

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khuang Suan Luang, Khet Suan Luang,  
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ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
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#### รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Monthly)
Stack	Total Suspended Particulate	Console Control Unit	BKG_F50527	12 Jan 22	12 Jul 22	6
Stack	Total Suspended Particulate	Digital Balance	RMG_EN0003	31 Mar 21	31 Mar 22	12
Ambient	Total Suspended Particulate	High Volume	RMG_F50178			On site Calibration
Ambient	Total Suspended Particulate	High Volume	RMG_F50179			On site Calibration
Ambient	Total Suspended Particulate	High Volume	RMG_F50177			On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RMG_EN0001	6 May 21	6 May 22	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RMG_F50011	29 Jul 21	27 Jan 25	18
Workplace	Slice (Quartz)	Field Rotameter	BGS_F51010	4 Jun 22	4 Apr 22	3
Workplace	Slice (Quartz)	Field Rotameter	RMG_F50197	1 Apr 22	1 Jul 22	3
Noise	Leq 24 hrs	Sound Calibrator	RMG_F50076	10 Jan 22	10 Jan 23	12
Noise	Leq 24 hrs	Sound Level Meter	RMG_F50015	21 Apr 21	21 Apr 22	12
Noise	Leq 24 hrs	Sound Level Meter	RMG_F50016	28 Jun 21	28 Jun 22	12
Noise	Leq 24 hrs	Sound Level Meter	RMG_F50017	4 Oct 21	4 Oct 22	12
Noise	Leq 24 hrs	Sound Level Meter	RMG_F50018	4 Oct 21	4 Oct 22	12
Noise	Leq 8 hrs	Sound Calibrator	RMG_F50215	9 Aug 21	9 Aug 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50418	6 Aug 21	6 Aug 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50419	6 Aug 21	6 Aug 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50422	10 Jan 22	10 Jan 23	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50423	10 Jan 22	10 Jan 23	12
Noise	Leq 8 hrs	Sound Calibrator	RMG_F50215	9 Aug 21	9 Aug 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50303	2 Jun 21	2 Jun 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50304	2 Jun 21	2 Jun 22	12
Noise	Leq 8 hrs	Sound Calibrator	RMG_F50216	9 Aug 21	9 Aug 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50388	13 Sep 21	13 Sep 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50389	13 Sep 21	13 Sep 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50390	13 Sep 21	13 Sep 22	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50432	21 Jan 22	21 Jan 23	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50433	21 Jan 22	21 Jan 23	12
Noise	Leq 8 hrs	Sound Level Meter	RMG_F50434	21 Jan 22	21 Jan 23	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50228	9 Jul 21	9 Jul 22	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50231	13 Jul 21	13 Jul 22	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50232	13 Jul 21	13 Jul 22	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50236	3 Mar 21	3 Mar 22	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50336	16 Feb 22	16 Feb 23	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50337	16 Feb 22	16 Feb 23	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50338	16 Feb 22	16 Feb 23	12
Heat	Heat Stress	Heat Stress Monitor	RMG_F50339	24 Jan 22	24 Jan 23	12

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#### รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Monthly)
Rayong Lab	pH at 25 °C	pH meter	RMG_EN0185	17 Mar 22	17 Mar 23	12
Rayong Lab	Color (at Original pH)	Spectrophotometer	RMG_EN0637	1 Apr 21	1 Oct 22	18
Rayong Lab	Color (at pH 7.0)	Spectrophotometer	RMG_EN0637	1 Apr 21	1 Oct 22	18
Rayong Lab	BOD (5 days at 20°C)	DO meter with Sensor	RMG_EN0140	2 Feb 21	3 Aug 22	18
Rayong Lab	BOD (5 days at 20°C)	Incubator	RMG_EN0194	22 Apr 22	21 Oct 23	18
Rayong Lab	COO	Spectrophotometer	RMG_EN0037	1 Apr 21	1 Oct 22	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RMG_EN0002	25 Mar 22	25 Mar 23	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RMG_EN0016	5 May 21	5 Nov 22	18
Rayong Lab	Total Dissolved Solids (MTC)	Electronic Balance	RMG_EN0002	25 Mar 22	25 Mar 23	12
Rayong Lab	Total Dissolved Solids (MTC)	Hot Air Oven	RMG_EN0016	5 May 21	5 Nov 22	18
Rayong Lab	Oil & Grease	Electronic Balance	RMG_EN0002	25 Mar 22	25 Mar 23	12
Rayong Lab	Oil & Grease	Hot Air Oven	RMG_EN0016	5 May 21	5 Nov 22	18
Rayong Lab	Oil & Grease	Water Bath	RMG_EN0061	5 May 21	5 Nov 22	18

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#### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 12 Jan 22		Ambient Temperature (°C) : 26	
Calibration sheet No. : C-120112-BKG_FS0528		Relative Humidity (%) : 58.8	
Digital Temperature ID : BKK_FS0528		Reference Temperature ID : BKK_FS06000	
Conacle Serial No. : 1508053		Serial No. : 7688004	
Conacle Model : XC-572-V		Model : FLUKE 714	
		Next Calibrate : 13 Jan 22	

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	2	2	
	25	24	-1	
	50	51	1	
	100	103	3	
	150	151	1	
	200	202	2	
	250	251	1	
	300	301	1	
	500	503	3	
	1000	1001	1	
Probe	1200	1202	2	
	100	101	1	
	125	126	1	
	150	153	3	
Oven	100	101	1	
	125	126	1	
	150	151	1	
Filter	100	102	2	
	125	125	0	
Est	150	152	2	
	0	0	0	
Meter	10	10	0	
	20	20	0	
AUX	0	0	0	
	50	50	0	
	0	0	0	
	25	25	0	
	0	0	0	
	50	50	0	

Calibrated by

Saksit Phaisanphit

(Mr. Saksit Phaisanphit)  
Field Scientist (4)

Approved by

Michon Choonharat

(Mr. Michon Choonharat)  
Manager

Form EBT-008 (07/02)



#### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration Date	12 Jan 22	Barometric Pressure (mm Hg)	759
Next Cal Date	12 Jul 22	Relative Humidity (%)	62.0
		Temperature (°C)	29.0
<b>Console Control Meter Data</b>		<b>Reference Dry Gas Meter Data</b>	
Calibration No	C-120122-BKG_F50527	Serial No	1507305
Dry Gas Meter No	BKG_F50527	Model No	CGM 5A-25MM QG8
Serial No	1508053	Correction Factor (%)	1.0000
Model No	XC-572-V	Next Calibration Date	8 Apr 22

ΔP (mm Hg)	θ (mm Hg)	Reference Dry Gas Meter Calibration						Console Control Dry Gas Meter						Dry Gas Meter Correction Factor (%)	Drift Correction Factor (%)
		Flow (mL/min)	Time (s)	P (mm Hg)	Flow (mL/min)	Time (s)	P (mm Hg)	Flow (mL/min)	Time (s)	P (mm Hg)	Flow (mL/min)	Time (s)	P (mm Hg)		
15	11.87	150.00	0.00	150.00	34.0	181602.0	181650.0	148.00	34.0	34.0	34.0	1.0103	43.8742		
25	9.21	150.00	0.00	150.00	34.0	181654.0	181660.0	148.00	34.0	34.0	34.0	1.0103	43.8742		
50	6.45	150.00	0.00	150.00	34.0	182102.0	181954.0	148.00	34.0	34.0	34.0	1.0147	43.8477		
80	5.18	150.00	0.00	150.00	34.0	182350.0	182102.0	148.00	34.0	34.0	34.0	1.0118	43.8030		
125	4.23	150.00	0.00	150.00	34.0	182390.0	182251.0	148.00	34.0	34.0	34.0	1.0079	43.7688		
												Avg	1.0126	43.8418	

Y: Field of testing reference to dry gas meter. Tolerance for individual values ± 0.02 % from average.  
ΔT: Dry gas pressure differential that occurs from 25 °C and 760 mm of mercury. ± 0.02 % tolerance for individual values ± 0.02 % from average.  
Precision: 0.1 CFM @ 62.4 mm Hg, 15°C ± 0.1

Calibrated by  
Nattapong Jitjanang  
(Mr. Nattapong Jitjanang)  
Field Scientist (1)

Approved by  
Michon Choonharat  
(Mr. Michon Choonharat)  
Manager



### Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK\_FS0531 Calibration Date: 12 Jan 22  
Lab test duct Number: 258-1-13-01 Standard Pitot ID: BKK\_FS0441  
Calibration Sheet No.: C-120122-BKK\_FS0531 Cp Standard: 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$C_{P(S)} = C_P \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$[C_{P(A)} - C_{P(B)}]_{\text{must BE}} \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [C_P(s) - C_P(A \text{ or } B)]}{3} \text{ must BE} \leq 0.01$$

Calibrated by: Saksit Phaisanphisit Approved by: Wichan Choonharat  
(Mr.Saksit Phaisanphisit) (Mr.Wichan Choonharat)  
Field Scientist (4) Manager

Form 281-046 (04/05/00)



### Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK\_FS0532 Calibration Date: 12 Jan 22  
Lab test duct Number: 258-1-13-01 Standard Pitot ID: BKK\_FS0441  
Calibration Sheet No.: C-120122-BKK\_FS0532 Cp Standard: 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$C_{P(S)} = C_P \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$[C_{P(A)} - C_{P(B)}]_{\text{must BE}} \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [C_P(s) - C_P(A \text{ or } B)]}{3} \text{ must BE} \leq 0.01$$

Calibrated by: Saksit Phaisanphisit Approved by: Wichan Choonharat  
(Mr.Saksit Phaisanphisit) (Mr.Wichan Choonharat)  
Field Scientist (4) Manager

Form 281-046 (04/05/00)

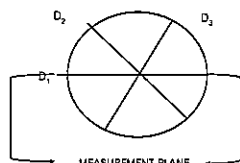
RYG\_EN0003



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date		12 Jan 22		Nozzle Set ID.:		BKK_F50533			
Calibration Sheet No.:				C-120122-BKK_F50533		Vernier Caliper ID.:		BKK_F50626	
Nozzle ID #	Nozzle Diameter (mm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$				
	$D_1$	$D_2$	$D_3$						
1	0.318	0.318	0.318	0.000	0.318				
2	0.475	0.475	0.475	0.000	0.475				
3	0.635	0.635	0.635	0.000	0.635				
4	0.792	0.792	0.792	0.000	0.792				
5	0.952	0.952	0.952	0.000	0.952				
6	1.110	1.110	1.110	0.000	1.110				
7	1.270	1.270	1.270	0.000	1.270				

Where:  
D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = Three different nozzle diameters at 60 degrees to each other, each measured to the nearest 0.025 mm.  
ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.  
D<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>)/3



Calibrated by: Saksit Phaisanphisit Approved by: Wichan Choonharat  
(Mr.Saksit Phaisanphisit) (Mr.Wichan Choonharat)  
Field Scientist (4) Manager

Form No. 04-281-009 (12/01/00)

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykong, Huaykong, Bangkok 10310  
Tel: +66 2642 6361-8, e-mail: service.thailand@sartorius.com



SARTORIUS

## Certificate of Calibration

Model Number: MSU224S-100-DU  
Description: Analytical Balance  
Serial Number: 31709552  
Manufacturer: Sartorius

Certificate No.: 21BC0111 rev1  
Issued Date: Monday, April 25, 2021  
Reference No.: 501627  
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.(Rayong Branch)  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated By: Mr.Chonchal Inthana

