

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Oxides of Nitrogen	Pitot Tube	BKK_FS0522	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0564	24-Apr-24	23-Apr-25	12
Stack	Oxides of Nitrogen	Field Rotameter	BKK_FS1040	2-Oct-24	2-Jan-25	3
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_FS0333	3-Oct-24	2-Apr-26	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0215	22-Oct-24	22-Oct-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0433	22-Feb-24	21-Feb-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0027	22-Jan-24	21-Jan-25	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0215	22-Oct-24	22-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0031	30-Aug-24	30-Aug-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0030	25-Jan-24	24-Jan-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0432	22-Feb-24	21-Feb-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0029	11-Jul-24	11-Jul-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0210	29-Jan-24	28-Jan-25	12
Rayong Lab	Temperature	pH meter	RYG_FS0425	30-May-24	30-May-25	12
Rayong Lab	pH at 25 °C	pH Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	21-Mar-24	21-Mar-25	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	24-Jul-23	24-Jan-25	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	24-Sep-24	24-Sep-25	12

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Report No. SITH-001-001

MTC No. SITH-001-001

10. Peak C level

Number of cycles in one signal	Measured value (dB)	Deviation value (dB)	Acceptance limit (dB)	Maximum permitted uncertainty (dB)
Complete cycle	125.0	0.0	0.0	0.0
Positive half cycle	124.0	-1.0	0.0	0.0
Negative half cycle	124.0	-1.0	0.0	0.0

11. Overload indication

Measured value (dB)	Deviation value (dB)	Acceptance limit (dB)	Maximum permitted uncertainty (dB)
Positive half cycle	125.0	0.0	0.0
Negative half cycle	125.0	0.0	0.0

12. High-level stability

Time	Measured value (dB)	Deviation value (dB)	Acceptance limit (dB)	Maximum permitted uncertainty (dB)
Begin	125.0	0.0	0.0	0.0
End	125.0	0.0	0.0	0.0

Calibrated by: *[Signature]*
(M. Pichai Pichai)

Approved by: *[Signature]*
(M. Pichai Pichai)

Date of Calibration: 22-01-2024
Date of Issue: 29-01-2024

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
10110, Bangkok, Thailand
10110, Bangkok, Thailand

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Cert. No. : ACL24076
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier N1-2F
Serial No. : 8074111 / 17777 / 22602
ID No. : RVL279007

Condition As Found : GOOD

Custodian : ALS LABORATORY GROUP (THAI) CO., LTD.
101 THIANTHANAKAN RD. THIANTHANAKAN ROAD,
KHUANG THIANTHANAKAN, KHUANG THIANTHANAKAN,
BANGKOK, 10250 THAI AND.

Location :
Ambient Temperature : (23.0 ± 0.3) °C
Pressure : (101.3 ± 0.3) kPa
Relative Humidity : (50.0 ± 2.0) %

Received Date : 11 JANUARY 2024
Calibration Date : 22-01 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nithakorn Pichaiwan
Approved by : *[Signature]*
(Nithakorn Pichaiwan)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, any may be reproduced
other than in full, except with the prior written approval of the head of Calibration Laboratory.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Cert. No. : ACL24076
Job No. : VC67AC0054
Page : 2 of 8

Calibration Procedure :

CP-AC(0)

Calibration Method :

This equipment was calibrated by follow in IEC 61672-1 (2013) Standard for sound level meter (SLM).
The SLM had been in Acoustic and Electrical signal test of frequency weighting with Acoustic chamber and Reference Standard Instruments.
For some 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	MY40017076	EP-0009-23	07-FEB-24
Waveform Generator	33111B	MY12302742	EP-0010-23	07-FEB-24
Digital Multimeter	34461A	MY33220104	EEL-0010-23	13-FEB-24
Digital Multimeter	34461A	MY33220106	EEL-0010-23	13-FEB-24
Digital Multimeter	34461A	MY30024273	EEL-0010-23	14-FEB-24
Programmable Attenuator	MAT-1070	02100114	EP-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	3496095	AA-1002-23	14-FEB-24

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 applicable to the international system of unit maintained at:
3.1 National Institute of Metrology (Thailand);
3.2 Thailand Institute of Scientific and Technological Resources (TISTR).

