelerometer Serial No.	547
Cable Type	N/A
Client Asset No.	N/A
Procedure ID.	SVAN958_80Hz_3Ch_Issue 2
Job Number	TRAC16/03088/01
Date of Calibration	06 Apr 2016
Previous Cert. number	N/A
Date of Previous Cert.	N/A
Calibration Status	**Reported Values Only**

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

The meter was calibrated at 80.0 Hz 10.00 m/s/s on the 316 m/s/s range HP10 weighting using a vibration table with a Dytran reference (precision grade) accelerometer type 3123A calibrated to National Standards as reference and the meter's accelerometer co-axially mounted. For a reading of 10.00 m/s/s on the meter, the calibration settings produced were -20.5 dB for Ch.1 (X), (was -20.6), -20.4 dB for Ch.2 (Y), (was -20.7), -20.3 dB for Ch.3 (Z), (was -20.8).
These readings should be set as the nominal level for future measurements.
The uncertainty on this reading is ±1.2% of reading for a confidence probability of not less than 95%.

The frequency response of each axis of the accelerometer was measured. Electrical tests were then conducted to the requirements of ISO 8041. As the tolerances in the Standard do not include any uncertainty budgets, no allowance for was made in these tests.

The meter meets the requirements and tolerances of ISO 8041 Class 1 for Hand-Arm, Whole-Body and general vibration measurements using the calibration settings listed above for those tests carried out over a dynamic range of greater than 80dB. (See Linearity results for channels 1 to 3).

Comment

This certificate reports recorded values after adjustment to the instrument was carried out.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate N° 1604163

Environment

The ambient environmental conditions at the time of the calibration were;
Temperature: 21.9 ± 1°C, Humidity: 36 ± 5%RH, Atmospheric pressure 99.8 ± 1 kPa

Test results

Linearity Errors in dB measured at 80 Hz on the 316 m/s/s range, HP10 weighting, with calibration coefficients detailed on page 1. The reference level was set to read 10.0 m/s/s (approximately 17 dB below full scale). Signal level changes in dB; reading error in dB given for each axis.

Input Level (dB)	Target m/s²	Error - Ch1 (dB)		Error - Ch2 (dB)		Error - Ch3(dB)	
18.0	79.43	-0.1	O/L	-0.1	O/L	-0.1	O/L
17.0	70.79	0.0	O/L	0.0		0.0	
16.0	63.10	0.0		0.0		0.0	
15.0	56.23	0.0		0.0		0.0	
10.0	31.62	0.0		0.0		0.0	
5.0	17.78	0.0		0.0		0.0	
0.0	10.00	0.0		0.0		0.0	
-10.0	3.162	0.0		0.0		0.0	
-20.0	1.000	0.0		0.0		0.1	
-30.0	0.3162	0.0		0.0		0.0	
-40.0	0.1000	0.0		0.1		0.1	
-50.0	0.0316	0.0		0.0		0.1	UR
-60.0	0.01000	0.0	UR	0.1	UR	0.0	UR
-70.0	0.00316	0.0	UR	0.0	UR	0.0	UR
-75.0	0.00178	0.1	UR	0.2	UR	0.0	UR
-80.0	0.00100	0.2	UR	0.5	UR	0.2	UR
-81.0	0.00089	0.6	UR	0.7	UR	0.4	UR
-82.0	0.00079	0.8	UR	0.9	UR	0.6	UR

O/L - meter indicates overload : UR - meter indicates underrange

Permitted tolerance ± 0.5 dB

Inter-range Accuracy

Measured using an electrical signal at 80 Hz on HP10 weighting.
Reference point set at 10 m/s/s on the 316 m/s/s range.

Range m/s²	Level m/s²	Channel 1	Channel 2	Channel 3
316	10.00	10.0	10.0	10.0
17.8	0.5623	0.564	0.564	0.564
Range Change Error(dB):-		0.0	0.0	0.0

Noise Floors

Noise floors measured on the 17.8 m/s/s range, HP10 weighting.