Calibration Date: Wednesday, March 31, 2021

Calibration Procedure No.: This calibration was conducted by Using In-house calibration procedure number (WH-001)  
Based on UKAS IAS 14

#### Metrological data:

Capacity: 220 g Readability: 0.0001 g

Temperature: 24.0 °C ± 5.0 °C

Humidity: 60.0 % RH ± 10.0 % RH

Pressure: ±

#### Reasons for calibration

☐ New Installation ☒ Service / Repair ☒ Recalibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ F/W

#### Measurement Method UKAS Publication Ref:Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

#### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-00	Sartorius weight set 1mg - 200g E2 YC5011-522-00	Sartorius	118934 D-R-19259-01-00	10-Sep-2021
M1B-38250	Humidity/Banometer/Comp Luton M1B-38250	SPC-RT	C1920076	1-Sep-2021

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

ISO/IEC 17025:2015 24/03/2020 R2

Mr.Chonchal Inthana(Technical Manager)

S  
T  
A  
M  
P



# Certificate of Calibration

Model Number: **MSU224S-100-DU** Certificate No.: **218C0111rev1**  
Description: **Analytical Balance** Issued Date: **Monday, April 26, 2021**  
Serial Number: **31709552** Reference No.: **501627**  
Manufacturer: **Sartorius** Page No.: **2 of 2**

## Calibration Results: Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same position. The standard deviation is used to express repeatability.			The off-center loading error is provided by the difference between the reading of the load, i.e. 1/3 or 2/3 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (each one defined according to OIML R113).		
Nominal Value: (Low Load)	20.0000	200.0001	Nominal value:	50	g
20 g	20.0000	200.0001	Tolerance	0.0004	g
Tolerance	0.0001	g			
Nominal Value: (High Load)	20.0001	200.0001			
200 g	20.0000	200.0002			
Tolerance	0.0001	g			
Standard Deviation	0.00004	0.00005			

Linearity				
The linearity also called accuracy error describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00012
0.1	0.1000	0.1000	0.0000	0.00012
0.5	0.5000	0.5000	0.0000	0.00012
1	1.0000	1.0000	0.0000	0.00012
5	5.0000	5.0001	0.0001	0.00013
10	10.0000	10.0000	0.0000	0.00013
20	20.0000	20.0000	0.0000	0.00013
50	50.0001	50.0001	0.0000	0.00014
100	100.0001	100.0000	-0.0001	0.00018
200	200.0001	200.0001	0.0000	0.00029

End of Report

ISO/IEC 17025, NF16 2603/2020 R2

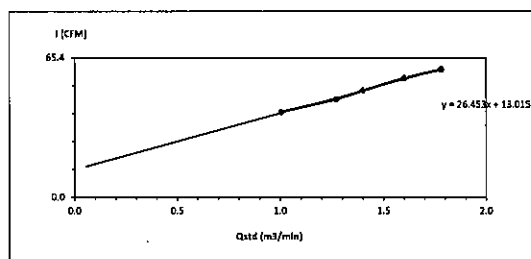
Note: This certificate is replacement with Certificate no.218C0111



## High Volume Air Sampler Calibration Worksheet

Project Site: **Kirru (Thailand) Co., Ltd.** Barometric Pressure (mm Hg): **756**  
Calibrate Location: **ท่าอากาศยานเชียงใหม่** Temperature (°C): **30**  
Calibrate Date: **14-Mar-22** High Volume ID: **RYG\_FS0178**  
Calibration Sheet No.: **C-140322-RYG\_FS0178** High Volume Model: **TE-S170D**  
Calibrator ID: **RYG\_FS0205** High Volume S/N: **4804**  
Calibrator Model: **TE-S028A** Calibrator Slope: **1.53016**  
Calibrator S/N: **1166** Calibrator Intercept: **-0.0468**

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	1.0056	40	Slope: 26.4531 Intercept: 13.0147 Correlation Coefficient: 0.9989
2	3.6	1.2733	46	
3	4.4	1.4027	50	
4	5.8	1.6035	56	
5	7.2	1.7813	60	



Calibrated by: **สุจินต์ น.** Approved by: **Mr. Noppong Juntarup**  
( Mr. Munin Pulsiri ) Enviro Field Coordinator Scientist (3)  
Field Scientist(1)

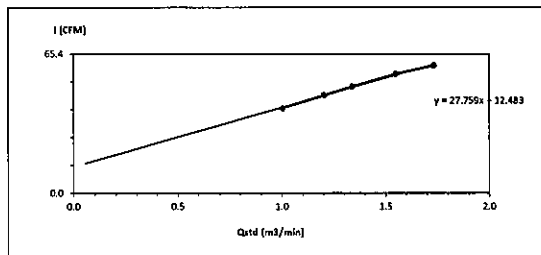
FORM NO: F 06-073 REVISION NO: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site: **Kirru (Thailand) Co., Ltd.** Barometric Pressure (mm Hg): **756**  
Calibrate Location: **ท่าอากาศยานเชียงใหม่** Temperature (°C): **30**  
Calibrate Date: **14-Mar-22** High Volume ID: **RYG\_FS0179**  
Calibration Sheet No.: **C-140322-RYG\_FS0179** High Volume Model: **TE-S170D**  
Calibrator ID: **RYG\_FS0205** High Volume S/N: **4805**  
Calibrator Model: **TE-S028A** Calibrator Slope: **1.53016**  
Calibrator S/N: **1166** Calibrator Intercept: **-0.0468**

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	1.0056	40	Slope: 27.7593 Intercept: 12.4831 Correlation Coefficient: 0.9982
2	3.2	1.2031	46	
3	4.8	1.3396	50	
4	5.4	1.5489	56	
5	6.8	1.7324	60	



Calibrated by: **สุจินต์ น.** Approved by: **Mr. Noppong Juntarup**  
( Mr. Munin Pulsiri ) Enviro Field Coordinator Scientist (3)  
Field Scientist(1)

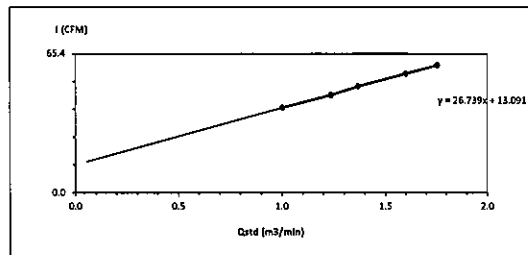
FORM NO: F 06-073 REVISION NO: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site: **Kirru (Thailand) Co., Ltd.** Barometric Pressure (mm Hg): **756**  
Calibrate Location: **ท่าอากาศยานเชียงใหม่** Temperature (°C): **30**  
Calibrate Date: **14-Mar-22** High Volume ID: **RYG\_FS0177**  
Calibration Sheet No.: **C-140322-RYG\_FS0177** High Volume Model: **TE-S170D**  
Calibrator ID: **RYG\_FS0205** High Volume S/N: **4803**  
Calibrator Model: **TE-S028A** Calibrator Slope: **1.53016**  
Calibrator S/N: **1166** Calibrator Intercept: **-0.0468**

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	1.0056	40	Slope: 26.7394 Intercept: 13.0913 Correlation Coefficient: 0.9998
2	3.4	1.2387	46	
3	4.2	1.3715	50	
4	5.8	1.6035	56	
5	7.0	1.7570	60	



Calibrated by: **สุจินต์ น.** Approved by: **Mr. Noppong Juntarup**  
( Mr. Munin Pulsiri ) Enviro Field Coordinator Scientist (3)  
Field Scientist(1)

FORM NO: F 06-073 REVISION NO: - ISSUE DATE: 14/03/16

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaywang, Bangkok 10310  
Tel: +66 2643 8261-4, e-mail: service.thailand@sartorius.com



SARTORIUS

# Certificate of Calibration

REVIEW BY: Dr. P. P.  
APPROVED BY: Dr. P. P.  
NEXT CAL. DATE: 11/12/21

Model Number: LA1305-F Certificate No.: 218C0102  
Description: Analytical Balance Issued Date: Monday, May 10, 2021  
Serial Number: 25409664 (RYG\_EN0001) Reference No.: 501644  
Manufacturer: Sartorius Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T.Mae Nam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)  
616/10 Moo 5 T.Mae Nam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated By: Mr. Chonchai Inthana Calibration Procedure No.: This calibration was conducted by  
Calibration Date: Thursday, May 06, 2021 Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14.

Metrological data:  
Capacity: 150 g Readability: 0.0001 g  
Ambient Conditions:  
Temperature: 21.9 °C ± 5.0 °C  
Humidity: 48.0 % RH ± 10.0 % RH  
Pressure: ±

Reasons for calibration  
☐ New Installation ☐ Service / Repair ☒ Recalibration / Maintenance  
Equipment Condition: ☒ Good Operation ☐ Fail

Measurement Method UKAS Publication Ref: Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realize the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 10g - 200g E2 YCS011-522-00	Sartorius	119934 D-K-19398-01-00	10-Sep-2021
MHB-3825D	Humidity/Balometer/Temp. Luton MHB-3825D	SPC-RT	C19203076	1-Sep-2021

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

ISO/IEC 17025:2005/2020 R2

Michonchai Inthana (Technical Manager)  
SARTORIUS (THAILAND) CO., LTD.  
129 Rama 9 Road, Huaywang, Bangkok 10310

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaywang, Bangkok 10310  
Tel: +66 2643 8261-4 Fax: +66 2643 8267, e-mail: service.thailand@sartorius.com

SARTORIUS

# Certificate of Calibration

Model Number: LA1305-F Certificate No.: 218C0102  
Description: Analytical Balance Issued Date: Monday, May 10, 2021  
Serial Number: 25409664 (RYG\_EN0001) Reference No.: 501644  
Manufacturer: Sartorius Page No.: 2 of 2

## Calibration Results: Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is provided by the difference between the reading of the load (e.g. 10 g or 100 g) of maximum capacity, placed at the center of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value: (Low Load)	10 g	100.0001	Nominal value:	50 g	
Tolerance	0.0001 g	0.0001 g	Tolerance	0.0004 g	
Nominal Value: (High Load)	100 g	100.0001	Difference		
Tolerance	0.0001 g	0.0001 g	1 0.0000		
Standard Deviation 0.00010 0.00010			2 -0.0001		
			3 -0.0001		
			4 0.0001		
			5 -0.0001		
			6 -		

## Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00024
0.05	0.0500	0.0500	0.0000	0.00024
0.1	0.1000	0.1000	0.0000	0.00024
0.5	0.5000	0.5000	0.0000	0.00024
1	1.0000	1.0000	0.0000	0.00024
2	2.0000	2.0000	0.0000	0.00024
5	5.0000	5.0000	0.0000	0.00024
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00024
100	100.0001	100.0003	0.0002	0.00026

End of Report

ISO/IEC 17025:2005/2020 R2

63/14-15,67/35-36, Sol Petchkasem 7,7/1, Petchkasem Rd,  
Walthapra, Bangkok, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jirantea.com

ISO/IEC 17025:2005/2020 R2

63/14-15,67/35-36, Sol Petchkasem 7,7/1, Petchkasem Rd,  
Walthapra, Bangkok, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jirantea.com

