

RECALIBRATION **DUE DATE:**

February 18, 2021

ertificate o

Calibration Certification Information

Cal. Date: February 18, 2020 Rootsmeter S/N: 438320

Ta: 294

Operator: Jim Tisch

Pa: 753.1

mm Hg

Calibration Model #:

TE-5025A

Calibrator S/N: 0005

R	un	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
	1	1	2	1	1.3790	3.2	2.00
	2	3	4	1	0.9840	6.4	4.00
	3	5	6	1	0.8740	7.9	5.00
	4	7	8	1	0.8350	8.8	5.50
	5	9	10	1	0.6910	12.6	8.00

	Data Tabulation										
Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right) \left(\frac{Tstd}{Ta}\right)}$		Qa	√∆H(Ta/Pa)						
(m3)	(x-axis)	(y-axis)	Va	(x-axis)	(y-axis)						
1.0001	0.7253	1.4173	0.9958	0.7221	0.8836						
0.9959	1.0121	2.0044	0.9915	1.0076	1.2496						
0.9939	1.1372	2.2410	0.9895	1.1322	1.3971						
0.9927	1.1888	2.3504	0.9883	1.1836	1.4653						
0.9876	1.4293	2.8347	0.9833	1.4230	1.7672						
	m=	2.00927		m=	1.25817						
QSTD	b=	-0.03767	QA	b=	-0.02348						
	r=	0.99995		r=	0.99995						

	Calculations							
Vstd=	ΔVoI((Pa-ΔP)/Pstd)(Tstd/Ta)	Va=	ΔVol((Pa-ΔP)/Pa)					
Qstd=	Vstd/∆Time	Qa=	= Va/ΔTime					
For subsequent flow rate calculations:								
Qstd=	$1/m\left(\left(\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}\right)-b\right)$	Qa=	$1/m\left(\left(\sqrt{\Delta H(Ta/Pa)}\right)-b\right)$					

	Standard Conditions	
Tstd:	298.15 °K	
Pstd:	760 mm Hg	
	Key	
ΔH: calibrato	r manometer reading (in H2O)	
ΔP: rootsmet	er manometer reading (mm Hg)	
	solute temperature (°K)	
Pa: actual bar	rometric pressure (mm Hg)	
b: intercept		
m· slone		

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30

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Location : CMA1b						Calbratio	on Date	:	11-Jan-21
Equipment no.	ŀ	HVS001				Calbratio	on Due Date	:	11-Mar-21
CALIBRATION OF CON	ITINUOUS	FLOW R	ECORDER						
				Ambient C	Condition				
Temperature, T _a		284	ļ	Kelvin	Pressure, P	a	1	026	mmHg
			Orifice Tr	ansfer Sta	ndard Inform	mation			
Equipment No.		0005		Slope, m _c	2.009	27	Intercept, bc		-0.03767
Last Calibration Date		18-Feb-2	0		(Hx	P _a / 101	3.3 x 298 /	T _a)	1/2
Next Calibration Date		17-Feb-2	:1		=	m _c x	$Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Mar	ometer R	eading	C	std	Continu	ous Flow		IC
Point	H (i	inches of	water)	(m ³ / min.)		Reco	rder, W	(W(P _a /1	013.3x298/T _a) ^{1/2} /35.31)
	(up)	(down)	(difference)	X-	axis	(C	FM)		Y-axis
1	1.5	1.5	3.0	0.9	9072		25		25.7663
2	2.4	2.4	4.8	1.	1426	;	31		31.9502
3	3.9	3.9	7.8	1.4	1 513	39		40.1954	
4	5.2	5.2	10.4	1.6	6730	48		49.4712	
5	6.4	6.4	12.8	1.8	3539		53		54.6245
By Linear Regression of	Y on X								
	Slope, m	=	30.9	194	Int	ercept, b =	-3	.0586	
Correlation Co	pefficient*	=	0.99	64					
Calibration	Accepted	=	Yes/A	10 **					
* if Correlation Coefficien	nt < 0.990,	check and	recalibration	again.					
				_					
** Delete as appropriate.									
Remarks :									
Calibrated by	Lau	rance Yun	9			Checked	by	:	James Chu
Date :	1	1-Jan-21				Date		:	11-Jan-21



				•	• `	•	•	
Location :		CMA2a			Calbration	Date	:	11-Jan-21
Equipment no.	ı	HVS002			Calbration	Due Date	:	11-Mar-21
CALIBRATION OF CON	ITINUOUS	S FLOW R	ECORDER					
				Ambient Condition				
Temperature, T _a		284		Kelvin Pressure, P	a	10	026	mmHg
			Orifice Tr	ransfer Standard Infor	mation			
Equipment No.		0005	0111100 11	Slope, m _c 2.009		ntercept, bc	Т	-0.03767
Last Calibration Date		18-Feb-2	20		c P _a / 1013		T) 1/2	0.00707
Next Calibration Date		17-Feb-2		=		$Q_{std} + b_c$	'a <i>)</i>	
						stu · ~ c		
	ı			Calibration of TSP		T		
Calibration			-	Q _{std}	Continuo			IC
Point	H (inches of	•	(m ³ / min.)	Record		(W(P _a /1013	3.3x298/T _a) ^{1/2} /35.31)
	(up)	(down)	(difference)	X-axis	(CF			Y-axis
1	1.6	1.6	3.2	0.9363	26	6		26.7969
2	2.6	2.6	5.2	1.1884	36	6	;	37.1034
3	4.1	4.1	8.2	1.4876	43	3		44.3180
4	5.4	5.4	10.8	1.7045	50)		51.5325
5	6.9	6.9	13.8	1.9243	54	1		55.6551
By Linear Regression of	Y on X							
	Slope, m	=	29.0	189 Int	ercept, b = _	1.0	0552	
Correlation Co	oefficient*	=	0.99	933				
Calibration	Accepted	=	Yes/	\0 **				
* if Correlation Coefficier	nt < 0.990,	check and	I recalibration	ı again.				
				_				
** Delete as appropriate.								
Remarks :								
Calibrated by	Lau	rance Yun	g		Checked b	ру	:	James Chu
Date	1	1-Jan-21	<u> </u>		Date		:	11-Jan-21



				•	• `	•	,	
Location :		CMA3a			Calbration	n Date	:	11-Jan-21
Equipment no.	ŀ	HVS012			Calbration	Due Date	:	11-Mar-21
CALIBRATION OF CON	ITINUOUS	S FLOW R	ECORDER					
				Ambient Condition				
Temperature, T _a		284	ļ	Kelvin Pressure, P	a	1	026	mmHg
			Orifico Tr	ransfer Standard Infor	mation			
Equipment No.		0005		Slope, m _c 2.009		ntercept, bc		-0.03767
Last Calibration Date		18-Feb-2			c P _a / 1013		T 1/2	
Next Calibration Date		17-Feb-2		($Q_{std} + b_c$	<i>l_a)</i>	
Next Campration Date		17-1 60-2	- 1	-	III c X G	std + D _C		
				Calibration of TSP	ı			
Calibration	Calibration Manometer Readi		eading	Q _{std}	Continuo	ous Flow		IC
Point	H (i	inches of	water)	(m ³ / min.)	nin.) Recorder		(W(P _a /1013.3x298/T _a) ^{1/2} /35.31)	
	(up)	(down)	(difference)	X-axis	(CF	·M)		Y-axis
1	1.7	1.7	3.4	0.9646	28	8		28.8582
2	2.6	2.6	5.2	1.1884	34	4		35.0421
3	3.4	3.4	6.8	1.3564	4	1		42.2567
4	4.4	4.4	8.8	1.5404	48	8		49.4712
5	5.1	5.1	10.2	1.6570	50	0		51.5325
By Linear Regression of	Y on X							
	Slope, m	=	34.49	981 Int	ercept, b =	-4.	.8419	
Correlation Co	pefficient*	=	0.99	52				
Calibration	Accepted	=	Yes/4	\0 **				
* if Correlation Coefficien	nt < 0.990.	check and	l recalibration	ı aqain.				
				C				
** Delete as appropriate.								
Remarks :								
Calibrated by	Lau	rance Yun	g		Checked b	ру	:	James Chu
Date	1	1-Jan-21			Date		:	11-Jan-21