Axis	µm/s²	Overload / Underrange
1	39.4	UR
2	40.4	UR
3	34.6	UR

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate N° 1604163

Frequency Response of Accelerometer type Dytran 3233A serial no. 547.
Measured by comparison to Dytran 3123A reference accelerometer. Response in dB rel. to 80 Hz. measured at level of 10.0 m/s²

Frequency Hz	Axis 1 (dB)	Axis 2 (dB)	Axis 3 (dB)
20	-0.1	0.0	0.0
40	-0.1	0.1	0.1
80	REF	REF	REF
160	-0.1	-0.1	0.0
315	-0.3	-0.1	-0.2
630	-0.6	0.2	-0.2
1250	-0.5	0.1	-0.3

Frequency Weightings, measured electrically on 316 m/s/s range, reference frequency 80 Hz, calibration setting as per page 1. Results reported as errors in dB.

HP10 Weighting at 80 Hz

Frequency Hz	Error - Ch 1 (dB)	Error - Ch 2 (dB)	Error - Ch 3 (dB)
1	1.2	1.2	1.3
2	1.0	1.0	1.0
4	0.7	0.7	0.7
8	0.1	0.1	0.1
20	0.0	0.0	0.0
40	0.0	0.0	0.0
80	REF	REF	REF
160	0.0	0.0	0.1
315	0.0	0.0	0.1
630	0.0	0.0	0.1
1250	0.0	0.0	0.0

HP10 is not defined in ISO8041. No tolerances are stated by the manufacturer in the instrument's handbook for the HP10 weighting.

Wd/Wk ref HP10 weighting at 80 Hz

Frequency Hz	Wd Weighting Error - Ch1 (dB)		Wd Weighting Error - Ch2 (dB)		Wk Weighting Error - Ch3 (dB)		Tolerance dB
1	-0.1		-0.1		-0.1		±1
2	-0.1		-0.1		0.0		±1
4	-0.1		-0.1		0.0		±1
8	-0.1		-0.1		0.0		±1
20	0.0		0.0		0.0		±1
40	0.0		0.0		0.0		±1
80	-0.1		-0.1		-0.1		±2
160	-0.2		-0.2		-0.2		+2/-∞

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate N° 1604163

Wh HAND-ARM, ref. HP10 Weighting at 80 Hz

Frequency Hz	Error - Ch1 (dB)		Error - Ch2 (dB)		Error - Ch3 (dB)		Tolerance dB
1	-0.2		-0.2		-0.2		+2/-∞
2	0.0		0.0		0.0		+2/-∞
4	0.0		0.0		0.1		±2
8	0.0		0.0		0.0		±1
20	0.0		0.0		0.0		±1
40	0.0		0.0		0.0		±1
80	0.0		0.0		0.0		±1
160	-0.1		-0.1		-0.1		±1
315	0.0		0.0		0.0		±1
630	0.0		0.0		0.0		±1
1250	0.5		0.5		0.5		±2

The total frequency response of the meter, to which the quoted tolerances for each weighting apply, will be obtained by adding together the PCB accelerometer response for each axis and the weighting response for that axis.

All responses, both with and without the accelerometer, are within the specifications in ISO 8041 for a Class 1 meter except for the points shown in RED

NOTE

The instrument was also supplied with a second accelerometer, Dytran 3233A s/no 470

For a reading of 10.0 m/s/s on the meter, the calibration settings produced were;

-20.3 dB for Ch.1 (x), -20.3 dB for Ch.2 (Y), -20.6 dB for Ch.3 (Z)

END OF CALIBRATION

CALIBRATED BY :- Allan Lloyd

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
25 °C	42%	990 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	87	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	5369	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.

2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.

3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.

4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.