ISO/IEC 17025:2005/2020 R2

## CERTIFICATE OF CALIBRATION

Certificate No: WS-11072021  
Page 1 of 2 pages

Measurement Item	: Cup anemometer with data logger
Manufacturer	: Data logger: Novellus : Cup anemometer: Novellus
Model/Type	: Data logger: 200WS-20LB : Cup anemometer: WS 02P
Serial Number	: Data logger: A5009 : Cup anemometer: -
ID No	: Data logger: RYG-F80411 : Cup anemometer: -
Customer	: ALS Laboratory Group (Thailand) Co., Ltd. : 104 Phrasathan: 40, Phrasathan Rd, Khwaeng Buri Luang, Khet Buri Luang, Bangkok 10250 Thailand
Test Conditions	: Wind tunnel: cross test section area 900 cm <sup>2</sup> : Anemometer frontal area 100 cm <sup>2</sup> : Diameter of mounting plate 111 mm : Blockage ratio of test object 0.111 %
Test Conditions	: Air temperature 24.3 ± 0.8 °C : Air pressure 1009.3 ± 0.4 hPa : Relative air humidity 68.0 ± 3.6 %RH
Calibration Procedure	: Calibration was carried out on an : KC 61450-12 1000 Power Performance Measurements of Electricity Producing Wind Turbine. : MCA/NET Anemometer Calibration Procedure - Version 2: 2020
Traceability	: This calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of units (SI) through National Institute of Metrology (Thailand NIMT)
Measurement Date	: Jul 29, 2021
Issued Date	: Jul 29, 2021

Calibrated by:  
☒ Mr. Srujan Inthana  
☐ Miss Drisara Wathana



Approved Signature: Dr. P. P.  
Mr. Panyia Poonchardorn  
Technical Support  
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-11072021  
Page 2 of 2 pages

Result of calibration: ☒ Without adjustment ☐ With adjustment  
Calibration in the range of 1 - 10 m/s at a calibration interval of 1 m/s  
The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>ref</sub> Reading m/s	V <sub>act</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.084	1.9	-0.2	2.3
4.102	4.1	0.0	1.2
5.99	5.1	0.1	0.97
8.03	8.0	0.0	0.73
10.02	10.1	0.1	0.63
11.69	12.2	0.7	0.57
13.96	14.3	0.3	0.42
15.97	16.5	0.5	0.40
18.00	18.4	0.4	0.45
19.03	19.1	0.1	0.57
11.00	11.1	0.1	0.51
9.01	9.1	0.1	0.63
6.99	7.0	0.0	0.84
5.164	5.1	-0.1	1.1
3.001	3.0	0.0	1.9
1.022	0.8	-0.2	2.4

UNIT: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

## Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flow state	ICSI INC.	C032143	July 16, 2020	W2-003570	5 - 30 m/s
2	Precision Differential Pressure Meter	Zepan	D-PA2000	July 16, 2020	W2-003570	5 - 30 m/s
3	Air velocity sensor (hot wire)	TEC	8455 1P	July 16, 2020	W2-003570	0 - 5 m/s
4	Temperature	Zugali	DS18B1	March 30, 2021	SL-027404	-30 - 70 °C
5	Relative Humidity	Zugali	DS18B1	March 30, 2021	W2-003570	5 - 100 %RH
6	Atmospheric pressure	Zugali	DPS-10P	March 30, 2021	GP-0133221	900 - 1100 hPa
7	Wind tunnel	ES&S	MP3303	-	-	0 - 50 m/s

\*\*\*End of certificate of calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WD-11072021  
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novatek.  
Wind direction sensor: Novatek.

Model/Type : Data logger: Z00-WB-25LB.  
Wind direction sensor: WB-02P.

Serial Number : Data logger: AS30P.  
Wind direction sensor: .

ID No : Data logger: RYG\_FS0411.  
Wind direction sensor: .

Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanasarn 40, Phatthanasarn Road, Suang Luang, Nakhon Si Thammarat 90250  
Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (23±3)°C and relative humidity of (40±10)%.

Measurement Method:  
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and the laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:  
The measurement results are traceable to the international system of units (SI) through Certificate No: 06363-07-0045.  
Certificate No: KWS03/0044.

Measurement Date : Jul 20, 2021.  
Issued Date : Jul 20, 2021.

Performed by  
☒ Mr. Sorak Thechad  
☐ Miss Orathai Watanakajays



Approved Signatory:   
Mr. Pinyu Booncharoen  
Technical Support  
and Calibration Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL, UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED BY WRITING FROM THE LABORATORY.

Continuation of Certificate of Calibration Number

Certificate No: WD-11072021  
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.  
Calibration in the range of 0 - 360 ° at a calibration interval of 45°.  
The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	180	0	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	180	0	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

UUC\*: Until Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



## ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	05 Jan 22	Y = 0.9899x + 0.9112	0.9999
BKK_FS0579	05 Jan 22	Y = 1.007x - 0.0299	1.0000
BKK_FS0583	05 Jan 22	Y = 1.0513x + 1.859	0.9997
BKK_FS0584	05 Jan 22	Y = 1.0948x + 1.069	1.0000
BKK_FS0585	05 Jan 22	Y = 1.0076x - 1.1038	0.9999
BKK_FS0586	05 Jan 22	Y = 0.9933x + 3.2655	1.0000
BKK_FS0587	05 Jan 22	Y = 1.0401x + 17.457	0.9999
BKK_FS0588	05 Jan 22	Y = 1.0154x + 4.8357	0.9999
BKK_FS0589	05 Jan 22	Y = 0.9918x + 4.8069	0.9999
BKK_FS0590	05 Jan 22	Y = 0.9861x + 10.07	0.9995
BKK_FS0591	05 Jan 22	Y = 1.0117x - 92.415	0.9995
BKK_FS0592	05 Jan 22	Y = 1.0031x - 69.305	0.9998
BKK_FS0593	05 Jan 22	Y = 1.0131x + 98.198	0.9998
BKK_FS0594	05 Jan 22	Y = 1.0075x - 7.0829	0.9999
BKK_FS0595	05 Jan 22	Y = 1.0249x - 98.162	0.9999
BKK_FS0596	05 Jan 22	Y = 0.9843x - 28.806	0.9991
BKK_FS0597	05 Jan 22	Y = 1.0203x - 122.14	0.9999
BKK_FS1004	04 Jan 22	Y = 0.9851x + 19.648	0.9989
BKK_FS1005	04 Jan 22	Y = 1.0096x + 4.8843	0.9997
BKK_FS1006	04 Jan 22	Y = 1.2188x - 7.1214	0.9984
BKK_FS1007	05 Jan 22	Y = 1.0563x - 1.0912	1.0000
BKK_FS1008	05 Jan 22	Y = 0.9889x + 1.9081	1.0000
BKK_FS1009	05 Jan 22	Y = 1.0132x + 1.1633	0.9990
BKK_FS1010	05 Jan 22	Y = 1.0033x + 0.5758	0.9999
BKK_FS1014	05 Jan 22	Y = 1.0021x + 0.3148	0.9998
BKK_FS1015	05 Jan 22	Y = 0.9964x + 1.786	1.0000
BKK_FS1016	05 Jan 22	Y = 1.0105x - 80.256	0.9998
BKK_FS1017	05 Jan 22	Y = 0.9955x + 0.849	1.0000
BKK_FS1018	05 Jan 22	Y = 1.0011x + 1.1786	1.0000
BKK_FS1019	05 Jan 22	Y = 1.0023x - 68.424	0.9996
BKK_FS1020	05 Jan 22	Y = 0.9887x + 2.8844	0.9999
BKK_FS1021	05 Jan 22	Y = 0.9859x + 1.4905	0.9978
BKK_FS1022	05 Jan 22	Y = 1.022x - 17.957	0.9997
BKK_FS1023	05 Jan 22	Y = 1.0094x + 0.0717	0.9999
BKK_FS1024	05 Jan 22	Y = 1.0042x + 0.4086	0.9997
BKK_FS1025	05 Jan 22	Y = 1.0132x - 88.507	0.9990
BKK_FS1026	05 Jan 22	Y = 0.9902x + 0.9554	1.0000
BKK_FS1027	05 Jan 22	Y = 1.0086x - 2.276	1.0000
BKK_FS1028	05 Jan 22	Y = 1.0105x - 81.055	0.9997



## ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	05 Jan 22	Y = 0.9935x + 0.8234	1.0000
BKK_FS1030	05 Jan 22	Y = 1.0039x + 0.515	0.9999
BKK_FS1031	05 Jan 22	Y = 1.008x - 79.295	0.9998
BKK_FS1039	04 Jan 22	Y = 0.9916x + 6.1524	0.9988
BKK_FS1040	04 Jan 22	Y = 1.0133x - 10.177	0.9985
BKK_FS1041	04 Jan 22	Y = 1.0605x - 1.7381	0.9998
BKK_FS1042	04 Jan 22	Y = 1.0061x + 1.3405	0.9994
BKK_FS1043	04 Jan 22	Y = 1.0112x - 10.393	0.9999
BKK_FS1044	04 Jan 22	Y = 1.0495x - 1.0136	0.9996
BKK_FS1181	05 Jan 22	Y = 0.9812x + 15571	1.0000
BKK_FS1182	05 Jan 22	Y = 0.9932x + 5.0014	0.9997
BKK_FS1183	05 Jan 22	Y = 1.0082x - 82.062	0.9998
BKK_FS1184	05 Jan 22	Y = 0.9914x + 0.8427	0.9997
BKK_FS1185	05 Jan 22	Y = 0.9893x + 5.5919	0.9998
BKK_FS1186	05 Jan 22	Y = 1.0031x - 77.881	0.9996
RYG_FS0197	04 Jan 22	Y = 1.0068x + 1.7152	0.9998
RYG_FS0198	04 Jan 22	Y = 0.9988x + 18.196	0.9995
RYG_FS0199	04 Jan 22	Y = 1.1202x - 3.5782	0.9999

Review By:   
(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By:   
(Mr. Sarayuth Jitranont)  
Assistant General Manager



# ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	01 Apr 22	$Y = 1.0202x + 0.1078$	1.0000
BKK_FS0579	01 Apr 22	$Y = 1.0078x + 0.4789$	0.9998
BKK_FS0583	01 Apr 22	$Y = 1.018x + 0.3822$	1.0000
BKK_FS0584	01 Apr 22	$Y = 1.0038x + 2.2282$	0.9997
BKK_FS0585	01 Apr 22	$Y = 1.0189x - 5.6476$	0.9997
BKK_FS0586	01 Apr 22	$Y = 1.0095x - 1.1524$	0.9995
BKK_FS0587	01 Apr 22	$Y = 1.013x - 3.6619$	0.9998
BKK_FS0588	01 Apr 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Apr 22	$Y = 0.9918x + 4.8089$	0.9999
BKK_FS0590	01 Apr 22	$Y = 1.0038x - 0.4857$	0.9998
BKK_FS0591	01 Apr 22	$Y = 0.9705x - 52.174$	0.9988
BKK_FS0592	01 Apr 22	$Y = 0.9846x - 37.542$	0.9985
BKK_FS0593	01 Apr 22	$Y = 0.9787x - 55.445$	0.9988
BKK_FS0594	01 Apr 22	$Y = 0.9902x - 82.87$	0.9989
BKK_FS0595	01 Apr 22	$Y = 1.0248x - 98.192$	0.9989
BKK_FS0596	01 Apr 22	$Y = 0.9843x - 28.806$	0.9991
BKK_FS0597	01 Apr 22	$Y = 0.9802x - 61.653$	0.9978
BKK_FS1004	01 Apr 22	$Y = 0.9698x + 17.89$	0.9990
BKK_FS1005	01 Apr 22	$Y = 1.0085x + 5.6786$	0.9997
BKK_FS1006	01 Apr 22	$Y = 1.2142x - 7.1037$	0.9993
BKK_FS1007	01 Apr 22	$Y = 0.9917x + 1.8582$	1.0000
BKK_FS1008	01 Apr 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Apr 22	$Y = 1.0132x + 1.1633$	0.9980
BKK_FS1010	01 Apr 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Apr 22	$Y = 1.0234x + 0.1759$	0.9998
BKK_FS1012	01 Apr 22	$Y = 1.0108x - 2.0048$	0.9997
BKK_FS1013	01 Apr 22	$Y = 0.9877x - 35.851$	0.9997
BKK_FS1014	01 Apr 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	01 Apr 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	01 Apr 22	$Y = 1.0105x - 80.258$	0.9998
BKK_FS1017	01 Apr 22	$Y = 0.9965x + 0.849$	1.0000
BKK_FS1018	01 Apr 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Apr 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	01 Apr 22	$Y = 1.0547x - 0.866$	0.9998
BKK_FS1021	01 Apr 22	$Y = 1.018x - 3.3288$	0.9998
BKK_FS1022	01 Apr 22	$Y = 0.9932x - 57.035$	0.9998
BKK_FS1023	01 Apr 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	01 Apr 22	$Y = 1.0042x + 0.4086$	0.9997