				•	• `	•	,	
Location :		MA1b			Calbratio	n Date	: 1:	2-Jan-21
Equipment no.	ŀ	HVS014			Calbratio	n Due Date	: 1	2-Mar-21
CALIBRATION OF CON	ITINUOUS	FLOW R	ECORDER					
				Ambient Condition				
Temperature, T _a		284		Kelvin Pressure, P	a	1	026	mmHg
			Orifico Tr	ransfer Standard Infor	mation			
Equipment No.		0005	Office II	Slope, m _c 2.009		Intercept, bc		0.03767
Last Calibration Date		18-Feb-2	20			3.3 x 298 /		0.03767
Next Calibration Date		17-Feb-2		($Q_{std} + b_c$	' a)	
Next Campration Date		17-1 60-2	.1	_	III _C X	Std + D c		
				Calibration of TSP				
Calibration			eading	Q _{std}	Continu	ous Flow		IC
Point	H (i	inches of	water)	(m ³ / min.)	Recorder, W		(W(P _a /1013.3x298/T _a) ^{1/2} /35.31)	
	(up)	(down)	(difference)	X-axis	(CI	FM)	Y	-axis
1	1.5	1.5	3.0	0.9072	3	34	35	5.0421
2	2.2	2.2	4.4	1.0947	4	11	42	2.2567
3	3.5	3.5	7.0	1.3759	4	19	50).5019
4	4.4	4.4	8.8	1.5404	5	55	56	5.6858
5	5.4	5.4	10.8	1.7045	5	59	60).8084
By Linear Regression of	Y on X							
	Slope, m	=	32.3	312 Int	ercept, b =	6.2	2352	
Correlation Co	pefficient*	=	0.99	984				
Calibration	Accepted	=	Yes/	\• **				
* if Correlation Coefficier	nt < 0 990	check and	l recalibration	again				
ii Contolation Coomolor	0.000,	orioon ario	rodanbration	agam.				
** Delete as appropriate.								
Remarks :								
Calibrated by	Lau	rance Yun	g		Checked	by	: Ja	ames Chu
Date	1:	2-Jan-21			Date		: 1	2-Jan-21



香港黄竹坑道37號利達中心12樓 12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong. E-mail: smec@cigismec.com Website: www.cigismec.com Tel: (852) 2873 6860 Fax: (852) 2555 7533



CERTIFICATE OF CALIBRATION

Certificate No.:

20CA0612 02-02

Page

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Item tested

Description:

Sound Level Meter (Type 1) Larson Davis Microphone PCB

Preamp PCB

of

Manufacturer: Type/Model No.:

Larson Davis LxT1 377B02

PCB PRMLxT1L

Serial/Equipment No.: Adaptors used:

0005062

173734

042836

Item submitted by

Customer Name:

Lam Environmental Services Limited

Address of Customer:

-

Request No.: Date of receipt:

12-Jun-2020

Date of test:

17-Jun-2020

Reference equipment used in the calibration

Description:

Model:

Serial No.

Expiry Date:

Traceable to:

Multi function sound calibrator Signal generator B&K 4226 DS 360 2288444 61227 23-Aug-2020 24-Dec-2020 CIGISMEC CEPREI

Ambient conditions

Temperature:

Air pressure:

22 ± 1 °C

Relative humidity:

55 ± 10 % 1005 ± 5 hPa

Test specifications

1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.

2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.

 The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Jungi

Actual Measurement data are documented on worksheets.

Approved Signatory:

Date:

17-Jun-2020

Company Chop:

\$105 * 011E

Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.

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Form No.CARP152-1/Issue 1/Rev.C/01/02/2007



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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

20CA0612 02-02

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of

2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertanity (dB)	Coverage Factor	
Self-generated noise	A	Pass	0.3		
	С	Pass	0.8	2.1	
	Lin	Pass	1.6	2.2	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3		
	Reference SPL on all other ranges	Pass	0.3		
	2 dB below upper limit of each range	Pass	0.3		
	2 dB above lower limit of each range	Pass	0.3		
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3		
Frequency weightings	A	Pass	0.3		
- , - , - , , , , , , , , , , , , , , ,	С	Pass	0.3		
	Lin	Pass	0.3		
Time weightings	Single Burst Fast	Pass	0.3		
	Single Burst Slow	Pass	0.3		
Peak response	Single 100µs rectangular pulse	Pass	0.3		
R.M.S. accuracy	Crest factor of 3	Pass	0.3		
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3		
	Repeated at frequency of 100 Hz	Pass	0.3		
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3		
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3		
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4		
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4		
Overload indication	SPL	Pass	0.3		
	Leq	Pass	0.4		

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

This calibration certificate supersedes the last certificate 19CA0527 01.

Calibrated by:

Date:

Fung Chi Yip 17-Jun-2020 Checked by:

Shek Kwong Tat 17-Jun-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

End

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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007



香港 黄 竹 坑 道 3 7 號 利 達 中 心 1 2 樓 12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong. E-mail: smec@cigismec.com Website: www.cigismec.com Tel: (852) 2873 6860 Fax: (852) 2555 7533 **SMECLab**

Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

LxT1

Serial No.

0005062

Date 17-

17-Jun-2020

Microphone Preamp type: type: 377B02 PRMLxT1L Serial No. Serial No. 173734 042836

Report: 20CA0612 02-02

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

10.2

dΒ

Noise level in C weighting Noise level in Lin

11.521.9

dB dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actua	ıl level	Tolerance	Devia	Deviation		
rtelefence/Expected level	non-integrated	integrated		non-integrated	integrated		
dB	dB	dB	+/- dB	dB	dB		
94.0	94.0	94.0	0.7	0.0	0.0		
99.0	99.0	99.0	0.7	0.0	0.0		
104.0	104.0	104.0	0.7	0.0	0.0		
109.0	109.0	109.0	0.7	0.0	0.0		
114.0	114.0	114.0	0.7	0.0	0.0		
115.0	115.0	115.0	0.7	0.0	0.0		
116.0	116.0	116.0	0.7	0.0	0.0		
117.0	117.0	117.0	0.7	0.0	0.0		
118.0	118.0	118.0	0.7	0.0	0.0		
119.0	119.0	119.0	0.7	0.0	0.0		
120.0	120.0	120.0	0.7	0.0	0.0		
89.0	89.0	89.0	0.7	0.0	0.0		
84.0	84.0	84.0	0.7	0.0	0.0		
79.0	79.0	79.0	0.7	0.0	0.0		
74.0	74.0	74.0	0.7	0.0	0.0		
69.0	69.0	69.0	0.7	0.0	0.0		
64.0	64.0	64.0	0.7	0.0	0.0		
59.0	59.0	59.0	0.7	0.0	0.0		
54.0	54.0	54.0	0.7	0.0	0.0		
49.0	49.0	49.0	0.7	0.0	0.0		
44.0	44.0	44.0	0.7	0.0	0.0		
39.0	39.0	39.0	0.7	0.0	0.0		
34.0	34.0	33.9	0.7	0.0	-0.1		
33.0	32.9	32.9	0.7	-0.1	-0.1		



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Test Data for Sound Level Meter

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Sound level meter type:		LxT1		Serial No.	0005062	Date	e 17-Jun	-2020
Microphone Preamp	type: type:	377B02 PRMLxT1L		Serial No. Serial No.	173734 042836	Rep	ort: 20CA06	12 02-02
32.0		31.9	31.9	0.7		-0.1	-0.1	
31.0		30.9	30.9	0.7		-0.1	-0.1	
30.0		29.9	29.9	0.7		-0.1	-0.1	

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-120	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-120	30.0	29.9	0.7	-0.1
20-120	118.0	118.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	54.6	1.5	1.5	0.0
63.1	94.0	67.8	67.8	1.5	1.5	0.0
125.9	94.0	77.9	77.9	1.0	1.0	0.0
251.2	94.0	85.4	85.4	1.0	1.0	0.0
501.2	94.0	90.8	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	95.0	1.0	1.0	0.0
7943.0	94.0	92.9	92.9	1.5	3.0	0.0
12590.0	94.0	89.7	89.6	3.0	6.0	-0.1

Frequency weighting C:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	91.0	1.5	1.5	0.0
63.1	94.0	93.2	93.2	1.5	1.5	0.0
125.9	94.0	93.8	93.8	1.0	1.0	0.0
251.2	94.0	94.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	94.0	1.0	1.0	0.0

(c)Soils Materials Eng. Co., Ltd.



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Test Data for Sound Level Meter

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Sound level me	eter type:	LxT1	Serial No.	000	5062	Date	17-Jun-2020
Microphone Preamp	type: type:	377B02 PRMLxT1L	Serial No. Serial No.		734 836	Report:	20CA0612 02-02
1995.0	94.0	93.8	93.9	1.0	1.0	0.1	
3981.0	94.0	93.2	93.2	1.0	1.0	0.0	
7943.0	94.0	91.0	91.0	1.5	3.0	0.0	
12590.0	94.0	87.8	87.7	3.0	6.0	-0.1	

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	93.9	1.5	1.5	-0.1
63.1	94.0	94.0	93.9	1.5	1.5	-0.1
125.9	94.0	94.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	94.0	1.0	1.0	0.0
7943.0	94.0	94.0	94.0	1.5	3.0	0.0
12590.0	94.0	94.0	93.9	3.0	6.0	-0.1

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.8	1.0	1.0	-0.1

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the 10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities:	(Weighting Z. s	set the generator	signal to	single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

LxT1

Serial No.

0005062

Date

17-Jun-2020

Microphone Preamp type: type: 377B02 PRMLxT1L Serial No. Serial No. 173734 042836

Report: 20CA0612 02-02

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

(Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.9	0.5	-0.1

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.1	2.0	-0.1

Repeated at 100 Hz

Ref. Level	Repeated bu	ırst indication	Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.1	1.0	-0.2

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	90.0	90.0	89.9	1.0	-0.1	60s integ.
10000	80.0	80.0	79.9	1.0	-0.1	6min. integ

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference rar

Test frequency:

4000 Hz

Integration time:

10 sec

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Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

LxT1

Serial No.