5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor ..... Test date: 2015-07-20

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45351*

with preamplifier SVANTEK type SV12L No. 47602 and microphone ACO PACIFIC type 7052E No. 60647

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{sin}=1 kHz; Input signal =100 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: : 113.90 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.84	-0.06
A	113.90	113.84	-0.06
C	113.90	113.84	-0.06

Calibration measured with the microphone ACO PACIFIC type 7052E No. 60647. Calibration factor: -0.95 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.0	0.0	-0.0	-0.0	-0.1	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.1	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{sin}= 4000 Hz; Burst duration: 2 s

Range: Low; Steady level nominal result = 117dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	117.0	116.9	116.0	114.4	112.2	108.7	105.8	102.9	99.0	96.0	92.9	89.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	115.0	113.0	109.6	106.8	103.9	100.0	97.0	94.0	90.0	-	-	-
		Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	117.0	114.0	110.0	107.0	104.0	100.0	97.0	94.0	90.0	87.0	83.9	80.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: **Low**; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	57.0	56.9	56.0	54.4	52.1	48.6	45.8	42.9	38.9	35.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.1
	Slow	Indication [dB]	55.0	52.9	49.5	46.8	43.8	39.9	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	57.0	54.0	50.0	47.0	44.0	40.0	37.0	34.0	30.0	27.0
		Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0

Range: **Low**; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	35.0	34.9	34.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	33.0	31.0	27.6
		Error [dB]	0.0	0.1	-0.0
SEL	-	Indication [dB]	35.0	32.0	28.1
		Error [dB]	0.0	0.0	0.1

Range: **High**; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	113.0	109.9	106.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	132.0	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: **High**; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.1
		Error [dB]	0.0	0.0	0.0	-0.0	-0.0
	Slow	Indication [dB]	52.0	49.9	46.6	43.8	40.8
		Error [dB]	0.0	0.1	0.0	0.0	-0.0
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0
		Error [dB]	0.0	-0.0	0.0	0.0	0.0

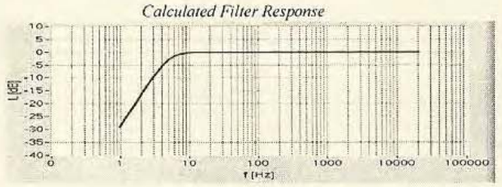
Range: **High**; Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	46.0	45.9	45.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	44.0	42.0	38.6
		Error [dB]	0.0	0.1	-0.0
SEL	-	Indication [dB]	46.0	43.0	39.1
		Error [dB]	0.0	0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L
(f - frequency, L - level)

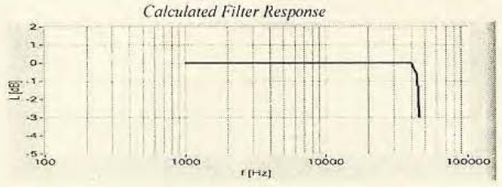
f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-5.9	16	0.0	250	0.0	16000	0.0
1.25	-25.5	5	-3.2	20	0.0	500	0.0	20000	0.0
1.6	-21.4	6.3	-1.4	25	0.0	1000	0.0		
2	-17.3	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.3	10	-0.2	63	0.0	4000	0.0		
3.15	-9.4	12.5	-0.0	125	0.0	8000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function; Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L
(f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1000	0.0	16000	-0.0	40000	-0.1
2000	0.0	20000	-0.0	43856*	-0.6
4000	-0.0	25000	-0.0	45255*	-3.0
8000	-0.0	32000	-0.0		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47602.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	10.0	18.2

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 140dB;

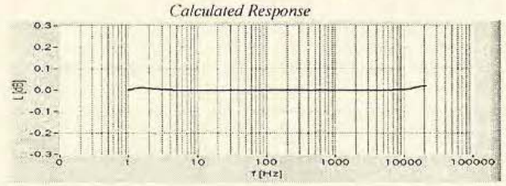
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.1	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	-0.0
1000	-0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	37.1

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
25 °C	42%	990 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	87	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	5369	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.
4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor ..... Test date: 2015-07-20

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45354*

with preamplifier SVANTEK type SV12L No. 47601 and microphone ACO PACIFIC type 7052E No. 60648