Page 1 of 2

ALS Laboratory Group



# ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1025	01 Apr 22	$Y = 1.0132x - 88.507$	0.9998
BKK_FS1026	01 Apr 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Apr 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Apr 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Apr 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Apr 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Apr 22	$Y = 1.006x - 78.295$	0.9998
BKK_FS1039	01 Apr 22	$Y = 0.9888x + 7.8119$	0.9993
BKK_FS1040	01 Apr 22	$Y = 1.0096x - 7.2905$	0.9990
BKK_FS1041	01 Apr 22	$Y = 1.076x - 2.0503$	0.9999
BKK_FS1042	01 Apr 22	$Y = 1.0054x + 1.6095$	0.9985
BKK_FS1043	01 Apr 22	$Y = 1.0108x - 11.048$	0.9999
BKK_FS1044	01 Apr 22	$Y = 1.0488x - 0.9391$	0.9997
BKK_FS1101	01 Apr 22	$Y = 1.0128x + 0.7738$	0.9989
BKK_FS1102	01 Apr 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1163	01 Apr 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1164	01 Apr 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	01 Apr 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	01 Apr 22	$Y = 1.0031x - 77.881$	0.9998
RYG_FS0197	01 Apr 22	$Y = 1.0055x + 1.1914$	0.9998
RYG_FS0198	01 Apr 22	$Y = 0.988x + 23.788$	0.9998
RYG_FS0199	01 Apr 22	$Y = 1.1188x - 3.3542$	0.9998

Review By:

Wichan Choonharat  
(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jittrantorn)  
Assistant General Manager

Page 2 of 2

ALS Laboratory Group

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sitrithorn Rd.,Bangbunni, Bangplud Bangkok 10700 THAILAND.  
Telo-2435-8800 Fax-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC22001  
Pages : 1 of 3

### Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-75  
Serial No. : 35002736  
ID No. : RY62403

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 JANUARY 2022  
Calibration Date : 10 JANUARY 2022  
Date of Issue : 13 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchum  
( Thanakul Petchum )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-01-04-020664

## SITHIPORN, SITHIPORN ASSOCIATES CO.,LTD. associates CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No. : ACC22001  
Job No. : VC65AC0840  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

#### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP. 03/0264	08-Feb-22
Digital Multimeter	33461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAL	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained as :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACC2001  
Job No. : VC65AC040  
Pages : 3 of 3

Result of Calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.99	-0.01	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.28	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-01-020664



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT  
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,  
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280  
Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



Certificate No.: 0167SV21  
Operation No.: CP2021040003

Certificate of Calibration

Equipment: Sound Level Meter  
Manufacturer: RION  
Model/Type: NL-21 (Meter), UC-52 (Microphone), NH-21 (Preamplifier)  
Serial No.: 00509355 (Meter), 143845 (Microphone), 32731 (Preamplifier)  
ID No.: RYG\_F50015  
Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan  
Khet Suan Luang, Bangkok 10250 Thailand  
Received Date: 7 April 2021  
Calibrated Date: 21 - 27 April 2021  
Issued Date: 28 April 2021  
Calibrated by: Ms. Juntapom Kunhakom

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 21/4/22

Approved by: *[Signature]*  
(Mr. Sittichai Swaksuriyayong)  
Group Manager

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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F-CAL-004 Ed.0



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: 0167SV21

Calibration Report

Equipment: Sound Level Meter  
Manufacturer: RION  
Model/Type: NL-21 (Meter), UC-52 (Microphone), NH-21 (Preamplifier)  
Serial No.: 00509355 (Meter), 143845 (Microphone), 32731 (Preamplifier)  
ID No.: RYG\_F50015  
Ambient Temperature: (23 ± 2) °C  
Relative Humidity: (50 ± 15) %  
Pressure: (101.3 ± 1.5) kPa  
Method of Calibration :-  
IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1013-20	12 May 2021
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	C010063	0099RF20	17 June 2021
4) Programmable Attenuator	PAS	2755	EF-0034-20	10 November 2021
5) 6.5 Digit precision multimeter	8846A	9609027	0498EL20	10 August 2021
6) 6.5 Digit precision multimeter	8846A	9610014	0669EL20	27 October 2021
7) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P200051	31 May 2021
8) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P200052	1 June 2021
			0305TE20	28 June 2021
			0306TE20	28 June 2021

2. This result of calibration was found accurate as shown on date and place of calibration only.

3. This certification is traceable to the international system of unit maintained at :-

- Reference standards instrument for Acoustic function
- National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; ONSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.0

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: 0167SV21

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
16.4

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	12.6
C-weighting	17.6
Z-weighting	25.2

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve				Acceptance limits (dB)
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)		
125	0.6	0.6	0.6		±1.5
1000	-0.1	-0.1	0.0		±1.0
8000	-0.8	-0.8	-0.9		±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve				Acceptance limits (dB)
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)		
63	-0.1	0.0	-0.2		±2.0
125	0.0	-0.1	-0.1		±1.5
250	0.0	0.0	0.0		±1.5
500	0.0	-0.1	0.0		±1.5
1000	0.0	0.0	0.0		±1.0
2000	0.1	0.1	0.1		±2.0
4000	0.1	0.1	0.1		±3.0
8000	0.2	0.3	0.0		±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2





Certificate No.: 0167SV21

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LReq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1
122.0	122.0	0.0	±1.1
123.0	123.0	0.0	±1.1
124.0	124.0	0.0	±1.1
125.0	125.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1



Certificate No.: 0167SV21

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
33.0	32.9	-0.1	±1.1
32.0	31.8	-0.2	±1.1
31.0	30.9	-0.1	±1.1
30.0	29.6	-0.2	±1.1
29.0	28.6	-0.2	±1.1
28.0	27.7	-0.3	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.1	0.1	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.3	0.3	±1.1
20-90	25.0	25.3	0.3	±1.1
20-100	25.0	25.3	0.3	±1.1
20-110	25.0	25.2	0.2	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	99.0	0.0	+1.0; -2.5
	0.25	89.9	-0.1	+1.5; -5.0
Slow	200	109.6	0.0	±1.0
	2	90.0	0.0	+1.0; -5.0
	200	110.0	0.0	±1.0
LAE	2	90.0	0.0	+1.0; -2.5
	0.25	80.9	-0.1	+1.5; -5.0



Certificate No.: 0167SV21

Calibration Report

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	124.9	-0.5	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

Function : 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.4	139.3	-0.1	±1.5

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.

-- End of Report --

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sitrithorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No.: ACL21063  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01122567 / 143473 / 22605  
ID No.: RYQ\_FS0016

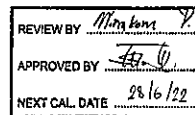
Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 22 JUNE 2021  
Calibration Date : 28-30 JUNE 2021  
Date of Issue : 05 JULY 2021

Calibrated by : Naibakorn Pisutpaisan

Approved by :   
( Thanakul Petchurai )



This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weightings with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petcha.

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petcha.

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.3
Flat	24.0

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.5	-0.9	± 5.0

QF-TS12-04-04-020664

T. Petcha.

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petcha.

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21063  
Job No. : VC64AC0048  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.4	89.5	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$   
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

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Cert. No. : ACL21118  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 01122578 / 143485 / 22620  
ID No. : RYO\_FS0017

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 21 SEPTEMBER 2021  
Calibration Date : 04-06 OCTOBER 2021  
Date of Issue : 11 OCTOBER 2021

Calibrated by : Nethakorn Pisutpoisan

Approved by : T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the International system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
17.9

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	15.5
C-weight	20.9
Flat	26.3

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.5	0.6	0.6	± 0.8

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.1	0.1	±1.1
30.0	30.2	0.2	±1.1
29.0	29.2	0.2	±1.1
28.0	28.2	0.2	±1.1
27.0	27.3	0.3	±1.1
26.0	26.4	0.4	±1.1
25.0	25.5	0.5	±1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
Job No. : VC64AC0070  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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## Continuation of Calibration Certificate

Cert. No. : ACL21118  
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## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sittithorn Rd, Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21118  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01122579 / 172172 / 74022  
ID No. : RYG\_FS0018

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 21 SEPTEMBER 2021  
Calibration Date : 04-06 OCTOBER 2021  
Date of Issue : 11 OCTOBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch.  
( Thanakul Petchurai )

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## Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anéchoic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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T. R. R. A.

## Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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T. R. R. A.

## Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	19.3
Flat	26.2

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.2	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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T. R. R. A.

Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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T. Retha

Continuation of Calibration Certificate

Cert. No. : ACL21119  
Job No. : VC64AC0070  
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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Retha

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC21009  
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178123  
ID No. : RYG\_FS0215

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 AUGUST 2021  
Calibration Date : 09 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

Calibrated by :

Nedakorn Pisutpaisan

Approved by :

T. Retha  
( Thanakul Peichurai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC21009  
Job No. : VC64AC0058  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.  
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY53202742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC21009  
Job No. : VC64AC0058  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.06	0.06	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.5	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.67	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Sindhorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21079  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00597168 / 180412 / 88182  
ID No. : RYQ\_FS0438

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 AUGUST 2021  
Calibration Date : 06-10 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchumai  
( Thanakul Petchumai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 3 of 8

## Summary of Measurement Result:

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-TS12-04-04-020664

P.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.2	-0.2	-0.1	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	-0.1	-0.1	-0.1	±1.5
500	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	±0.2
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	93.9	94.0	0.1	±0.3

QP-TS12-04-04-020664

P.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.8
Flat	23.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.6	0.7	0.7	±5.0

QP-TS12-04-04-020664

P.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

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P.A.