0005062

Date

17-Jun-2020

Microphone Preamp type:

377B02 PRMLxT1L Serial No. Serial No. 173734 042836

Report: 20CA0612 02-02

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	58.0	1.7	0.0

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	68.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
112.6	111.6	108.6	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as follow The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference rar

Test frequency:

4000 Hz

Integration time:

10 sec

Single burst duration:

1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
119.9	118.9	78.9	78.9	2.2	0.0

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level Tolerance (dB)		Deviation	
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	77.7	1.0	1.0	-0.2
8000	92.9	90.8	1.5	3.0	-2.1

-----END-----



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CERTIFICATE OF CALIBRATION

Certificate No.:

20CA0907 03

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of

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Item tested

Description: Manufacturer: Sound Level Meter (Type 1)

Microphone B & K Preamp B & K

Type/Model No.:

B & K 2250-L

4950 2827240 ZC0032 21213

Serial/Equipment No.: Adaptors used:

3006790

-

Item submitted by

Customer Name:

Lam Geotechnics Limited

Address of Customer:

-

Request No.:

07-Sep-2020

Date of test:

10-Sep-2020

Reference equipment used in the calibration

Description:

Model:

Serial No.

Expiry Date:

Traceable to:

Multi function sound calibrator

B&K 4226

2288444

23-Aug-2021

CIGISMEC

Signal generator

DS 360

61227

24-Dec-2020

CEPREI

Ambient conditions

Temperature:

22 ± 1 °C

Relative humidity: Air pressure:

55 ± 10 % 1005 ± 5 hPa

Test specifications

1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.

2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.

 The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Feng Junqi

Approved Signatory:

Date:

11-Sep-2020

Company Chop:

Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

20CA0907 03

Page

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2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

			Expanded	Coverage
Test:	Subtest:	Status:	Uncertanity (dB)	Factor
Self-generated noise	A	Pass	0.3	
con generated notes	Č	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leg	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	Α	Pass	0.3	
	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

			Expanded	Coverage
Test:	Subtest	Status	Uncertanity (dB)	Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

End

Checked by

Date:

Fung Chi Yip 10-Sep-2020

Date:

11-Sep-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

2250-L

Serial No.

3006790

Date 10-Sep-2020

Microphone Preamp

type: type: 4950 ZC0032 Serial No. 2827240 Serial No. 21213

Report: 20CA0907 03

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

17.2

dB

Noise level in C weighting

16.6

dB

Noise level in Lin

24.6 dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actual level Tolerance Devia		ation		
Treference/Expedied level	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
124.0	124.0	124.0	0.7	0.0	0.0
129.0	129.0	129.0	0.7	0.0	0.0
134.0	134.0	134.0	0.7	0.0	0.0
135.0	135.0	135.0	0.7	0.0	0.0
136.0	136.0	136.0	0.7	0.0	0.0
137.0	137.0	137.0	0.7	0.0	0.0
138.0	138.0	138.0	0.7	0.0	0.0
139.0	139.0	139.0	0.7	0.0	0.0
140.0	140.0	140.0	0.7	0.0	0.0
89.0	89.0	89.0	0.7	0.0	0.0
84.0	84.0	84.0	0.7	0.0	0.0
79.0	79.0	79.0	0.7	0.0	0.0
74.0	74.0	74.0	0.7	0.0	0.0
69.0	69.0	69.0	0.7	0.0	0.0
64.0	64.0	64.0	0.7	0.0	0.0
59.0	59.0	59.0	0.7	0.0	0.0
54.0	54.0	54.0	0.7	0.0	0.0
49.0	49.0	49.0	0.7	0.0	0.0
44.0	44.0	44.0	0.7	0.0	0.0
39.0	39.0	39.0	0.7	0.0	0.0

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Test Data for Sound Level Meter

Page 2 of 5

Sound level meter t	type: 2250-L		Serial No.	3006790	Date	e 10-Sep-	-2020
	ype: 4950 ype: ZC0032		Serial No. Serial No.	2827240 21213	Rep	ort: 20CA090	07 03
34.0	34.1	34.1	0.7		0.1	0.1	
33.0	33.1	33.1	0.7		0.1	0.1	
32.0	32.1	32.1	0.7		0.1	0.1	
31.0	31.1	31.1	0.7		0.1	0.1	
30.0	30.2	30.2	0.7		0.2	0.2	

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	94.0	94.0	0.7	0.0

· Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	30.0	30.2	0.7	0.2
20-140	138.0	138.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL. Frequency weighting A:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolera	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	0.0	54.6	1.5	1.5	0.0
63.1	94.0	67.8	0.0	67.8	1.5	1.5	0.0
125.9	94.0	77.9	0.0	77.9	1.0	1.0	0.0
251.2	94.0	85.4	0.0	85.3	1.0	1.0	-0.1
501.2	94.0	90.8	0.0	90.8	1.0	1.0	0.0
1995.0	94.0	95.2	0.0	95.1	1.0	1.0	-0.1
3981.0	94.0	95.0	-0.1	94.9	1.0	1.0	0.0
7943.0	94.0	92.9	-0.3	92.6	1.5	3.0	0.0
12590.0	94.0	89.7	-0.3	89.3	3.0	6.0	-0.1

Frequency weighting C:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	0.0	91.0	1.5	1.5	0.0
63.1	94.0	93.2	0.0	93.2	1.5	1.5	0.0
125.9	94.0	93.8	0.0	93.8	1.0	1.0	0.0

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Test Data for Sound Level Meter

Page 3 of 5

Sound level me	ter type:	2250-L		Serial No.	300	6790	Date 10-	Sep-2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	282 212	7240 13	Report: 200	A0907 03
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
1995.0	94.0	93.8	0.0	93.8	1.0	1.0	0.0	
3981.0	94.0	93.2	-0.1	93.1	1.0	1.0	0.0	
7943.0	94.0	91.0	-0.3	90.7	1.5	3.0	0.0	
12590.0	94.0	87.8	-0.3	87.4	3.0	6.0	-0.1	

Frequency weighting Lin:

r requericy weigi			0 " (- .	(10)	
Frequency	Ref. level	Expected level	electrical response	Actual level	I olerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	0.0	94.1	1.5	1.5	0.1
63.1	94.0	94.0	0.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	0.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	0.0	93.9	1.0	1.0	-0.1
3981.0	94.0	94.0	-0.1	93.9	1.0	1.0	0.0
7943.0	94.0	94.0	-0.3	93.7	1.5	3.0	0.0
12590.0	94.0	94.0	-0.3	93.7	3.0	6.0	0.0

^{*}Deviation = Actual level - (Expected level + Correction of electrical response)

The correction of electrical response is specified in the Table A.2 of technical documentation of BE 1853-11. The maximum expanded uncertainty of correction of electrical response is 0.3 dB.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	114.9	1.0	1.0	-0.1

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. leve	el Expected le	vel Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the

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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

2250-L

Serial No.

3006790

Date 10-Sep-2020

Microphone Preamp

type: type: 4950 ZC0032 Serial No. Serial No. 2827240 21213

Report: 20CA0907 03

10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities:

(Weighting L, set the generator signal to single, LLPeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

(Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.9	0.5	-0.1

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burs	Single burst indication		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.1	2.0	-0.1

Repeated at 100 Hz

Ref. Level	Repeated bu	Repeated burst indication		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.1	1.0	-0.2

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	110.0	110.0	109.9	1.0	-0.1	60s integ.
10000	100.0	100.0	99.8	1.0	-0.2	6min. integ.

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Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

2250-L

Serial No.

3006790

Date 10-Sep-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No.

2827240 21213

Report: 20CA0907 03

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	58.0	1.7	0.0

The integrating sound level meter set to SFL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	68.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
135.9	134.9	131.9	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leg.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

Single burst duration:

1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
142.7	141.7	101.7	101.7	2.2	0.0

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	vel Tolerance (dB)		Deviation
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.2	1.0	1.0	0.3
8000	92.9	92.8	1.5	3.0	-0.1

-----END-----

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Tel: (852) 2873 6860 Fax: (852) 2555 7533



CERTIFICATE OF CALIBRATION

Certificate No.:

20CA0225 02

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Item tested

Description: Manufacturer: Sound Level Meter (Type 1)

B&K

2250 2701778

B & K 4950 2755097

Microphone

Preamp **B&K** ZC0032 19223

Adaptors used:

Type/Model No.:

Customer Name:

Lam Geotechnics Limited.

Address of Customer:

Serial/Equipment No.:

Item submitted by

Request No .:

Date of receipt:

25-Feb-2020

Date of test:

26-Feb-2020

Reference equipment used in the calibration

Description:

Multi function sound calibrator

Model: B&K 4226 Serial No.

Expiry Date:

Traceable to:

Signal generator

DS 360

2288444 33873

23-Aug-2020 10-May-2020 CIGISMEC CEPREI

Ambient conditions

Temperature:

21 ± 1 °C 55 ± 10 %

Relative humidity: Air pressure:

1005 ± 5 hPa

Test specifications

- The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2, replaced by an equivalent capacitance within a tolerance of +20%.
- 3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Feng

Actual Measurement data are documented on worksheets.