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{sin}=1 kHz; Input signal =100 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: : 113.90 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.83	-0.07
A	113.90	113.83	-0.07
C	113.90	113.83	-0.07

Calibration measured with the microphone ACO PACIFIC type 7052E No. 60648. Calibration factor: -1.10 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.1	0.0	-0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{sin}= 4000 Hz; Burst duration: 2 s

Range: **Low**; Steady level nominal result = 117dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	116.9	116.8	115.9	114.3	112.1	108.6	103.8	102.8	98.9	95.9	92.8	89.8
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	114.9	112.9	109.5	106.7	103.8	99.9	96.9	93.9	89.9	-	-	-
		Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	116.9	113.9	109.9	106.9	103.9	99.9	96.9	93.9	89.9	86.9	83.8	80.8
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: **Low**; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	56.9	56.8	55.9	54.3	52.1	48.6	45.7	42.8	38.9	35.8
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1
	Slow	Indication [dB]	54.9	52.8	49.5	46.7	43.8	39.8	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	56.9	53.9	49.9	46.9	43.9	39.9	36.9	33.9	29.9	26.9
		Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0

Range: **Low**; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	34.9	34.8	33.9
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	32.9	30.9	27.5
		Error [dB]	0.0	0.0	-0.0
SEL	-	Indication [dB]	34.9	31.9	28.0
		Error [dB]	0.0	0.0	0.1

Range: **High**; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	133.9	133.8	132.9	131.3	129.1	125.6	122.8	119.8	115.9	112.8	109.8	106.8
		Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	131.9	129.8	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	133.9	130.9	126.9	123.9	120.9	116.9	113.9	110.9	106.9	103.8	100.8	97.8
		Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: **High**; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	53.9	53.8	52.9	51.3	49.1
		Error [dB]	0.0	0.0	0.0	0.0	0.0
	Slow	Indication [dB]	51.9	49.8	46.5	43.6	40.8
		Error [dB]	0.0	0.1	-0.0	-0.0	0.0
SEL	-	Indication [dB]	53.9	50.9	46.9	43.9	40.9
		Error [dB]	0.0	-0.0	0.0	0.0	0.1

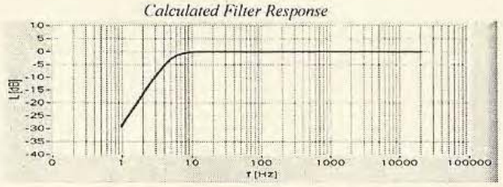
Range: **High**; Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	45.9	45.8	45.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	43.9	41.8	38.6
		Error [dB]	0.0	0.0	0.0
SEL	-	Indication [dB]	45.9	42.9	39.0
		Error [dB]	0.0	-0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

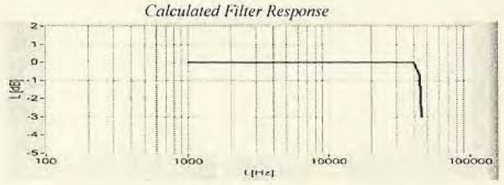
f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-6.0	16	0.0	250	0.0	16000	0.0
1.25	-25.5	5	-3.2	20	0.0	500	0.0	20000	-0.0
1.6	-21.4	6.3	-1.4	25	0.0	1000	0.0		
2	-17.3	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.3	10	-0.2	63	0.0	4000	-0.0		
3.15	-9.5	12.5	-0.0	125	-0.0	8000	-0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function; Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1000	-0.0	16000	-0.0	40000	-0.1
2000	-0.0	20000	-0.0	43856*	-0.7
4000	-0.0	25000	-0.0	45255*	-3.1
8000	-0.0	32000	-0.1		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47601.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	10.7	17.9

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 140dB;

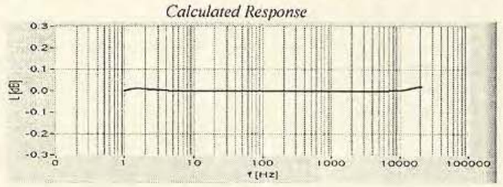
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.0	0.0

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	0.0
1000	0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	36.2

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
25 °C	36%	991 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	87	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	5369	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.