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QP-TS12-04-04-020664

451-451/1 Sitrithorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21080  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00597169 / 180411 / 88181  
ID No. : RYQ\_P50439

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 AUGUST 2021  
Calibration Date : 06-10 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchum*  
( Thanakul Petchum )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :  
3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 3 of 8

## Summary of Measurement Result.

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

S. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

S. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 4 of 8

## Result of calibration.

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.5
Flat	23.0

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	±1.5
1000	0.0	0.0	0.1	±1.0
8000	1.3	1.4	1.4	±5.0

QF-TS12-04-04-020664

S. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

S. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 7 of 8

8. Level Hierarchy including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighing	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.3	-1.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirthorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22026  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00900071 / 188464 / 01733  
ID No. : RYG\_FS0492

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 JANUARY 2022  
Calibration Date : 10-12 JANUARY 2022  
Date of Issue : 13 JANUARY 2022

Calibrated by : Nethakorn Pisutpeisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 8 of 8

11. Overload Indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.6	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-IP, 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-IP, 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

T. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.8
Flat	23.6

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.2	0.3	0.3	±5.0

QF-TS12-04-04-020664

T. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.8	-0.2	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 : -5.0
	2	8	117.0	117.0	0.0	1.0 : -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 : -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 : -5.0
SEL	2	8	108.0	108.0	0.0	1.0 : -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirthiporn Rd, Bangsumru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL22027  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00900072 / 188465 / 01734  
ID No. : RYG\_FS0493

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 JANUARY 2022  
Calibration Date : 10-12 JANUARY 2022  
Date of Issue : 13 JANUARY 2022

Calibrated by : Nathakorn Pisupaisan

Approved by : T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
associates CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments. For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EELBP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EELBP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Ratan

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

T. Ratan

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Ratan

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Ratan

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 : -5.0
	2	8	117.0	116.9	-0.1	1.0 : -2.5
	200	800	134.0	134.0	0.0	±7.0
Slow	2	8	108.0	108.0	0.0	1.5 : -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 : -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 : -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>Cpeak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability


Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %


End of Calibration Certificate

QF-TS12-04-04-020664

T. Rth



**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**  
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,  
Phraek Sa, Mueng Samut Prakan, Samut Prakan 10280  
Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



**NAC**  
NATIONAL CALIBRATION

---

Certificate No.: 02245V21  
Operation No.: CP2021050034

### Certificate of Calibration

**Equipment:** Sound Level Meter  
**Manufacturer:** RION  
**Model/Type:** NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)  
**Serial No.:** 00472130 (Meter), 157774 (Microphone), 72464 (Preampifier)  
**ID No.:** RYG\_F50303  
**Customer:** ALS Laboratory Group (Thailand) Co.,Ltd.  
**Address:** 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan Khet Suan Luang, Bangkok 10250 Thailand


**Received Date:** 28 May 2021  
**Calibrated Date:** 2 - 9 June 2021  
**Issued Date:** 11 June 2021  
**Calibrated by:** Ms. Juntapom Kunhakom

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 2/6/22


Approved by: *[Signature]*  
(Mr. Sittichai Suvachanachandana)  
Group Manager, Calibration Department

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**



**NAC**  
NATIONAL CALIBRATION

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Certificate No.: 02245V21

### Calibration Report

**Equipment:** Sound Level Meter  
**Manufacturer:** RION  
**Model/Type:** NL-42 (Meter), UC-52 (Microphone), NH-24 (Preampifier)  
**Serial No.:** 00472130 (Meter), 157774 (Microphone), 72464 (Preampifier)  
**ID No.:** RYG\_F50303  
**Ambient Temperature:** (23 ± 2) °C  
**Relative Humidity:** (50 ± 15) %  
**Pressure:** (101.3 ± 1.5) kPa  
**Method of Calibration:** IEC 61672-3:2013

**Condition of this result of calibration**  
1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1001-21	12 January 2022
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	C010063	0099RF20	17 June 2021
4) Programmable Attenuator	PAS	2913	EF-0017-21	1 April 2022
5) Programmable Attenuator	PAS	2755	EF-0034-20	10 November 2021
6) 6.5 Digit precision multimeter	8846A	9609027	0498EL20	10 August 2021
7) 6.5 Digit precision multimeter	8846A	9610014	0669EL20	27 October 2021
8) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P210020	22 March 2022
			0176TE21	1 April 2022

2. This result of calibration was found accurate as shown on date and place of calibration only.  
3. This certification is traceable to the international system of unit maintained at :-  
Reference standards instrument for Acoustic function  
- National Institute of Metrology (Thailand)  
Reference standards instrument for Electrical function  
- National Institute of Metrology (Thailand)  
- Electrical and Electronics Institute, ONSC Accredited Calibration No.0119

**Result of Calibration:**  
Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.0

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

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Certificate No.: 0224SV21

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
19.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	15.8
C-weighting	21.5
Z-weighting	27.7

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.7	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.9	-0.9	-1.0	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.1	0.0	±2.0
125	0.0	-0.2	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.1	0.1	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2



Certificate No.: 0224SV21

### Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.0	130.0	0.0	±1.1
131.0	131.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
137.0	137.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1



Certificate No.: 0224SV21

### Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
29.0	29.0	0.0	±1.1
24.0	24.1	0.1	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	126.0	0.0	±1.0
	2	108.9	-0.1	+1.0 ; -2.5
	0.25	99.9	-0.1	+1.5 ; -5.0
Slow	200	119.6	0.0	±1.0
	2	100.0	0.0	+1.0 ; -5.0
	200	120.0	0.0	±1.0
LAeq	2	100.0	0.0	+1.0 ; -2.5
	0.25	90.8	-0.2	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.2	-0.2	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.5	0.0	±1.5



Certificate No.: 0224SV21

### Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal 1 dB below upper boundary.


Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Uncertainty of measurement


Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings + Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.

-- End of Report --



**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**  
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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280  
Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



**DIN**  
ISO 15189:2013  
CALIBRATION 0119

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Certificate No.: 0225SV21  
Operation No.: CP2021050035


### Certificate of Calibration

Equipment:	Sound Level Meter
Manufacturer:	RION
Model/Type:	NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)
Serial No.:	00472132 (Meter), 169445 (Microphone), 72466 (Preamplifier)
ID No.:	RYG_FS0304
Customer:	ALS Laboratory Group (Thailand) Co.,Ltd.
Address:	104 Phatthanakan 40, Phatthanakan Rd., Kwaeng Phatthanakan Khet Suan Luang, Bangkok 10250 Thailand
Received Date:	28 May 2021
Calibrated Date:	2 - 9 June 2021
Issued Date:	11 June 2021
Calibrated by:	Ms. Juntaporn Kunhakom

REVIEW BY *Markam P.*

APPROVED BY *[Signature]*


NEXT CAL. DATE *2/6/22*



Approved by:  
(Mr. Sittichai Syamsakul) Group Manager

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

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Certificate No.: 0225SV21

### Calibration Report

Equipment:	Sound Level Meter
Manufacturer:	RION
Model/Type:	NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)
Serial No.:	00472132 (Meter), 169445 (Microphone), 72466 (Preamplifier)
ID No.:	RYG_FS0304
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %
Pressure:	(101.3 ± 1.5) kPa
Method of Calibration :-	IEC 61672-3:2013.
Condition of this result of calibration	

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1001-21	12 January 2022
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	C010063	0099RF20	17 June 2021
4) Programmable Attenuator	PA5	2913	EF-0017-21	1 April 2022
5) Programmable Attenuator	PA5	2755	EF-0034-20	10 November 2021
6) 6.5 Digit precision multimeter	8846A	9609027	0498EL20	10 August 2021
7) 6.5 Digit precision multimeter	8846A	9610014	0669EL20	27 October 2021
8) Pressure humidity and Temperature Transmitter	PTJ501	L3950484	CL1-P210020	22 March 2022
			0176TE21	1 April 2022


2. This result of calibration was found accurate as shown on date and place of calibration only.  
3. This certification is traceable to the international system of unit maintained at :-  
Reference standards instrument for Acoustic function  
- National Institute of Metrology (Thailand)  
Reference standards instrument for Electrical function  
- National Institute of Metrology (Thailand)  
- Electrical and Electronics Institute; ONSC Accredited Calibration No.0119

**Result of Calibration:**  
Function : 1. Indication at the calibration check frequency

Reference	Measured value	Deviation	Acceptance limits
Acoustic Signal (dB)	(dB)	(dB)	(dB)
94.0	94.0	0.0	±1.0

Note: Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

---

Certificate No.: 0225SV21

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value
(dB)
14.5

2.2 Microphone replaced by the electrical input signal device

Frequency	Measured value
Weighting	(dB)
A-weighting	10.4
C-weighting	17.5
Z-weighting	23.1

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)  
Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.6	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-0.9	-0.9	-1.0	±5.0

Function : 4. Electrical signal tests of frequency weightings  
Weighting network response with relative to 1 kHz.


Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	-0.1	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.1	0.1	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency	Measured value	Deviated value	Acceptance limits
Weighting	(dB)	(dB)	(dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

---

Certificate No.: 0225SV21

### Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
Lin	94.0	0.0	±0.1

Function : 6. Long-Term Stability  
Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.0	130.0	0.0	±1.1
131.0	131.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
137.0	137.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1

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Certificate No.: 0225SV21

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
29.0	28.8	-0.2	±1.1
24.0	23.9	-0.1	±1.1

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
Fast	200	126.0	0.0	±1.0
	2	109.0	0.0	+1.0 ; -2.5
	0.25	99.9	-0.1	+1.5 ; -5.0
Slow	200	119.6	0.0	±1.0
	2	100.0	0.0	+1.0 ; -5.0
	200	120.0	0.0	±1.0
LAE	2	100.0	0.0	+1.0 ; -2.5
	0.25	90.9	-0.1	+1.5 ; -5.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
Complete cycle	125.4	125.4	0.0	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.4	-0.1	±1.5

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sitrinhorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2431-1679 e-mail:center@sitihporm.com http://www.sitihporm.com



Cert. No. : ACC21010  
Pages : 1 of 3

### Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178124  
ID No. : RYG\_FS0216

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 05 AUGUST 2021  
Calibration Date : 09 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

Calibrated by :

Nabakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.



Certificate No.: 0225SV21

### Calibration Report

#### Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance Limits (dB)
5	129.0	129.0	0.0	±0.3

#### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.

-- End of Report --

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No. : ACC21010  
Job No. : VC64AC0058  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

#### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	35511B	MY53202742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACC21010  
Job No. : VC64AC0058  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.16	0.16	0.23	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.88	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sittithorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:2435-8800 Fax:2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21109  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NIF-24  
Serial No. : 01173609 / 172170 / 74021  
ID No. : RYQ\_FS0388

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 01 SEPTEMBER 2021  
Calibration Date : 13-15 SEPTEMBER 2021  
Date of Issue : 16 SEPTEMBER 2021

REVIEW BY : *[Signature]*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 15/9/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*[Signature]*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 05-0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06-0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-5003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21109  
Job No. : VC64AC0066  
Pages : 3 of 8

Summary of Measurement Result:

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.1
Flat	23.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

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7- Pth

## Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

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## Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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## Continuation of Calibration Certificate

Cert. No. : ACL21100  
Job No. : VC64AC0066  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

451-451/1 Sirinthorn Rd., Bangumru, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21101  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01173610 / 143485 / 22619  
ID No.: RYG\_FS0389

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 01 SEPTEMBER 2021  
Calibration Date : 13-15 SEPTEMBER 2021  
Date of Issue : 16 SEPTEMBER 2021

REVIEW BY	<i>Thanakul P.</i>
APPROVED BY	<i>Tha</i>
NEXT CAL. DATE	13/12/22

Calibrated by : Nathakorn Pisurpisan

Approved by :

*T. Petchum*  
( Thanakul Petchum )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 05/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz				
Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
18.5

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	13.1
C-weight	19.3
Flat	24.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	±1.5
1000	-0.2	-0.2	-0.1	±1.0
8000	-0.5	-0.4	-0.4	±5.0

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.1	0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.2	0.2	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

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P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.2	-0.1	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	0.0	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL21101  
Job No. : VC64AC0066  
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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