Approved Signatory:

Date:

26-Feb-2020

Company Chop:

The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.

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Form No CARP152-1/Issue 1/Rev C/01/02/2007



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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

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2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

		Expanded	Coverage
Subtest:	Status:	Uncertanity (dB)	Factor
	_		
	Pass		
At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Reference SPL on all other ranges	Pass	0.3	
2 dB below upper limit of each range	Pass	0.3	
2 dB above lower limit of each range	Pass	0.3	
At reference range, Step 5 dB at 4 kHz	Pass	0.3	
A	Pass	0.3	
С	Pass	0.3	
Lin	Pass	0.3	
Single Burst Fast	Pass	0.3	
Single Burst Slow	Pass	0.3	
Single 100µs rectangular pulse	Pass	0.3	
Crest factor of 3	Pass	0.3	
Single burst 5 ms at 2000 Hz	Pass	0.3	
Repeated at frequency of 100 Hz	Pass	0.3	
1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
1 ms burst duty factor 1/104 at 4kHz	Pass	0.3	
Single burst 10 ms at 4 kHz	Pass	0.4	
Single burst 10 ms at 4 kHz	Pass	0.4	
SPL	Pass	0.3	
Leq	Pass	0.4	
	A C Lin At reference range, Step 5 dB at 4 kHz Reference SPL on all other ranges 2 dB below upper limit of each range 2 dB above lower limit of each range At reference range, Step 5 dB at 4 kHz A C Lin Single Burst Fast Single Burst Slow Single 100µs rectangular pulse Crest factor of 3 Single burst 5 ms at 2000 Hz Repeated at frequency of 100 Hz 1 ms burst duty factor 1/10³ at 4kHz 1 ms burst duty factor 1/10⁴ at 4kHz Single burst 10 ms at 4 kHz Single burst 10 ms at 4 kHz SPL	A Pass C Pass Lin Pass At reference range, Step 5 dB at 4 kHz Reference SPL on all other ranges 2 dB below upper limit of each range 2 dB above lower limit of each range At reference range, Step 5 dB at 4 kHz A Pass C Pass C Pass Lin Pass Single Burst Fast Pass Single Burst Slow Pass Single 100µs rectangular pulse Pass Crest factor of 3 Pass Crest factor of 3 Pass Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass 1 ms burst duty factor 1/10³ at 4kHz Pass 1 ms burst duty factor 1/10⁴ at 4kHz Pass Single burst 10 ms at 4 kHz Pass SPL	Subtest: Status: Uncertanity (dB) A Pass 0.3 C Pass 0.8 Lin Pass 1.6 At reference range , Step 5 dB at 4 kHz Pass 0.3 Reference SPL on all other ranges Pass 0.3 2 dB below upper limit of each range Pass 0.3 2 dB above lower limit of each range Pass 0.3 At reference range , Step 5 dB at 4 kHz Pass 0.3 A Pass 0.3 C Pass 0.3 Lin Pass 0.3 Single Burst Fast Pass 0.3 Single Burst Slow Pass 0.3 Single burst Slow Pass 0.3 Single burst 5 ms at 2000 Hz Pass 0.3 Repeated at frequency of 100 Hz Pass 0.3 1 ms burst duty factor 1/10 ⁴ at 4kHz Pass 0.3 1 ms burst duty factor 1/10 ⁴ at 4kHz Pass 0.3 Single burst 10 ms at 4 kHz Pass 0.4

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
ļ	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Date:

1

Fung Chi Yip 26-Feb-2020 End

Checked by:

Date:

26-Feb-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007



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Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

2250

Serial No.

2701778

Date

26-Feb-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2755097 19223

Report: 20CA0225 02

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

12.7

dB

Noise level in C weighting

14.2

dB

Noise level in Lin

20.3 dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actua	Actual level Tolerance		Devia	ation
Neierence/Expedied level	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
124.0	124.0	124.0	0.7	0.0	0.0
129.0	129.0	129.0	0.7	0.0	0.0
134.0	134.0	134.0	0.7	0.0	0.0
135.0	135.0	135.0	0.7	0.0	0.0
136.0	136.0	136.0	0.7	0.0	0.0
137.0	137.0	137.0	0.7	0.0	0.0
138.0	138.0	138.0	0.7	0.0	0.0
139.0	139.0	139.0	0.7	0.0	0.0
140.0	140.0	140.0	0.7	0.0	0.0
89.0	89.0	89.0	0.7	0.0	0.0
84.0	84.0	84.0	0.7	0.0	0.0
79.0	79.0	79.0	0.7	0.0	0.0
74.0	74.0	74.0	0.7	0.0	0.0
69.0	69.0	69.0	0.7	0.0	0.0
64.0	64.0	64.0	0.7	0.0	0.0
59.0	59.0	59.0	0.7	0.0	0.0
54.0	54.0	54.0	0.7	0.0	0.0
49.0	49.0	49.0	0.7	0.0	0.0
44.0	43.9	43.9	0.7	-0.1	-0.1
39.0	39.0	39.0	0.7	0.0	0.0



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Test Data for Sound Level Meter

Page 2 of 5

Sound level met	ter type:	2250		Serial No.	2701778	Date	26-Feb-2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	2755097 19223	Repo	ort: 20CA0225 02
34.0		33.9	33.9	0.7		-0.1	-0.1
33.0		32.9	32.9	0.7		-0.1	-0.1
32.0		32.0	32.0	0.7		0.0	0.0
31.0		31.0	31.0	0.7		0.0	0.0
30.0		30.0	30.0	0.7		0.0	0.0

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	30.0	30.0	0.7	0.0
20-140	138.0	138.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolera	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	N/A	54.6	1.5	1.5	0.0
63.1	94.0	67.8	0.0	67.8	1.5	1.5	0.0
125.9	94.0	77.9	0.0	77.9	1.0	1.0	0.0
251.2	94.0	85.4	0.0	85.4	1.0	1.0	0.0
501.2	94.0	90.8	0.0	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	0.0	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	-0.1	94.9	1.0	1.0	0.0
7943.0	94.0	92.9	-0.3	92.6	1.5	3.0	0.0
12590.0	94.0	89.7	-0.3	89.4	3.0	6.0	0.0

Frequency weighting C:

requeries weig	nung O.						
Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolera	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	N/A	91.1	1.5	1.5	0.1
63.1	94.0	93.2	0.0	93.2	1.5	1.5	0.0
125.9	94.0	93.8	0.0	93.8	1.0	1.0	0.0



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Test Data for Sound Level Meter

Page 3 of 5

Sound level me	eter type:	2250		Serial No.	270	1778	Date 26-Feb-2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	275 192	5097 23	Report: 20CA0225 02
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
1995.0	94.0	93.8	0.0	93.8	1.0	1.0	0.0
3981.0	94.0	93.2	-0.1	93.1	1.0	1.0	0.0
7943.0	94.0	91.0	-0.3	90.7	1.5	3.0	0.0
12590.0	94.0	87.8	-0.3	87.4	3.0	6.0	-0.1

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolera	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	N/A	94.1	1.5	1.5	0.1
63.1	94.0	94.0	0.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	0.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	0.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	-0.1	93.9	1.0	1.0	0.0
7943.0	94.0	94.0	-0.3	93.7	1.5	3.0	0.0
12590.0	94.0	94.0	-0.3	93.7	3.0	6.0	0.0

^{*}Deviation = Actual level - (Expected level + Correction of electrical response)

The correction of electrical response is specified in the Table A.2 of technical documentation of BE 1712-21. The maximum expanded uncertainty of correction of electrical response is 0.29 dB.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the

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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

2250

Serial No.

2701778

Date

26-Feb-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2755097 19223

Report: 20CA0225 02

10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities:

(Weighting Z, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.6	2.0	0.6

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.6	2.0	0.6

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency: 40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

(Set to INT)

1 0110 10 110 1 013					12 1111
	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	118.0	0.5	0.0

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burs	Single burst indication		Deviation	
dB	Expected (dB)	Actual (dB)	+/- dB	dB	
120.0	111.2	111.1	2.0	-0.1	

Repeated at 100 Hz

Ref. Level	Repeated bu	Repeated burst indication		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.2	1.0	-0.1

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	110.0	110.0	109.9	1.0	-0.1	60s integ.
10000	100.0	100.0	99.9	1.0	-0.1	6min. integ

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Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

2250

Serial No.

2701778

Date 26-Feb-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2755097 19223

Report: 20CA0225 02

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	58.0	1.7	0.0

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	68.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
135.3	134.3	131.3	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time: Single burst duration: 10 sec 1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
142.0	141.0	101.0	101.0	2.2	0.0

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerar	nce (dB)	Deviation
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.1	1.0	1.0	0.2
8000	92.9	92.2	1.5	3.0	-0.7

-----END-----



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CERTIFICATE OF CALIBRATION

Certificate No.:

21CA0120 04-01

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of

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone

Preamp

Manufacturer: Type/Model No.: B & K 2250L B & K 4950 B & K ZC0032

Serial/Equipment No.: Adaptors used:

3002695

2940839

18582

Item submitted by

Customer Name:

Lam Geotechnics Limited.