[Signature]

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Cert. No. : ACL24076
Job No. : VC67AC0054
Page : 3 of 8

Summary of Measurement Result :

Parameter	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 1 kHz	0.3	0.6
For 1 kHz to 10 kHz	0.3	0.7
For 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.1	0.3
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. Time burst response	0.1	0.3
10. Peak C level	0.2	0.2
11. Overload indication	0.2	0.2
12. High level stability	0.1	0.3

[Signature]

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Cert. No. : ACL24076
Job No. : VC67AC0054
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (0.01)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal use

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A-weight	17.8
C-weight	18.9
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.5	-0.6	-0.6	±0.9

[Signature]

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

ISO 17025
SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

THAILAND
10110, Bangkok, Thailand
10110, Bangkok, Thailand

Cert. No. : ACL24076
Job No. : VC67AC0054
Page : 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	-0.1	-0.1	-0.1	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	-0.1	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.3
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.0	0.0	±1.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.7
C-weight	94.0	94.0	0.0	±0.7
Flat	94.0	94.0	0.0	±0.7

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Flat	94.0	94.0	0.0	±0.7
Slow	94.0	94.0	0.0	±0.7
Fast	94.0	94.0	0.0	±0.7

6. Long-term stability

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

[Signature]

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

429-4522 Srinakharinwirot Road, Bangkok 10110, Thailand
Tel: +66 2422 8232 Email: sithiporn@siacalibration.com



Cert. No. : ACL24076
Job No. : VC67AC084
Page : 7 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	+0.3
136.0	136.1	0.1	+0.3
135.0	135.1	0.1	+0.3
134.0	134.1	0.1	+0.3
133.0	133.0	0.0	+0.3
132.0	132.0	0.0	+0.3
131.0	131.0	0.0	+0.3
130.0	130.1	0.1	+0.3
129.0	129.0	0.0	+0.3
128.0	128.1	0.1	+0.3
127.0	127.1	0.1	+0.3
126.0	126.0	0.0	+0.3
125.0	125.1	0.1	+0.3
124.0	124.1	0.1	+0.3
123.0	123.0	0.0	+0.3
122.0	122.1	0.1	+0.3
121.0	121.0	0.0	+0.3
120.0	120.0	0.0	+0.3
119.0	119.0	0.0	+0.3
118.0	118.0	0.0	+0.3
117.0	117.0	0.0	+0.3
116.0	116.0	0.0	+0.3
115.0	115.0	0.0	+0.3
114.0	114.0	0.0	+0.3
113.0	113.0	0.0	+0.3
112.0	112.0	0.0	+0.3
111.0	111.0	0.0	+0.3
110.0	110.0	0.0	+0.3
109.0	109.0	0.0	+0.3
108.0	108.0	0.0	+0.3
107.0	107.0	0.0	+0.3
106.0	106.0	0.0	+0.3
105.0	105.0	0.0	+0.3
104.0	104.0	0.0	+0.3
103.0	103.0	0.0	+0.3
102.0	102.0	0.0	+0.3
101.0	101.0	0.0	+0.3
100.0	100.0	0.0	+0.3
99.0	99.0	0.0	+0.3
98.0	98.0	0.0	+0.3
97.0	97.0	0.0	+0.3
96.0	96.0	0.0	+0.3
95.0	95.0	0.0	+0.3
94.0	94.0	0.0	+0.3
93.0	93.0	0.0	+0.3
92.0	92.0	0.0	+0.3
91.0	91.0	0.0	+0.3
90.0	90.0	0.0	+0.3
89.0	89.0	0.0	+0.3
88.0	88.0	0.0	+0.3
87.0	87.0	0.0	+0.3
86.0	86.0	0.0	+0.3
85.0	85.0	0.0	+0.3
84.0	84.0	0.0	+0.3
83.0	83.0	0.0	+0.3
82.0	82.0	0.0	+0.3
81.0	81.0	0.0	+0.3
80.0	80.0	0.0	+0.3
79.0	79.0	0.0	+0.3
78.0	78.0	0.0	+0.3
77.0	77.0	0.0	+0.3
76.0	76.0	0.0	+0.3
75.0	75.0	0.0	+0.3
74.0	74.0	0.0	+0.3
73.0	73.0	0.0	+0.3
72.0	72.0	0.0	+0.3
71.0	71.0	0.0	+0.3
70.0	70.0	0.0	+0.3
69.0	69.0	0.0	+0.3
68.0	68.0	0.0	+0.3
67.0	67.0	0.0	+0.3
66.0	66.0	0.0	+0.3
65.0	65.0	0.0	+0.3
64.0	64.0	0.0	+0.3
63.0	63.0	0.0	+0.3
62.0	62.0	0.0	+0.3
61.0	61.0	0.0	+0.3
60.0	60.0	0.0	+0.3
59.0	59.0	0.0	+0.3
58.0	58.0	0.0	+0.3
57.0	57.0	0.0	+0.3
56.0	56.0	0.0	+0.3
55.0	55.0	0.0	+0.3
54.0	54.0	0.0	+0.3
53.0	53.0	0.0	+0.3
52.0	52.0	0.0	+0.3
51.0	51.0	0.0	+0.3
50.0	50.0	0.0	+0.3
49.0	49.0	0.0	+0.3
48.0	48.0	0.0	+0.3
47.0	47.0	0.0	+0.3
46.0	46.0	0.0	+0.3
45.0	45.0	0.0	+0.3
44.0	44.0	0.0	+0.3
43.0	43.0	0.0	+0.3
42.0	42.0	0.0	+0.3
41.0	41.0	0.0	+0.3
40.0	40.0	0.0	+0.3
39.0	39.0	0.0	+0.3
38.0	38.0	0.0	+0.3
37.0	37.0	0.0	+0.3
36.0	36.0	0.0	+0.3
35.0	35.0	0.0	+0.3
34.0	34.0	0.0	+0.3
33.0	33.0	0.0	+0.3
32.0	32.0	0.0	+0.3
31.0	31.0	0.0	+0.3
30.0	30.0	0.0	+0.3
29.0	29.0	0.0	+0.3
28.0	28.0	0.0	+0.3
27.0	27.0	0.0	+0.3
26.0	26.0	0.0	+0.3
25.0	25.0	0.0	+0.3
24.0	24.0	0.0	+0.3
23.0	23.0	0.0	+0.3
22.0	22.0	0.0	+0.3
21.0	21.0	0.0	+0.3
20.0	20.0	0.0	+0.3
19.0	19.0	0.0	+0.3
18.0	18.0	0.0	+0.3
17.0	17.0	0.0	+0.3
16.0	16.0	0.0	+0.3
15.0	15.0	0.0	+0.3
14.0	14.0	0.0	+0.3
13.0	13.0	0.0	+0.3
12.0	12.0	0.0	+0.3
11.0	11.0	0.0	+0.3
10.0	10.0	0.0	+0.3
9.0	9.0	0.0	+0.3
8.0	8.0	0.0	+0.3
7.0	7.0	0.0	+0.3
6.0	6.0	0.0	+0.3
5.0	5.0	0.0	+0.3
4.0	4.0	0.0	+0.3
3.0	3.0	0.0	+0.3
2.0	2.0	0.0	+0.3
1.0	1.0	0.0	+0.3
0.0	0.0	0.0	+0.3