451-451/1 Sindhorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2433-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21102  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01173611 / 172173 / 74023  
ID No.: RYG\_FS0390

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 01 SEPTEMBER 2021  
Calibration Date : 13-15 SEPTEMBER 2021  
Date of Issue : 16 SEPTEMBER 2021

REVIEW BY : *Nathakorn Pisutpisan*  
APPROVED BY : *T. Petchurai*  
NEXT CAL. DATE : 13/01/22

Calibrated by : Nathakorn Pisutpisan

Approved by :

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 3 of 8

Summary of Measurement Result:

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.8
Flat	22.8

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.3	-0.2	-0.2	±5.0

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 8 of 8

11. Overload Indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighing	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthorn Rd., Bangumru, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23055  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamp NH-24  
Serial No. : 00296515 / 179119 / 87526  
ID No. : RYQ\_FS0432

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 JANUARY 2022  
Calibration Date : 21-24 JANUARY 2022  
Date of Issue : 25 JANUARY 2022

REVIEW BY : *Thakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 11/1/23

Calibrated by : Nathakorn Pisurpaian

Approved by : *T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-J008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC65AC0043  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22055  
Job No. : VC65AC0043  
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.7
Flat	23.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.2	-0.2	±5.0

QF-TS12-04-04-020664

~ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22055  
Job No. : VC65AC0043  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

~ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22055  
Job No. : VC65AC0043  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

~ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22055  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	124.0	124.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

~ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22055  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload Indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664



451-451/1 Srinthorn Rd, Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL221056  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00296516 / 180412 / 88182  
ID No. : RYG\_FS0433

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 14 JANUARY 2022  
Calibration Date : 21-24 JANUARY 2022  
Date of Issue : 25 JANUARY 2022

REVIEW BY : *Nathakorn P.*  
APPROVED BY : *T. Petchurai*  
NEXT CAL. DATE : 21/1/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 03/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.7
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.7	0.7	0.7	±5.0

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

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P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL22056  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22057  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00296517 / 179120 / 87527  
ID No. : RYQ\_FS0434

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 14 JANUARY 2022  
Calibration Date : 21-24 JANUARY 2022  
Date of Issue : 25 JANUARY 2022

REVIEW BY : *Thantorn P.*  
APPROVED BY : *Thantorn P.*  
NEXT CAL. DATE : 21/1/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device,

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.7
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

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T. R. R.

## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.1	0.1	± 0.3

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## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	± 1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Walthapa, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jranatee.com



CERTIFICATE OF CALIBRATION

Certificate No. : CL-045-84  
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor  
Manufacturer : DeltaOHM  
Model: HD32.2  
Serial No: 15020734  
ID No: RRG\_FS0228

Customer  
Name : ALS laboratory group (thailand) Co.,Ltd.  
Address : 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date : 05 JUL 2021  
Calibration date : 09 JUL 2021  
Issue date : 13 JUL 2021

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No. : 687682-09, Due date : 25 Mar 2022  
2. Digital Temperature Indicator Model : DTI-1000-A MK II, Serial No: 671407-00591 Due date : 04 June 2022

Calibration Condition  
Temperature : (23±3)°C  
Relative Humidity : (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number : TT-0038-21, Certificate number : ER-0032-21

Calibrated by  
☐ Mr. Sorawit Thechalad  
☒ Miss Orathai Wivattawitaya



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
And Calibration Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

QT-TS12-04-04-020664

T. R. R.



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Walthapa, Bangkok 10600 Thailand.  
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Certificate No. : CL-045-84  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20°C - 40°C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3207.2 S/N: 15031956.  
Dimension : Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.055	20.4	0.3	0.16
30	25.046	25.3	0.3	0.099
30	30.040	30.4	0.3	0.16
30	35.036	35.3	0.2	0.14
30	40.029	40.3	0.3	0.30

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15031951.  
Dimension : Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.054	20.3	0.2	0.099
70	24.878	25.0	0.1	0.099
70	29.825	29.9	0.1	0.099
70	34.778	34.8	0.0	0.099
70	39.731	39.7	0.0	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15028490.  
Dimension : Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.055	20.1	0.0	0.099
110	25.046	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.035	35.1	0.1	0.099
110	40.029	40.1	0.1	0.099

UUC\* : Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.

\* End of Certificate \*



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Walthapa, Bangkok 10600 Thailand.  
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CERTIFICATE OF CALIBRATION

Certificate No. : CL-048-84  
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor  
Manufacturer : DeltaOHM  
Model: HD32.2  
Serial No: 15020735  
ID No: RRG\_FS0231

Customer  
Name : ALS laboratory group (thailand) Co.,Ltd.  
Address : 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date : 05 JUL 2021  
Calibration date : 13 JUL 2021  
Issue date : 13 JUL 2021

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No. : 687682-09, Due date : 25 Mar 2022  
2. Digital Temperature Indicator Model : DTI-1000-A MK II, Serial No: 671407-00591 Due date : 04 June 2022

Calibration Condition  
Temperature : (23±3)°C  
Relative Humidity : (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number : TT-0038-21, Certificate number : ER-0032-21

Calibrated by  
☐ Mr. Sorawit Thechalad  
☒ Miss Orathai Wivattawitaya



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
And Calibration Manager

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Certificate No.: CL-048-64  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15035050.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.042	20.1	0.1	0.099
30	25.043	25.1	0.1	0.099
30	30.032	30.0	0.0	0.14
30	35.027	35.0	0.0	0.099
30	40.031	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15033221.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.036	20.1	0.1	0.099
70	24.657	24.6	-0.1	0.099
70	29.804	29.7	-0.1	0.099
70	34.755	34.6	-0.2	0.099
70	39.709	39.4	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 17023215.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.042	20.1	0.1	0.099
110	25.043	25.1	0.1	0.099
110	30.032	30.1	0.1	0.099
110	35.027	35.1	0.1	0.099
110	40.031	40.1	0.1	0.099

UUC: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



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Certificate No.: CL-049-64  
Page 1 of 2

## CERTIFICATE OF CALIBRATION

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 15020738  
ID No: RYO\_FS0232

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 05 JUL 2021  
Calibration date: 13 JUL 2021  
Issue date: 13 JUL 2021

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 697882-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as W-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

REVIEW BY	<i>Nasir P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL DATE	13/1/22

Calibrated by  
☐ Mr. Soravit Thachalad  
☒ Miss Orathai Winitwitaya



Approved Signatory:  
Mr. Parinya Booncharoen  
Technical Support  
And Calibration Manager

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Certificate No.: CL-049-64  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15027737.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.045	20.1	0.1	0.099
30	25.042	25.1	0.1	0.099
30	30.034	30.1	0.0	0.10
30	35.029	35.1	0.1	0.099
30	40.031	40.1	0.0	0.30

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015503.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.036	20.1	0.1	0.099
70	24.669	24.9	0.0	0.099
70	29.810	29.8	0.0	0.099
70	34.759	34.6	-0.2	0.099
70	39.700	39.5	-0.2	0.30

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15031184.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.045	20.1	0.1	0.099
110	25.042	25.1	0.1	0.099
110	30.034	30.1	0.0	0.16
110	35.029	35.1	0.1	0.099
110	40.031	40.1	0.0	0.30

UUC: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2717-3000-24 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 21H497  
Page: 1 of 2

Equipment: Heat Stress Monitor  
Manufacturer: Deltaohm  
Model: HD 32.2  
Serial No: 15006728  
ID No: RYO\_FS0228

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Condition As-Received: Used Item  
Received Date: 02 March 2021  
Calibration Date: 05 March 2021  
Reference: 2103-0118WSC  
Ambient Temperature: ( 29 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using In-house calibration procedure CP-H03 according to comparison with standard temperature probe for temperature measurement function Into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Humidity/Temperature Meter	400	10240757	TH-0076-20	07 Dec 2021
2) The certificate is valid only to the item calibrated on date and place of calibration.				
3) This Calibration is traceable to the International System of Unit maintained at:-				
-National Institute of Metrology Thailand (NIMT)				

REVIEW BY	<i>N. P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL DATE	9/3/22

Calibrated by: Somchai Dumvor  
Issue Date: 12 March 2021

Approved Signatory:

☒ Chakrit Wawanyakul  
☐ Pombtipa Tameyaskul  
☐ Pitak Srirongkol

B 0255827



Cert. No: 21H497  
Page: 2 of 2

**Result of Calibration:** Without Adjustment  
Function: Temperature measurement.  
This instrument was connected with temperature probe.

Measurement Function	Model of Sensor	Serial of Sensor	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
Tn	HP3201.2	15015841	25.01	25.0	-0.01	0.42
			35.00	34.9	-0.10	0.42
			45.02	45.0	-0.02	0.42
Tp	TP 3276.2	15009817	25.01	25.0	-0.01	0.42
			35.00	34.9	-0.10	0.42
			45.02	45.0	-0.02	0.42
T	TP 3207.2	15015494	25.01	25.1	0.09	0.42
			35.00	34.8	-0.10	0.42
			45.02	44.8	-0.12	0.42

\* Not NSO-ONSC Accredited

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-019-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018311  
ID No: RYG\_F50356

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan  
Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 10 JAN 2022  
Calibration date: 16 FEB 2022  
Issue date: 17 FEB 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 667582-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the  
International system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0038-21, Certificate number: ER-0032-  
21

REVIEW BY	<i>Manon P.</i>
APPROVED BY	<i>44-10</i>
NEXT CAL. DATE	16/02/23

Calibrated by  
☒ Mr. Sorawit Thachalea  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CL-019-65  
Page 2 of 2

**Result of Calibration:** ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021466.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.054	20.0	-0.1	0.099
30	25.043	25.0	0.0	0.099
30	30.036	30.0	0.0	0.099
30	35.026	35.0	0.0	0.099
30	40.027	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021258.  
Dimension: Diameter 14 mm. Length 150 mm.