Address of Customer:

.

Request No.: Date of receipt:

20-Jan-2021

Date of test:

24-Jan-2021

Reference equipment used in the calibration

Description:

Model:

Serial No.

Expiry Date:

Traceable to:

Multi function sound calibrator

B&K 4226

2288444

23-Aug-2021

CIGISMEC

Signal generator

DS 360

33873

19-May-2021

CEPREI

Ambient conditions

Temperature:

21 ± 1 °C

Relative humidity:

55 ± 10 % 1000 ± 5 hPa

Air pressure:

1000 ± 5

Test specifications

 The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.

 The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.

The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

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Actual Measurement data are documented on worksheets.

Approved Signatory:

Date:

25-Jan-2021

Company Chop:

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Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

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Form No.CARP152-1/Issue 1/Rev.C/01/02/2007



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CERTIFICATE OF CALIBRATION

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1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

			Expanded	Coverage
Test:	Subtest:	Status:	Uncertanity (dB)	Factor
Self-generated noise	Α	Pass	0.3	
Gell-gerierated holde	Ĉ	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Ellicanty range for Edq	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	Α	Pass	0.3	
,,	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
0 0	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
-	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/103 at 4kHz	Pass	0.3	
3 3	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
en en estado en entre en entre en entre en en en en entre	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

- End

Checked by

Date:

Fung Chi Yip 24-Jan-2021

Date:

25-Jan-202

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007



SMECLab

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Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

2250L

Serial No.

3002695

Date 24-Jan-2021

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2940839 18582

Report: 21CA0120 04-01

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

14.3

dB

Noise level in C weighting

15.6

dB

Noise level in Lin

21.4

dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actua	l level	Tolerance	Devia	ation
Neierence/Expected level	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
124.0	124.0	124.0	0.7	0.0	0.0
129.0	129.0	129.0	0.7	0.0	0.0
134.0	134.0	134.0	0.7	0.0	0.0
135.0	135.0	135.0	0.7	0.0	0.0
136.0	136.0	136.0	0.7	0.0	0.0
137.0	137.0	137.0	0.7	0.0	0.0
138.0	138.0	138.0	0.7	0.0	0.0
139.0	139.0	139.0	0.7	0.0	0.0
140.0	140.0	140.0	0.7	0.0	0.0
89.0	89.0	89.0	0.7	0.0	0.0
84.0	84.0	84.0	0.7	0.0	0.0
79.0	79.0	79.0	0.7	0.0	0.0
74.0	74.0	74.0	0.7	0.0	0.0
69.0	69.0	69.0	0.7	0.0	0.0
64.0	64.0	64.0	0.7	0.0	0.0
59.0	59.0	59.0	0.7	0.0	0.0
54.0	54.0	54.0	0.7	0.0	0.0
49.0	49.0	49.0	0.7	0.0	0.0
44.0	44.0	44.0	0.7	0.0	0.0
39.0	38.9	38.9	0.7	-0.1	-0.1

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Test Data for Sound Level Meter

Page 2 of 5

Sound level met	er type:	2250L	Se	rial No.	3002695	Date	e 24-Jan-	2021
Microphone Preamp	type: type:	4950 ZC0032	7.7	rial No. rial No.	2940839 18582		ort: 21CA012	20 04-01
34.0		33.9	33.9	0.7		-0.1	-0.1	
33.0		32.9	32.9	0.7		-0.1	-0.1	
32.0		32.0	32.0	0.7		0.0	0.0	
31.0		31.0	31.0	0.7		0.0	0.0	
30.0		30.0	30.0	0.7		0.0	0.0	

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20.140	30.0	30.0	0.7	0.0
20-140	138.0	138.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	0.0	54.6	1.5	1.5	0.0
63.1	94.0	67.8	0.0	67.8	1.5	1.5	0.0
125.9	94.0	77.9	0.0	77.9	1.0	1.0	0.0
251.2	94.0	85.4	0.0	85.4	1.0	1.0	0.0
501.2	94.0	90.8	0.0	90.8	1.0	1.0	0.0
1995.0	94.0	95.2	0.0	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	-0.1	94.9	1.0	1.0	0.0
7943.0	94.0	92.9	-0.3	92.6	1.5	3.0	0.0
12590.0	94.0	89.7	-0.3	89.4	3.0	6.0	0.0

Frequency weighting C:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	0.0	91.1	1.5	1.5	0.1
63.1	94.0	93.2	0.0	93.2	1.5	1.5	0.0
125.9	94.0	93.8	0.0	93.8	1.0	1.0	0.0



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Test Data for Sound Level Meter

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Sound level me	eter type:	2250L		Serial No.	300	2695	Date	24-Jan-2021
Microphone Preamp	type: type:	4950 ZC0032				2940839 18582 Report		21CA0120 04-01
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
1995.0	94.0	93.8	0.0	93.8	1.0	1.0	0.0	
3981.0	94.0	93.2	-0.1	93.1	1.0	1.0	0.0	
7943.0	94.0	91.0	-0.3	90.7	1.5	3.0	0.0	
12590.0	94.0	87.8	-0.3	87.4	3.0	6.0	-0.1	

Frequency weighting Lin:

rrequerity weighting Lin.							D
Frequency	Ref. level	Expected level	correction of electrical response	Actual level	l olerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	0.0	94.1	1.5	1.5	0.1
63.1	94.0	94.0	0.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	0.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	0.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	-0.1	93.9	1.0	1.0	0.0
7943.0	94.0	94.0	-0.3	93.7	1.5	3.0	0.0
12590.0	94.0	94.0	-0.3	93.7	3.0	6.0	0.0

^{*}Deviation = Actual level - (Expected level + Correction of electrical response)

The correction of electrical response is specified in the Table A.2 of technical documentation of BE 1712-21. The maximum expanded uncertainty of correction of electrical response is 0.29 dB.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

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Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+		dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the



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SMFCLab

Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

2250L

Serial No.

3002695

24-Jan-2021 Date

Microphone Preamp

type: type: 4950 ZC0032 Serial No. Serial No.

2940839 18582

Report: 21CA0120 04-01

10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

(Weighting Z, set the generator signal to single, Lzpeak) Positive polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

40 Hz

Burst repetition frequency: Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz. (Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.9	0.5	-0.1

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burs	t indication	Tolerance	Deviation	
dB	Expected (dB)	Actual (dB)	+/- dB	dB	
120.0	111.2	111.1	2.0	-0.1	

Repeated at 100 Hz

Ref. Level	Repeated bu	Repeated burst indication		Deviation	
dB	Expected (dB)	Actual (dB)	+/- dB	dB	
120.0	117.3	117.1	1.0	-0.2	

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Daration of tone barst.	1 1110					
Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	110.0	110.0	109.9	1.0	-0.1	60s integ.
10000	100.0	100.0	99.9	1.0	-0.1	6min. integ.



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Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

2250L

Serial No.

3002695

Date 24-Jan-2021

Microphone Preamp type: type:

4950 ZC0032 Serial No. Serial No. 2940839 18582

Report: 21CA0120 04-01

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leg:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	110.0	80.0	79.9	1.7	-0.1

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	110.0	90.0	90.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
136.3	135.3	132.3	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time: Single burst duration: 10 sec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
143.5	142.5	102.5	102.4	2.2	-0.1

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerar	Tolerance (dB)	
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.1	1.0	1.0	0.2
8000	92.9	93.1	1.5	3.0	0.2

-----END-----



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Tel: (852) 2873 6860 Fax: (852) 2555 7533



CERTIFICATE OF CALIBRATION

Certificate No.:

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Item tested

Description: Manufacturer: Type/Model No.: Sound Level Meter (Type 1) **B&K**

Microphone **B&K** 4950

Preamp **B&K** ZC0032

Serial/Equipment No.: Adaptors used:

2250-L 2722311

2698703 13321

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Address of Customer:

Request No.:

Date of receipt:

05-May-2020

Date of test:

06-May-2020

Reference equipment used in the calibration

Description:

Model:

Serial No. 2288444

Expiry Date: 23-Aug-2020

Traceable to: CIGISMEC

Multi function sound calibrator Signal generator

B&K 4226 DS 360

61227

24-Dec-2020

CEPREI

Ambient conditions

Temperature:

22 ± 1 °C 55 ± 10 %

Relative humidity: Air pressure:

1005 ± 5 hPa

Test specifications

- The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2. replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference 3, between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

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carry no implication regarding the long-term stability of the instrument.

Approved Signatory:

Date:

06-May-2020

Company Chop:

The results reported in this certificate refer to the condition of the instrument on the date of calibration and

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Form No CARP152-1/Issue 1/Rev C/01/02/2007



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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

20CA0505 01

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1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertanity (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	С	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	A	Pass	0.3	
	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Subtest	Status	Expanded Uncertanity (dB)	Coverage Factor
Weighting A at 125 Hz	Pass	0.3	
Weighting A at 8000 Hz	Pass	0.5	
	Weighting A at 125 Hz	Weighting A at 125 Hz Pass	SubtestStatusUncertanity (dB)Weighting A at 125 HzPass0.3

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Date:

Fung Chi Yip 06-May-2020 End

Checked by:

Date:

Shek Kwong Tat 06-May-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007



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Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

2250-L

Serial No.