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

429-4522 Srinakharinwirot Road, Bangkok 10110, Thailand
Tel: +66 2422 8232 Email: sithiporn@siacalibration.com



Cert. No. : ACL24076
Job No. : VC67AC084
Page : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive over half cycle	Negative over half cycle	
89.6	89.6	0.0
		+0.3

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 $k=2$ at any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

429-4522 Srinakharinwirot Road, Bangkok 10110, Thailand
Tel: +66 2422 8232 Email: sithiporn@siacalibration.com



Cert. No. : ACL24076
Job No. : VC67AC084
Page : 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	+0.3

9. Time burst response

Time Weighting	Time burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0, -2.0
	2	8	117.0	116.9	-0.1	1.0, -2.0
	200	800	134.0	134.0	0.0	+0.3
Slow	2	8	108.0	108.0	0.0	1.5, -3.0
	200	800	127.6	127.6	0.0	+0.3
	0.25	1	99.0	98.8	-0.2	1.5, -3.0
SEL	2	8	108.0	107.9	-0.1	1.0, -2.0
	200	800	125.0	125.0	0.0	+0.3

10. Peak C annual level

Number of cycles in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	+0.3
One	136.1	136.0	-0.1	+0.3

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	+0.3
Positive half cycle	133.4	133.1	-0.3	+0.3
Negative half cycle	133.4	133.1	-0.3	+0.3

Cert. No. : ACL24076
Page : 7 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Model : NC-42 / Microphone UC-52 / Pre-amplifier NIS-24
Serial No. : 00734218 / 148837 / 34368
ID No. : RYO / J50031

Condition As Found : GOOD

Customer : AUST LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHUANG PHATTANAKAN, KHUANG MUANG, BANGKOK, 10250 THAILAND