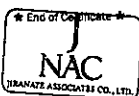
Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.051	20.1	0.0	0.099
70	24.990	25.1	0.1	0.099
70	29.917	29.9	0.0	0.099
70	34.873	34.7	-0.2	0.099
70	39.884	39.6	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020493.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.044	25.1	0.1	0.099
110	30.036	30.1	0.1	0.099
110	35.029	35.1	0.1	0.099
110	40.029	40.1	0.1	0.099

UUC\* : Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-020-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018312  
ID No: RYG\_F50357

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan  
Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 10 JAN 2022  
Calibration date: 15 FEB 2022  
Issue date: 17 FEB 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 667582-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the  
International system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
21

REVIEW BY	<i>Manon P.</i>
APPROVED BY	<i>44-10</i>
NEXT CAL. DATE	16/02/23

Calibrated by  
☒ Mr. Sorawit Thachalea  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021464.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.049	20.0	0.0	0.099
30	25.048	25.0	0.0	0.099
30	30.037	30.0	0.0	0.099
30	35.029	35.0	0.0	0.099
30	40.018	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021263.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.1	0.1	0.099
70	24.994	25.0	0.0	0.099
70	29.940	29.8	-0.1	0.099
70	34.905	34.7	-0.2	0.099
70	39.860	39.6	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020495.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.046	20.0	0.0	0.099
110	25.048	25.0	0.0	0.099
110	30.036	30.0	0.0	0.099
110	35.029	35.0	0.0	0.099
110	40.016	40.0	0.0	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-02105  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018313  
ID No: RYG\_F50359

Customer  
Name: ALS laboratory group (thailand) Co.,Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan  
Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 10 JAN 2022  
Calibration date: 16 FEB 2022  
Issue date: 17 FEB 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the  
International system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
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REVIEW BY	<i>Parinya Booncharoen</i>
APPROVED BY	<i>Mr. Parinya Booncharoen</i>
NEXT CAL DATE	16/1/23

Calibrated by  
☒ Mr. Sorawit Thechadad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: *Mr. Parinya Booncharoen*  
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021467.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.046	20.1	0.1	0.099
30	25.050	25.1	0.1	0.099
30	30.036	30.1	0.1	0.099
30	35.027	35.1	0.1	0.099
30	40.024	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021270.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.0	0.0	0.099
70	24.993	25.1	0.1	0.099
70	29.932	29.9	0.0	0.099
70	34.848	34.4	-0.1	0.099
70	39.819	39.6	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020497.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.045	20.1	0.1	0.099
110	25.050	25.1	0.1	0.099
110	30.037	30.1	0.1	0.099
110	35.026	35.1	0.1	0.099
110	40.023	40.1	0.1	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-005-85  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018314  
ID No: RYG\_F50359

Customer  
Name: ALS laboratory group (thailand) Co.,Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan  
Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 12 JAN 2022  
Calibration date: 24 JAN 2022  
Issue date: 25 JAN 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the  
International system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
21

REVIEW BY	<i>Parinya Booncharoen</i>
APPROVED BY	<i>Mr. Parinya Booncharoen</i>
NEXT CAL DATE	24/1/23

Calibrated by  
☒ Mr. Sorawit Thechadad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: *Mr. Parinya Booncharoen*  
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021465.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.050	20.0	0.0	0.099
30	25.039	25.0	0.0	0.099
30	30.030	30.0	0.0	0.099
30	35.025	34.9	-0.1	0.099
30	40.019	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021282.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.1	0.1	0.099
70	24.965	24.8	-0.2	0.099
70	29.925	29.7	-0.2	0.099
70	34.869	34.5	-0.4	0.099
70	39.850	39.4	-0.5	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008280.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.0	0.0	0.099
110	25.039	25.0	0.0	0.099
110	30.030	30.0	0.0	0.099
110	35.025	35.1	0.1	0.099
110	40.019	40.1	0.1	0.099

UUC: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



## Certificate of Calibration

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: Seven Compact S220  
Serial No.: C104059460  
ID No.: RYG\_EN0183  
Condition As-Received: Used Item  
Received Date: 16 March 2022  
Calibration Date: 17 March 2022  
Reference: 2203-0611DSC-4  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5 T.Mae Nam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand

REVIEW BY: N. Banthit  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 17/12/23

Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 15) %  
Calibration Procedure:  
In-house method:  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH6 by comparison with standard thermometer

Calibrated by: Warakorn Lemgagrakul

Approved by: [Signature]  
Approved Signatory

( ) Malee Butkrua  
( ) Saithip Meangmal  
( ) Warakorn Lemgagrakul

Issue Date: 22 March 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior notice  
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0037307



### Condition of this calibration result

#### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC110	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21H1201	25 Oct 2022

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :- The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	788995	01 Jan 2024
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration Results

Function: mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter SN: C104059460	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



### Calibration Results

Function: pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode SN: 1453404	4.008	4.010	177.7	0.0048	2.00
	6.982	6.988	3.6	0.0084	2.00
	10.015	10.010	-172.9	0.0073	2.05

Function: Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model: InLab Expert Pro-ISM

- Serial No.: 1453404

Dimension of probe;

- Length: 120 mm.

- Diameter: 12 mm.

- Immersion Depth: 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC Reading (°C)	Error (°C)	Uncertainty of measurement (±°C)	Coverage factor k
25.0	25.002	24.9	-0.102	0.13	2.00

Remark: - UUC = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-00-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2713-3000-24 FAX: 0-2713-9184



## Certificate of Calibration

Certificate No.: 22E956  
Page: 1 of 2

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenCompact S220  
Serial No.: C104059450  
ID No.: RYG\_END153  
Condition As-Received: Used Item  
Received Date: 16 March 2022  
Calibration Date: 21 March 2022  
Reference: 2203-0611DSC  
Ambient Temperature: ( 25 ± 2 ) °C  
Relative Humidity: ( 50 ± 10 ) %

This certificate may not be reproduced other than in full,  
except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
615/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong  
21140, Thailand

Procedure used: Calibration were conducted using In-house calibration Procedure CP-E17 According to direct measurement  
method with Multi-Product Calibrator.

### Condition of this result of calibration

#### 1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	8440007	21E1444	07 May 2022

2. This result of calibration was made on requested at the point specified by customer.  
3. The certificate is valid only to the item calibrated on date and place of calibration.  
4. This Calibration is traceable to the International System of Unit maintained at:-  
National Institute of Metrology Thailand (NIMT)

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 21/3/23

Calibrated by: Pongsagorn Boonyaporn  
Issue Date: 22 March 2022

Approved Signatory:

( ) Phatinee Prabselai  
( ) Nuntawee Khanchai  
( ) Ponthippa Taneyakul

B 0284414



Cert. No.: 22E988  
Page: 2 of 2

### Result of calibration: ( ) Without adjustment ( ) After adjustment

Function:	DC voltage measurement	Range:	2000	mV
Standard Value	UUC* Reading	Error	Uncertainty	
( mV )	( mV )	( mV )	( ± μV )	
-200.0000	-200.0	0.0	72	
-150.0000	-150.0	0.0	69	
-100.0000	-100.0	0.0	65	
-50.0000	-50.0	0.0	62	
0.0000	0.0	0.0	58	
50.0000	50.0	0.0	62	
100.0000	100.0	0.0	65	
150.0000	150.0	0.0	69	
200.0000	200.0	0.0	72	

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %

\*UUC= Unit Under Calibration.

-000-

a 1101070

SPC Calibration Center



SPC Calibration Center



## Certificate of Calibration

Certificate No.: C06210159  
Page 2 of 3

Equipment: SPECTROPHOTOMETER  
Model: DR6000  
Serial No. (or ID.): 1627845 (RYG\_END0037)  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06210159  
Issued Date: 01 April 2021  
Job No.: KSPR2104738  
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
615/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 01/10/22

Environment Condition: Temperature 25.1 °C ± 0.4 °C  
Humidity 48.8 %RH ± 3.7 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) ( Wet Chemistry Lab )  
615/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Chattuphon Fothong

Calibration Date: 01 April 2021

The Method used: In house method, SPCC-Wi-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sigma Scientific Limited.

The standard for Wavelength Certificate No. 87146 and 87152  
The standard for Photometric Certificate No. 87220 and 87139  
The standard for Stray light Certificate No. 87163 and 87161  
The standard for Spectral resolution Certificate No. 87173

(Mr. Chattuphon Fothong)  
Person in charge

SERT  
SPP RT Co., Ltd.

(Mr. Dumrong Boonsopon)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ( $k=2$ ) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPP RT Co., Ltd.

### Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.81	418.4	0.21	0.13	
538.66	536.7	-0.04	0.13	
637.96	638.3	-0.32	0.14	
748.48	748.7	-0.22	0.14	
807.03	807.4	-0.37	0.14	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5880	0.590	-0.0010	0.0045
	0.7616	0.762	-0.0004	0.0045
	1.0263	1.027	-0.0007	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5787	0.579	-0.0003	0.0045
	0.7442	0.744	0.0002	0.0045
	1.0039	1.004	-0.0001	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5282	0.530	-0.0008	0.0045
	0.8665	0.867	-0.0005	0.0045
	0.9534	0.954	-0.0006	0.0045
545.1 nm	0.0000	0.000	0.0000	0.0045
	0.5468	0.546	0.0008	0.0045
	0.8957	0.895	0.0007	0.0045
	0.9991	0.998	0.0011	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5851	0.584	0.0011	0.0045
	0.7238	0.723	0.0008	0.0045
	1.0857	1.094	0.0017	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5692	0.568	0.0012	0.0045
	0.8914	0.891	0.0004	0.0045
	1.0881	1.087	0.0011	0.0045

**Calibration Results:**  
**Without Adjustment**

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0000
	0.7307	0.730	0.0007	0.0000
257 nm	0.0000	0.000	0.0000	0.0000
	0.6516	0.650	0.0016	0.0000
313 nm	0.0000	0.000	0.0000	0.0000
	0.2836	0.285	-0.0014	0.0000
350 nm	0.0000	0.000	0.0000	0.0000
	0.6319	0.629	0.0029	0.0000

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.57 +/- 0.11 nm	260.6	1.5	1.824
392.03 +/- 0.11 nm	392.0	1.5	1.824

The stray light transmission reference is less than 1.0 T(%) and absorbance is greater than 2.0 (A)

Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	268.72	266.76	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance ( A )	0.4516	0.2797		
Absorbance ( A )	0.415	0.300		

\* Calibration Marked \* Not TISI Accredited \* In this Certificate have been included for completeness.

### The End of Certificate

**ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม**

เลขที่ใบงาน: KSPR2104738

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขหนังสือ: 1627845

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
01 Apr 2021		ระบบการตรวจเชื้อ	01 Apr 2021		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		<i>General</i>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<i>Spectrophotometer</i>			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	656.1±656.1 nm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ขั้ววัดหลายตัวอ่าน (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<i>pH Meter and Conductivity Meter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	12. ขั้วไฟฟ้า ( Electrode and Connection Cable )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันละออง Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับขั้วไฟฟ้า (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Turbidimeter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความรบกวนที่สุ่ม (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการกรองแสงของแสง (>= 2.5 ไมครอน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Automatic titrator</i>			
<input type="checkbox"/>	<input type="checkbox"/>	18. สลัก Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติมข้อมูล :

Mr. Chattaphon Folthong  
Service Engineer



**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
**CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES**  
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL. 0-2711-3000 FAX. 0-2719-9484

CertNo.: 21TW20  
Page.: 1 of 2

## Certificate of Testing

Equipment :	DO Meter	REVIEW BY <u>N. Bantit</u> APPROVED BY <u>D. [Signature]</u> NEXT CAL. DATE <u>3/8/22</u>
Manufacturer :	YSI	
Model :	5100	
Serial No. :	15L102139	
ID No. :	RYG_EN0140	
Received Date :	29 January 2021	
Test Date :	02 February 2021	
Reference :	2101-0817DSC-1	
Submitted by :	ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch Eastern Seaboard Industrial Estate (Rayong) 64/77 Moo 4, Building No.B1, Highway 331, Km91.5, T.Pluakdaeng, A.Pluakdaeng, Rayong 21140 Thailand	
Laboratory Condition :	Temperature ( $25 \pm 5$ ) °C Humidity ( $50 \pm 20$ ) %	
Test Procedure :	In - house method : CP-C99 by Comparison Technique with Azide Modification Method	

**Calibrated by :** Walalak Srithean

Approved by : \_\_\_\_\_  
Approved Signature

(✓) Malee Bulkruea  
( ) Saithip Meangmai  
( ) Warakorn Lemgatrakul

Issue Date : 3 February 2021



**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 16C100647

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.02	8.02	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

-oDp-

Cert.No.: 21TW20  
 Page.: 2 of 2



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM271  
Page: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L102139  
ID No. : RYG\_EN0140  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
Eastern Seaboard Industrial Estate (Rayong)  
64/77 Moo 4 Building No.81, Highway 331 km. 81.5,  
T. Pluakdaeng, A. Pluakdaeng, Rayong 21140 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 29 January 2021  
Calibrated Date : 3 February 2021  
Ambient Temperature : ( 25 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Maloo Burkua