2722311

Date

06-May-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2698703 13321

Tel: (852) 2873 6860

Fax: (852) 2555 7533

Report: 20CA0505 01

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

13.2

dB

Noise level in C weighting

15.2 dB

Noise level in Lin

22.5

dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actual level		Tolerance	Deviation		
Melerence/Expected level	non-integrated	integrated		non-integrated	integrated	
dB	dB	dB	+/- dB	dB	dB	
94.0	94.0	94.0	0.7	0.0	0.0	
99.0	99.0	99.0	0.7	0.0	0.0	
104.0	104.0	104.0	0.7	0.0	0.0	
109.0	109.0	109.0	0.7	0.0	0.0	
114.0	114.0	114.0	0.7	0.0	0.0	
119.0	119.0	119.0	0.7	0.0	0.0	
124.0	124.0	124.0	0.7	0.0	0.0	
129.0	129.0	129.0	0.7	0.0	0.0	
134.0	134.0	134.0	0.7	0.0	0.0	
135.0	135.0	135.0	0.7	0.0	0.0	
136.0	136.0	136.0	0.7	0.0	0.0	
137.0	137.0	137.0	0.7	0.0	0.0	
138.0	138.0	138.0	0.7	0.0	0.0	
139.0	139.0	139.0	0.7	0.0	0.0	
140.0	140.0	140.0	0.7	0.0	0.0	
89.0	89.0	89.0	0.7	0.0	0.0	
84.0	84.0	84.0	0.7	0.0	0.0	
79.0	79.0	79.0	0.7	0.0	0.0	
74.0	74.0	74.0	0.7	0.0	0.0	
69.0	69.0	69.0	0.7	0.0	0.0	
64.0	64.0	64.0	0.7	0.0	0.0	
59.0	59.0	59.0	0.7	0.0	0.0	
54.0	53.9	53.9	0.7	-0.1	-0.1	
49.0	49.0	49.0	0.7	0.0	0.0	
44.0	43.9	43.9	0.7	-0.1	-0.1	
39.0	39.0	39.0	0.7	0.0	0.0	



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Test Data for Sound Level Meter

Page 2 of 5

Sound level met	er type:	2250-L		Serial No.	2722311	Date	e 06-May	-2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	2698703 13321	Rep	ort: 20CA050	05 01
34.0		34.0	34.0	0.7		0.0	0.0	
33.0		33.0	33.0	0.7		0.0	0.0	
32.0		32.0	32.0	0.7		0.0	0.0	
31.0		31.0	31.0	0.7		0.0	0.0	
30.0		30.0	30.0	0.7		0.0	0.0	

Tel: (852) 2873 6860

Fax: (852) 2555 7533

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	30.0	30.0	0.7	0.0
20-140	138.0	138.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	N/A	54.6	1.5	1.5	0.0
63.1	94.0	67.8	0.0	67.8	1.5	1.5	0.0
125.9	94.0	77.9	0.0	77.9	1.0	1.0	0.0
251.2	94.0	85.4	0.0	85.4	1.0	1.0	0.0
501.2	94.0	90.8	0.0	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	0.0	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	-0.1	94.9	1.0	1.0	0.0
7943.0	94.0	92.9	-0.3	92.6	1.5	3.0	0.0
12590.0	94.0	89.7	-0.3	89.3	3.0	6.0	-0.1

Frequency weighting C:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	N/A	91.0	1.5	1.5	0.0
63.1	94.0	93.2	0.0	93.2	1.5	1.5	0.0
125.9	94.0	93.8	0.0	93.8	1.0	1.0	0.0



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Test Data for Sound Level Meter

Page 3 of 5

Sound level me	ter type:	2250-L		Serial No.	272	2311	Date 06	-May-2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	269 133	8703 21	Report: 20	CA0505 01
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0	
1995.0	94.0	93.8	0.0	93.8	1.0	1.0	0.0	
3981.0	94.0	93.2	-0.1	93.1	1.0	1.0	0.0	
7943.0	94.0	91.0	-0.3	90.7	1.5	3.0	0.0	
12590.0	94.0	87.8	-0.3	87.4	3.0	6.0	-0.1	

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolera	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	N/A	94.1	1.5	1.5	0.1
63.1	94.0	94.0	0.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	0.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	0.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	-0.1	93.9	1.0	1.0	0.0
7943.0	94.0	94.0	-0.3	93.7	1.5	3.0	0.0
12590.0	94.0	94.0	-0.3	93.7	3.0	6.0	0.0

^{*}Deviation = Actual level - (Expected level + Correction of electrical response)

The correction of electrical response is specified in the Table A.2 of technical documentation of BE 1853-11. The maximum expanded uncertainty of correction of electrical response is 0.3 dB.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A. Maximum hold)

William and digital to domainadas.	(Trongine) i, maxim	, a, , , , , , , , , , , , , , , , , ,			
Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	114.9	1.0	1.0	-0.1

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the

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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

2250-L

Serial No.

2722311

Date

06-May-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2698703 13321

Report: 20CA0505 01

10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities:

(Weighting L, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.5	2.0	0.5

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

Tone burst signal:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

11 cycles of a sine wave of frequency 2000 Hz. (Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.9	0.5	-0.1

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Level Single burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.1	2.0	-0.1

Repeated at 100 Hz

Ref. Level	Repeated bu	ırst indication	Tolerance	Deviation	
dB	Expected (dB)	Actual (dB)	+/- dB	dB	
120.0	117.3	117.2	1.0	-0.1	

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Daration of tone barst.	1 1115					
Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	110.0	110.0	109.9	1.0	-0.1	60s integ.
10000	100.0	100.0	99.9	1.0	-0.1	6min. integ.

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Tel: (852) 2873 6860 Fax: (852) 2555 7533 **SMECLab**

Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

2250-L

Serial No.

2722311

Date

06-May-2020

Microphone Preamp

type: type: 4950 ZC0032 Serial No. Serial No. 2698703 13321

Report: 20CA0505 01

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leg:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	57.9	1.7	-0.1

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	67.9	1.7	-0.1

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
135.7	134.7	131.7	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time: Single burst duration: 10 sec 1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
142.3	141.3	101.3	101.2	2.2	-0.1

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level Actual level		Tolerar	Deviation	
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.0	1.0	1.0	0.1
8000	92.9	93.6	1.5	3.0	0.7

-----END-----



合試驗有限公司

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CERTIFICATE OF CALIBRATION

Certificate No.:

20CA0922 01

Page

of

2

Item tested

Description:

Manufacturer:

B&K Type/Model No.: Serial/Equipment No.:

2250-L 2722310

Microphone **B&K** 4950 2698702

Preamp B & K ZC0032 13318

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Sound Level Meter (Type 1)

Address of Customer:

Adaptors used:

Request No.:

Date of receipt:

22-Sep-2020

Date of test:

23-Sep-2020

Reference equipment used in the calibration

Description:

Multi function sound calibrator

Model: B&K 4226 Serial No. 2288444

Expiry Date: 23-Aug-2021

Traceable to: CIGISMEC

Signal generator

DS 360

61227

24-Dec-2020

CEPREI

Ambient conditions

Temperature: Relative humidity:

Air pressure:

22 ± 1 °C 55 ± 10 % 1005 ± 5 hPa

Test specifications

The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 1, and the lab calibration procedure SMTP004-CA-152.

The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2, replaced by an equivalent capacitance within a tolerance of ±20%.

3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:

Date:

24-Sep-2020

Company Chop:

The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

20CA0922 01

Page

2

Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

_			Expanded	Coverage
Test:	Subtest:	Status:	Uncertanity (dB)	Factor
Self-generated noise	A	Pass	0.3	
Self-generated noise	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leg	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Ellicanty range for Ecq	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	Α	Pass	0.3	
. , , ,	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, **Acoustic tests**

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

		Expanded	Coverage
Subtest	Status	Uncertanity (dB)	Factor
Weighting A at 125 Hz	Pass	0.3	
Weighting A at 8000 Hz	Pass	0.5	
	Weighting A at 125 Hz	Weighting A at 125 Hz Pass	SubtestStatusUncertanity (dB)Weighting A at 125 HzPass0.3

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Fung Chi Yip 23-Sep-2020 Checked by

Date:

ınai 24-Sep-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type:

2250-L

Serial No.

2722310

Date 23-Sep-2020

Microphone Preamp

type: type:

4950 ZC0032

Serial No. Serial No.