2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.

3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.

4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.

5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor ..... Test date: 2015-07-21

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45355*

with preamplifier SVANTEK type SV12L No. 47603 and microphone ACO PACIFIC type 7052E No. 60645

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{sin}=1 kHz; Input signal =100 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: : 113.90 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.84	-0.06
A	113.90	113.84	-0.06
C	113.90	113.84	-0.06

Calibration measured with the microphone ACO PACIFIC type 7052E No. 60645. Calibration factor: -1.20 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.1	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{sin}= 4000 Hz; Burst duration: 2 s

Range: Low; Steady level nominal result = 117dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	117.0	116.9	116.0	114.4	112.2	108.7	105.8	102.9	99.0	96.0	92.9	89.9
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	115.0	113.0	109.6	106.8	103.9	100.0	97.0	94.0	90.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	117.0	114.0	110.0	107.0	104.0	100.0	97.0	94.0	90.0	87.0	83.9	80.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: Low; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	57.0	56.9	56.0	54.4	52.1	48.6	45.8	42.9	38.9	35.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.1
	Slow	Indication [dB]	55.0	52.9	49.5	46.8	43.9	39.9	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	57.0	54.0	50.0	47.0	44.0	40.0	37.0	34.0	30.0	27.0
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0

Range: Low; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	35.0	34.9	34.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	33.0	31.0	27.6
		Error [dB]	0.0	0.1	0.0
SEL	-	Indication [dB]	35.0	32.0	28.1
		Error [dB]	0.0	0.0	0.1

Range: High; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	112.9	109.9	106.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	132.0	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: High; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.2
		Error [dB]	0.0	0.0	0.0	0.0	-0.0
	Slow	Indication [dB]	52.0	49.9	46.5	43.7	40.9
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0
		Error [dB]	0.0	0.0	0.0	0.0	0.0

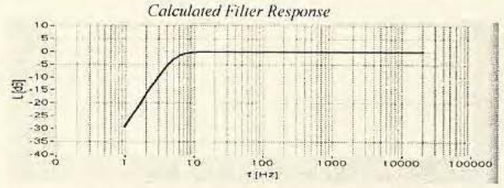
Range: High; Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	46.0	45.9	45.0
		Error [dB]	0.0	-0.0	0.0
	Slow	Indication [dB]	44.0	41.9	38.6
		Error [dB]	0.0	0.0	-0.0
SEL	-	Indication [dB]	46.0	43.0	39.1
		Error [dB]	0.0	-0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L
(f - frequency, L - level)

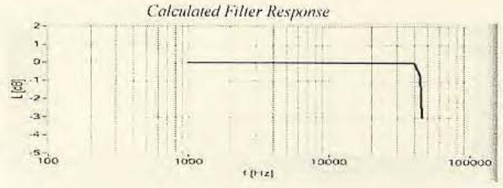
f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-6.0	16	0.0	250	0.0	16000	0.0
1.25	-25.5	5	-3.2	20	0.0	500	0.0	20000	0.0
1.6	-21.4	6.3	-1.4	25	0.0	1000	0.0		
2	-17.3	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.3	10	-0.2	63	0.0	4000	0.0		
3.15	-9.5	12.5	-0.0	125	0.0	8000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function; Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L
(f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1000	0.0	16000	-0.0	40000	-0.1
2000	0.0	20000	-0.0	43856*	-0.6
4000	0.0	25000	-0.0	45255*	-3.0
8000	-0.0	32000	-0.0		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47603.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	11.1	17.6

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 140dB;

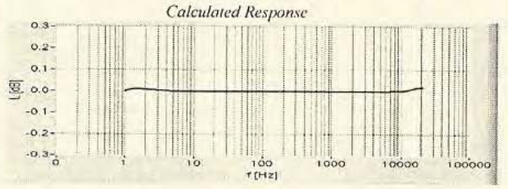
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.1	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	-0.0
1000	-0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	36.7