Approved by :   
Approved Signatory

( ) Pomsilpa Tameyakul  
(/ ) Suwit Imjai

Issue Date : 4 February 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0024028



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2101-0817DSC-2  
Procedure Used :-

Cert. No.: 21TM271  
Page: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with  
Industrial Platinum Resistance Thermometer ( IPT ) into Temperature Bath.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument-
- | Instrument              | Model | Serial No. | Cert. No. | Due Date    |
|-------------------------|-------|------------|-----------|-------------|
| (1) Digital Thermometer | 1523  | 2168080    | 201389    | 20 Nov 2021 |

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit maintained at-

- National Institute of Metrology Thailand (NIMT)

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 16C100847

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty ( ± °C )	Coverage Factor k
20.00	60	20.008	19.96	-0.048	0.15	2.00

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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a 1038626



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM317  
Page: 1 of 3

## Certificate of Calibration

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : IPP750  
Serial No. : V016.0084  
ID No. : RYG\_EN0154  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand  
Location : BOD Room  
Received Order : 22 April 2022  
Calibration Date : 22 April 2022  
Ambient Temperature : ( 28 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpalboon

Approved by :   
Approved Signatory

( ) Pomsilpa Tameyakul  
(/ ) Maloo Burkua  
( ) Suwit Imjai

Issue Date : 3 May 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0040735



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204-0146OC-1  
Procedure Used :-

Cert. No.: 22TM317  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

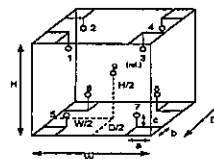
1. Reference standard instrument-
- | Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| (1) Data Acquisition | 34670A | MY44031769 | 21LM12    | 02 Sep 2022 |

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :  
a = 10 cm D = 0.60 m  
b = 10 cm W = 1.0 m  
c = 10 cm H = 1.2 m  
Capacity = 0.75 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL. Humid. ( % )	54	58
AC Supply ( Volt )	221	223

Position	Ref. Std. ID No.
1	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9

a 1106485



Equipment: Low Temp. Incubator  
 Condition As-Received: Used Item  
 Reference: 2204-01480C-1  
 Result of Calibration: (\*) Without Adjustment  
 Function of UUC: Temperature Source  
 Fresh air setting: Close

Cert. No.: 22TM317  
 Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	20.0	0.022	0.20	0.22	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.209	20.174	20.199	20.110	20.075	20.062	20.027	20.069	20.030

Average\*: The average of 30 values in each position.  
 Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.  
 Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.  
 UUC\*: Unit Under Calibration

Note: The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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a 1106484



PENTA CALIBRATION CO., LTD.  
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 www.pentalab.com

## Certificate of Calibration

Represent to Certificate of Calibration PTC07/22103

Certificate No.: PTC07/22103 Page: 1 of 2  
 Equipment: Digital Balance Condition: Normal  
 Manufacturer: Sartorius Serial No: 26207038  
 Model: MSE224S-100-DU ID No: RYG\_EN0002  
 Type of Balance: Single Interval

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
 616/10 Moo 5 T. Maenamkoo, A. Puakdaeng,  
 Rayong 21140, Thailand

Environment Condition: Temperature 23.9 °C ± 0.3 °C  
 Humidity 58.1 %RH ± 4.4 %RH  
 Air density 1.17 kg/m<sup>3</sup>

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.  
 616/10 Moo 5 T. Maenamkoo, A. Puakdaeng,  
 Rayong 21140, Thailand

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18  
 Traceability: This certificate is traceable to the SI units through Thai Calibration Service Co., Ltd.  
 , NSC-ONSC Accreditation No.: Calibration D189

Date Received: March 23, 2022  
 Calibration Date: March 23, 2022  
 Issued Date: March 25, 2022  
 Calibration By: Mr. Rungroj Metakul

REVIEW BY: *Thantol*  
 APPROVED BY: *D. K.*  
 NEXT CAL DATE: 03/03/23



Approved By: *D. K.*  
 (Mr. Keattisak Kerdlo)  
 Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

The calibration certificate shall not be reproduced except in full, without written approval from Penta Calibration Co., Ltd.

PTC-ENC-07-02 2 Feb 2020



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Represent to Certificate of Calibration PTC07/22103

Certificate No.: PTC07/22103 Page: 2 of 2

### Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3, 1/2 or of Maximum capacity

Eccentricity test		100 (g)				
		Position (g)				
		1	2	3	4	5
		0.0000	0.0000	-0.0002	0.0002	0.0002
Maximum deviation:		0.0002				

Repeatability Test: Weight to be 1/2 ≤ L<sub>1</sub> ≤ Maximum capacity

Determination of the standard deviation of weighing balance, Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00003

Error of Indication: from nominal value, Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.000006	2.16
0.01	0.01000	0.0100	0.0000	0.000010	2.06
0.1	0.10000	0.1000	0.0000	0.000010	2.06
1	1.00000	1.0000	0.0000	0.000010	2.06
2	2.00000	1.9999	0.0001	0.000010	2.06
5	5.00001	5.0000	0.0000	0.000010	2.06
10	10.00000	10.0000	0.0000	0.000010	2.06
20	20.00003	19.9999	0.0001	0.000011	2.05
50	50.00004	49.9999	0.0001	0.000012	2.00
100	100.00004	100.0001	-0.0001	0.000017	2.00
200	200.00011	200.0000	0.0001	0.000027	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-ENC-07-02 2 Feb 2020



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 TEL: 0-2717-3082-7 FAX: 0-2716-9484



Cert. No.: 21TMB27  
 Page: 1 of 3

## Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UFE 500

Serial No.: GS11.1572

ID No.: RYG\_EN0010

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
 616/10 Moo 5 T. Maenam Khu,  
 A. Puakdaeng,  
 Rayong 21140 Thailand

Location: Oven Room

Received Order: 5 May 2021

Calibration Date: 5 May 2021

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khit Rutanaprapachai

Approved by: *Kh. Rutanaprapachai*  
 Approved Signatory

( ) Pormthippa Tameyakul  
 (✓) Malae Bulkruea  
 ( ) Suwit Injai

Issue Date: 14 May 2021

REVIEW BY: *Thantol*  
 APPROVED BY: *D. K.*  
 NEXT CAL DATE: 03/03/23

The Uncertainties are for a confidence probability of approximately 95%

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Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2105-0005OC-4  
Procedure Used:-

Cert. No.: 21TM827  
Page: 2 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard Instrument:-

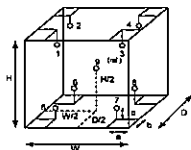
Instrument: Model: Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY57013823 21LM3 28 Feb 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

#### Result of Calibration:- (\*) Without Adjustment

Function of UUC\*: Temperature Source

Fresh air setting: Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL.Humid. (%)	59	56
AC Supply (Volt)	220	221

Ref. Std. ID No.: @ Calibration Point		
Position:	(104) °C	(180) °C
1	21-17RTD-01	19-17TC-01
2	21-17RTD-02	19-17TC-02
3	17RTD-03	19-17TC-03
4	17RTD-04	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	17RTD-08	19-17TC-08
9 (ref.)	17RTD-09	19-17TC-09

Probe Installation Details: Dimension of Chamber:  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m³



Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2105-0005OC-4  
Procedure Used:-

Cert. No.: 21TM827  
Page: 3 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

Instrument: Model: Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY57013823 21LM3 28 Feb 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration:- (\*) Without Adjustment

Function of UUC\*: Temperature Source

Fresh air setting: Close

Calibration Point: Measured Temperature (°C)

Position: 1 2 3 4 5 6 7 8 9 (ref.)

104.0 104.243 103.732 103.760 103.742 103.863 103.743 104.311 103.689 103.815

180.0 180.101 180.481 179.401 179.692 179.980 179.943 180.127 179.915 179.709

Average\*: The average of 30 values in each position.

Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\*: Unit Under Calibration

Note: The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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RYG\_EN0006



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Cert. No.: 21TM829  
Page: 1 of 3

## Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UM 400

Serial No.: b495.0899

ID No.: RYG\_EN0006

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
816/10 Moo 5 T. Moenam Khu,  
A. Phutkadeang,  
Rayong 21140 Thailand

Location: Oven Room

Received Order: 5 May 2021

Calibration Date: 5 - 6 May 2021

Ambient Temperature: (28 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khit Ruttanaprapachal

Approved by:   
Approved Signatory

( ) Pongthippa Tamayakul  
( ) Malee Buikrua  
( ) Suwit Imjai

Issue Date: 14 May 2021

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 01/12/21



Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2105-0005OC-1  
Procedure Used:-

Cert. No.: 21TM829  
Page: 2 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard Instrument:-

Instrument: Model: Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY57013823 21LM3 28 Feb 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.

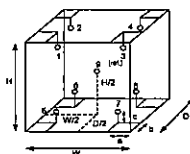
3. This certification is traceable to the International System of Unit.

Result of Calibration:- (\*) Without Adjustment

Function of UUC\*: Temperature Source

Fresh air setting: Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	30
REL.Humid. (%)	56	58
AC Supply (Volt)	221	222



Probe Installation Details: Dimension of Chamber:  
a = 5.0 cm D = 0.33 m  
b = 5.0 cm W = 0.40 m  
c = 5.0 cm H = 0.40 m  
Capacity = 0.063 m³

Position:	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

The Uncertainties are for a confidence probability of approximately 95%

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A 0028096

a 1054310



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2105-0005OC-1  
 Result of Calibration : ( \* ) Without Adjustment  
 Function of UUC : Temperature Source

Cert. No.: 21TM829  
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
70.0	70.0	70.0	0.21	1.8	2.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
70.0	70.404	70.277	70.607	70.307	68.789	69.257	68.846	69.331	70.495

Average\* : The average of 30 values in each position.  
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
 UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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Cert. No.: 21TM873  
 Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
 Manufacturer : Memmert  
 Model : WNB22  
 Serial No. : L513.0648  
 ID No. : RYG\_EN00581

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
 616/10 Moo 5 T. Maenam Khu,  
 A. Pluakdaeng,  
 Rayong 21140 Thailand  
 Location : Wet Chemistry Lab

Received Order : 5 May 2021  
 Calibration Date : 5 May 2021  
 Ambient Temperature : ( 25 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Tawatchai Pama

Approved by :   
 Approved Signatory

( ) Ponthipha Tameyakul  
 ( / ) Malee Bulkrusa  
 ( ) Suwit Imjai

Issue Date : 14 May 2021

The Uncertainties are for a confidence probability of approximately 95 %

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 Approval of the head of Corporate Services : Equipment Calibration and Testing Services.

a 1054309

A 0028098



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2105-0005OC-3  
 Procedure Used :

Cert. No.: 21TM673  
 Page.: 2 of 3

Calibration was conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard Instrument-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44060450	21LM4	06 Mar 2022

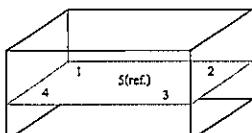
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration : ( \* ) Without Adjustment

Function of UUC : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	22	68	230
Finished of Calibration	20	64	231



Front

Position :	Ref. Std. S/N.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
S(ref.)	4803988-005



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2105-0005OC-3  
 Result of Calibration : ( \* ) Without Adjustment  
 Function of UUC : Temperature Source

Cert. No.: 21TM673  
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.891	84.893	84.880	84.892	84.917

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
85.0	0.089	0.052	0.22	2

Average\* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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