2698702 13318

Report: 20CA0922 01

Form No.: CAWS 152/Issue 1/Rev. B/01/02/2007

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting

12.8

dB

Noise level in C weighting

14.4

Noise level in Lin

dΒ

21.0 dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actua	l level	Tolerance	Deviation		
Neierenee/Expected level	non-integrated	integrated		non-integrated	integrated	
dB	dB	dB	+/- dB	dB	dB	
94.0	94.0	94.0	0.7	0.0	0.0	
99.0	99.0	99.0	0.7	0.0	0.0	
104.0	104.0	104.0	0.7	0.0	0.0	
109.0	109.0	109.0	0.7	0.0	0.0	
114.0	114.0	114.0	0.7	0.0	0.0	
119.0	119.0	119.0	0.7	0.0	0.0	
124.0	124.0	124.0	0.7	0.0	0.0	
129.0	129.0	129.0	0.7	0.0	0.0	
134.0	134.0	134.0	0.7	0.0	0.0	
135.0	135.1	135.1	0.7	0.1	0.1	
136.0	136.1	136.1	0.7	0.1	0.1	
137.0	137.1	137.1	0.7	0.1	0.1	
138.0	138.1	138.1	0.7	0.1	0.1	
139.0	139.0	139.0	0.7	0.0	0.0	
140.0	140.0	140.0	0.7	0.0	0.0	
89.0	89.0	89.0	0.7	0.0	0.0	
84.0	84.0	84.0	0.7	0.0	0.0	
79.0	79.0	79.0	0.7	0.0	0.0	
74.0	74.0	74.0	0.7	0.0	0.0	
69.0	69.0	69.0	0.7	0.0	0.0	
64.0	64.0	64.0	0.7	0.0	0.0	
59.0	59.0	59.0	0.7	0.0	0.0	
54.0	54.0	54.0	0.7	0.0	0.0	
49.0	49.0	49.0	0.7	0.0	0.0	
44.0	44.0	44.0	0.7	0.0	0.0	
39.0	39.0	39.0	0.7	0.0	0.0	

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Test Data for Sound Level Meter

Page 2 of 5

Sound level meter type:		2250-L		Serial No.	2722310	Date	e 23-Sep-	2020
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	2698702 13318	Rep	ort: 20CA092	22 01
34.0		34.0	34.0	0.7		0.0	0.0	
33.0		33.1	33.1	0.7		0.1	0.1	
32.0		32.1	32.1	0.7		0.1	0.1	
31.0		31.1	31.1	0.7		0.1	0.1	
30.0		30.1	30.1	0.7		0.1	0.1	

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
20-140	30.0	30.1	0.7	0.1
20-140	138.0	138.1	0.7	0.1

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	N/A	54.4	1.5	1.5	-0.2
63.1	94.0	67.8	0.0	67.7	1.5	1.5	-0.1
125.9	94.0	77.9	0.0	77.9	1.0	1.0	0.0
251.2	94.0	85.4	0.0	85.3	1.0	1.0	-0.1
501.2	94.0	90.8	0.0	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	0.0	95.1	1.0	1.0	-0.1
3981.0	94.0	95.0	-0.1	94.8	1.0	1.0	-0.1
7943.0	94.0	92.9	-0.3	92.5	1.5	3.0	-0.1
12590.0	94.0	89.7	-0.3	89.3	3.0	6.0	-0.1

Frequency weighting C:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	N/A	91.0	1.5	1.5	0.0
63.1	94.0	93.2	0.0	93.1	1.5	1.5	-0.1
125.9	94.0	93.8	0.0	93.8	1.0	1.0	0.0

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Test Data for Sound Level Meter

Page 3 of 5

Sound level meter	er type:	2250-L		Serial No.	272	2310	Date	23-Sep-2020	
Microphone Preamp	type: type:	4950 ZC0032		Serial No. Serial No.	269 133	8702 18	Report:	20CA0922 01	
251.2	94.0	94.0	0.0	93.9	1.0	1.0	-0.1		
501.2	94.0	94.0	0.0	94.0	1.0	1.0	0.0		
1995.0	94.0	93.8	0.0	93.7	1.0	1.0	-0.1		
3981.0	94.0	93.2	-0.1	93.0	1.0	1.0	-0.1		
7943.0	94.0	91.0	-0.3	90.6	1.5	3.0	-0.1		
12590.0	94.0	87.8	-0.3	87.4	3.0	6.0	-0.1		

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Correction of electrical response	Actual level	Tolerar	nce(dB)	Deviation *
Hz	dB	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	0.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	N/A	94.0	1.5	1.5	0.0
63.1	94.0	94.0	0.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	0.0	93.9	1.0	1.0	-0.1
251.2	94.0	94.0	0.0	93.9	1.0	1.0	-0.1
501.2	94.0	94.0	0.0	93.9	1.0	1.0	-0.1
1995.0	94.0	94.0	0.0	93.9	1.0	1.0	-0.1
3981.0	94.0	94.0	-0.1	93.9	1.0	1.0	0.0
7943.0	94.0	94.0	-0.3	93.6	1.5	3.0	-0.1
12590.0	94.0	94.0	-0.3	93.6	3.0	6.0	-0.1

^{*}Deviation = Actual level - (Expected level + Correction of electrical response)

The correction of electrical response is specified in the Table A.2 of technical documentation of BE 1853-11. The maximum expanded uncertainty of correction of electrical response is 0.3 dB.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

9	` • ·	,			
Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+		dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

9	(,			
Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the

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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type:

2250-L

Serial No.

2722310

Date 23-Sep-2020

Microphone Preamp type: type: 4950 ZC0032 Serial No. Serial No. 2698702 13318

Report: 20CA0922 01

10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities:

(Weighting L, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.4	2.0	0.4

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.4	2.0	0.4

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

(Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.9	0.5	-0.1

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burs	t indication	Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.1	2.0	-0.1

Repeated at 100 Hz

Ref. Level	Repeated bu	Repeated burst indication Tolerance De		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.2	1.0	-0.1

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			
msec	dB	dB	dB	+/- dB	dB	
1000	110.0	110.0	109.9	1.0	-0.1	60s integ.
10000	100.0	100.0	99.9	1.0	-0.1	6min. integ.

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Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type:

2250-L

Serial No. 2722310

Date 23-Sep-2020

Microphone Preamp

type: type: 4950 ZC0032 Serial No. Serial No. 2698702 13318

Report: 20CA0922 01

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	58.0	1.7	0.0

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	68.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
135.2	134.2	131.2	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leg.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time: Single burst duration: 10 sec 1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
142.2	141.2	101.2	101.2	2.2	0.0

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerar	nce (dB)	Deviation
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	77.9	1.0	1.0	0.0
8000	92.9	93.5	1.5	3.0	0.6

-----END-----

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Tel: (852) 2873 6860 Fax: (852) 2555 7533



CERTIFICATE OF CALIBRATION

Certificate No.:

20CA0214 01-01

Page

2

Item tested

Description: Manufacturer:

Sound Level Meter (Type 1) Nti

Microphone Nti Andio

Preamp Nti Andio

Type/Model No.:

XI2

MC230A

MA220

Serial/Equipment No.: Adaptors used:

A2A-15360-EO

A16673

8034

Item submitted by

Customer Name:

Lam Environmental Services Limited.

Address of Customer:

Request No .: Date of receipt:

14-Feb-2020

Date of test:

17-Feb-2020

Reference equipment used in the calibration

Description:

Multi function sound calibrator

Model:

Serial No.

Expiry Date:

Traceable to:

B&K 4226

2288444

23-Aug-2020

CIGISMEC

Signal generator

DS 360

33873

10-May-2020

CEPREI

Ambient conditions

Temperature:

21 ± 1 °C

Relative humidity: Air pressure:

55 ± 10 % 1000 ± 5 hPa

Test specifications

The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 1, and the lab calibration procedure SMTP004-CA-152.

2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.

The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference 3. between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Fend

Approved Signatory:

Date:

18-Feb-2020

Company Chop:

The results reported hat his certificate refer to the condition of the instrument on the date of calibration and Comments: carry no implication regarding the long-term stability of the instrument.

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Form No.CARP152-1/Issue 1/Rev.C/01/02/2007



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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

20CA0214 01-01

Page

2

2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertanity (dB)	Coverage Factor
Self-generated noise	Α	Pass	0.3	
9	С	Pass	0.8	2.1
	Lin	Pass	1.6	2.2
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	A	Pass	0.3	
	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2. Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

End

Date:

Fung Chi Yip 7-Feb-2020 Checked by:

Date:

Shek Kwong Tat 18-Feb-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007



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Test Data for Sound Level Meter

Page 1 of 6

Sound level meter type:

XL2

Serial No.

A2A-15360-EO Date

17-Feb-2020

Microphone

type:

MC230A

Serial No.

A16673

Report: 20CA0214 01-01

SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting 17.8 dB
Noise level in C weighting 18.0 dB
Noise level in Lin 23.3 dB

LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actua	ıl level	Tolerance	Devia	ation
Neierence/Expected rever	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
115.0	115.0	115.0	0.7	0.0	0.0
116.0	116.0	116.0	0.7	0.0	0.0
117.0	117.0	117.0	0.7	0.0	0.0
118.0	118.0	118.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
120.0	120.0	120.0	0.7	0.0	0.0
89.0	89.0	89.0	0.7	0.0	0.0
84.0	84.0	84.0	0.7	0.0	0.0
79.0	79.0	79.0	0.7	0.0	0.0
74.0	74.0	74.0	0.7	0.0	0.0
69.0	69.0	69.0	0.7	0.0	0.0
64.0	64.0	64.0	0.7	0.0	0.0
59.0	59.0	59.0	0.7	0.0	0.0
54.0	54.0	54.0	0.7	0.0	0.0
49.0	49.0	49.0	0.7	0.0	0.0
44.0	44.0	44.0	0.7	0.0	0.0
39.0	39.0	39.0	0.7	0.0	0.0
34.0	34.1	34.1	0.7	0.1	0.1
33.0	33.1	33.1	0.7	0.1	0.1



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Test Data for Sound Level Meter

Page 2 of 6

Sound level me		XL2		Serial No.	A2A-15360-EO	Date 17-Fe	b-2020
Microphone	type:	MC230A		Serial No.	A16673	Report: 20CAC	214 01-01
32.0		32.2	32.2	0.7	0.2	0.2	
31.0		31.2	31.2	0.7	0.2	0.2	
30.0		30.3	30.3	0.7	0.3	0.3	

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
40-140	94.0	94.0	0.7	0.0
20-120	94.0	94.0	0.7	0.0
0-100	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
40.140	52.0	52.5	0.7	0.5
40-140	138.0	138.0	0.7	0.0
20.420	30.0	30.3	0.7	0.3
20-120	118.0	118.0	0.7	0.0
0.100	30.0	30.0	0.7	0.0
0-100	98.0	98.0	0.7	0.0

FREQUENCY WEIGHTING TEST

The frequency response of the weighting netwoks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	54.4	1.5	1.5	-0.2
63.1	94.0	67.8	67.6	1.5	1.5	-0.2
125.9	94.0	77.9	77.8	1.0	1.0	-0.1
251.2	94.0	85.4	85.3	1.0	1.0	-0.1
501.2	94.0	90.8	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	95.1	1.0	1.0	-0.1
3981.0	94.0	95.0	94.9	1.0	1.0	-0.1
7943.0	94.0	92.9	92.9	1.5	3.0	0.0
12590.0	94.0	89.7	89.5	3.0	6.0	-0.2

Frequency weighting C:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	_	dB



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Test Data for Sound Level Meter

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Sound level me	ter type:	XL2	Serial No.	A2A	A-15360-EO	Date	17-Feb-2020
Microphone	type:	MC230A	Serial No.	A16	673		
						Report: 2	20CA0214 01-01
1000.0	94.0	94.0	94.0	0.0	0.0	0.0	
31.6	94.0	91.0	90.8	1.5	1.5	-0.2	
63.1	94.0	93.2	93.0	1.5	1.5	-0.2	
125.9	94.0	93.8	93.8	1.0	1.0	0.0	
251.2	94.0	94.0	93.9	1.0	1.0	-0.1	
501.2	94.0	94.0	94.0	1.0	1.0	0.0	
1995.0	94.0	93.8	93.8	1.0	1.0	0.0	
3981.0	94.0	93.2	93.2	1.0	1.0	0.0	
7943.0	94.0	91.0	91.0	1.5	3.0	0.0	
12590.0	94.0	87.8	87.6	3.0	6.0	-0.2	

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Actual level	Tolerar	nce(dB)	Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	93.8	1.5	1.5	-0.2
63.1	94.0	94.0	93.8	1.5	1.5	-0.2
125.9	94.0	94.0	93.9	1.0	1.0	-0.1
251.2	94.0	94.0	93.9	1.0	1.0	-0.1
501.2	94.0	94.0	93.9	1.0	1.0	-0.1
1995.0	94.0	94.0	93.9	1.0	1.0	-0.1
3981.0	94.0	94.0	94.0	1.0	1.0	0.0
7943.0	94.0	94.0	94.0	1.5	3.0	0.0
12590.0	94.0	94.0	94.0	3.0	6.0	0.0

Note: No corrections for the frequency response of the microphone, instrument case and windshield are made to the sound level meter.

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A. Maximum hold)

Whom the digital to continuous.	(vvoigine) i, maxim	14111 11014			
Ref. level	Expected level	Actual level	Tolera	nce(dB)	Deviation
dB	dB	dB	+	-	dB
116.0	111.9	112.0	1.0	1.0	0.1

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Test Data for Sound Level Meter

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Sound level meter type:

XL2

Serial No.

A2A-15360-EO Date

(Set to INIT)

17-Feb-2020

Microphone

type:

MC230A

Serial No.

A16673

Report: 20CA0214 01-01

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the 10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities: (Weighting Z, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.2	2.0	0.2

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.2	2.0	0.2

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency: 2000 Hz Amplitude:

Burst repetition frequency: Tone hurst signal

2 dB below the upper limit of the primary indicator range.

11 cycles of a sine wave of frequency 2000 Hz

Tone burst sig	ilai.	TI Cycles of a sille	wave of frequency z	000 112. (561	to livi)
	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time wighting	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	118.0	0.5	0.0

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency:

2000 Hz

Amplitude:

The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burs	Single burst indication		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.0	2.0	-0.2

Repeated at 100 Hz

Ref. Level	Repeated bu	Repeated burst indication		Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.1	1.0	-0.2

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst:

4000 Hz

Duration of tone burst:

1 ms

Repetition Time	Level of	Expected	Actual	Tolerance	Deviation	Remarks
	tone burst	Leq	Leq			

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Test Data for Sound Level Meter

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Sound level meter type:

XL2

Serial No. Serial No. A2A-15360-EO Date

17-Feb-2020

Microphone

type:

MC230A

A16673

Report: 20CA0214 01-01

msec	dB	dB	dB	+/- dB	dB	
1000	90.0	90.0	90.0	1.0	0.0	60s integ.
10000	80.0	80.0	79.9	1.0	-0.1	6min. integ.

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

The integrating sound level meter set to Leg:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	88.0	58.0	58.0	1.7	0.0

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	88.0	68.0	68.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency:

2000 Hz

Amplitude:

2 dB below the upper limit of the primary indicator range.

Burst repetition frequency:

40 Hz

Tone burst signal:

11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
121.1	120.1	117.1	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following: The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency:

4000 Hz

Integration time:

10 sec

Single burst duration:

1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
127.1	126.1	86.1	86.1	2.2	0.0

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerand	ce (dB)	Deviation
Hz	dB	Measured (dB)	+	-	dB

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SMECLab

Test Data for Sound Level Meter

Page 6 of 6

Sound level me	eter type:	XL2	Ser	ial No.	A2A	A-15360-EO	Date	17-Feb-2020
Microphone	type:	MC230A	Ser	ial No.	A16	6673	Report:	20CA0214 01-01
1000	94.0		94.0		0.0	0.0	0.0	
125	77.9		77.9		1.0	1.0	0.0	
8000	92.9		93.0		1.5	3.0	0.1	

-----END-----



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CERTIFICATE OF CALIBRATION

Certificate No.:

20CA1119 02-01

Page:

Item tested

Description:

Acoustical Calibrator (Class 1)

Manufacturer: Type/Model No.: Larson Davis CAL200

Serial/Equipment No.:

13437

Adaptors used:

Item submitted by

Curstomer:

Lam Environmental Services Limited.

Address of Customer:

Request No.:

Date of receipt:

19-Nov-2020

Date of test:

20-Nov-2020

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	11-May-2021	SCL
Preamplifier	B&K 2673	2743150	03-Jun-2021	CEPREI
Measuring amplifier	B&K 2610	2346941	03-Jun-2021	CEPREI
Signal generator	DS 360	33873	19-May-2021	CEPREI
Digital multi-meter	34401A	US36087050	19-May-2021	CEPREI
Audio analyzer	8903B	GB41300350	18-May-2021	CEPREI
Universal counter	53132A	MY40003662	18-May-2021	CEPREI

Ambient conditions

Temperature: Air pressure:

Relative humidity:

22 ± 1 °C 55 ± 10 % 1005 ± 5 hPa

Test specifications

- 1, The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- 2, The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

Test results

Details of the performed measurements are presented on page 2 of this certificate.

Approved Signatory:

Date: 21-Nov-2020

Company Chop:

Comments: The results reported in this certificate refer to the conditon of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

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Form No.CARP156-1/Issue 1/Rev.D/01/03/2007



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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

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Page:

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1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties

			(Output level in dB re 20 μPa	
Frequency Shown	Output Sound Pressure Level Setting	Measured Output Sound Pressure Level	Estimated Expanded Uncertainty	
Hz	dB	dB	dB	
1000	94.00	93.66	0.10	

2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz

STF = 0.013 dB

Estimated expanded uncertainty

0.005 dB

3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz

Actual Frequency = 1000.1 Hz

Estimated expanded uncertainty

0.1 Hz

Coverage factor k = 2.2

4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz

TND = 0.5%

Estimated expanded uncertainty

0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

End

Date:

Fung Chi Yip 20-Nov-2020 Checked by:

Date:

21-Nov-2020

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

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Form No.CARP156-2/Issue 1/Rev.C/01/05/2005