Location :
Ambient Temperature : (27.0 ± 1.1) °C
Pressure : (101.3 ± 3.3) kPa
Relative Humidity : (30.0 ± 3.0) %
Received Date : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 01 SEPTEMBER 2024

REVIEW BY : *Petch P.*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 30/8/25

Calibrated by : Nattakorn Pongpattana

Approved by : *T. Petch*
(Thanakorn Pongpattana)

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 Issuer of Calibration Laboratory.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

429-4522 Srinakharinwirot Road, Bangkok 10110, Thailand
Tel: +66 2422 8232 Email: sithiporn@siacalibration.com



Cert. No. : ACL24266
Job No. : VC67AC084
Page : 2 of 8

Calibration Procedure : CP-AU-01

Calibration Method :

This equipment was calibrated by SLM on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had been tested to Acoustic and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.
For test results of each item were made by observation of each instrument 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	IE-00369-24	05-FEB-25
Waveform Generator	33311B	MY3232742	IE-0007-24	05-FEB-25
Digital Multimeter	33461A	MY3220104	EEL-BP 2140257	13-FEB-25
Digital Multimeter	33461A	MY3220076	EEL-BP 200267	13-FEB-25
Digital Multimeter	34461A	MY6002473	EEL-BP 2542487	13-FEB-25
Programmable Attenuator	MA7-1079	62100114	IE-0008-24	05-FEB-25
Condenser Microphone	4180	2977969	AA-1000-24	12-FEB-25
Measuring Amplifier	NA-425A1	34268494	AA-1001-24	05-FEB-25

2. This result of calibration was based on data and place of calibration for this calibrated item only.

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

- National Institute of Metrology (Thailand);
- Thailand Institute of Scientific and Technological Research (TISTR);

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

429-4522 Srinakharinwirot Road, Bangkok 10110, Thailand
Tel: +66 2422 8232 Email: sithiporn@siacalibration.com



Cert. No. : ACL24266
Job No. : VC67AC084
Page : 2 of 8

SUMMARY of Measurement Result :

Parameter	Uncertainty (dB)	Maximum permitted uncertainty (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	0.2
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.3	0.3
7. Level linearity on the reference level range	0.3	0.3
8. Level linearity including the level range control	0.5	0.3
9. Time burst response	0.2	0.3
10. Peak C annual level	0.3	0.3
11. Overload indication	0.2	0.2
12. High level stability	0.3	0.3

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 1 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Internal test

Measured Value (dB)
19.5

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

Frequency Weighting	Weighting (dB)
A-weight	11.6
C-weight	17.6
Flat	22.3

3. Acoustical signal tests of frequency weightings

Mean free-field acoustic response at a level of 93 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.6	0.6	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.4	-1.1	-1.1	±5.0

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	±1.1
126.0	126.0	0.0	±1.1
125.0	125.0	0.0	±1.1
124.0	124.0	0.0	±1.1
123.0	123.0	0.0	±1.1
122.0	122.0	0.0	±1.1
121.0	121.0	0.0	±1.1
120.0	120.0	0.0	±1.1
119.0	119.0	0.0	±1.1
118.0	118.0	0.0	±1.1
117.0	117.0	0.0	±1.1
116.0	116.0	0.0	±1.1
115.0	115.0	0.0	±1.1
114.0	114.0	0.0	±1.1
113.0	113.0	0.0	±1.1
112.0	112.0	0.0	±1.1
111.0	111.0	0.0	±1.1
110.0	110.0	0.0	±1.1
109.0	109.0	0.0	±1.1
108.0	108.0	0.0	±1.1
107.0	107.0	0.0	±1.1
106.0	106.0	0.0	±1.1
105.0	105.0	0.0	±1.1
104.0	104.0	0.0	±1.1
103.0	103.0	0.0	±1.1
102.0	102.0	0.0	±1.1
101.0	101.0	0.0	±1.1
100.0	100.0	0.0	±1.1
99.0	99.0	0.0	±1.1
98.0	98.0	0.0	±1.1
97.0	97.0	0.0	±1.1
96.0	96.0	0.0	±1.1
95.0	95.0	0.0	±1.1
94.0	94.0	0.0	±1.1
93.0	93.0	0.0	±1.1
92.0	92.0	0.0	±1.1
91.0	91.0	0.0	±1.1
90.0	90.0	0.0	±1.1
89.0	89.0	0.0	±1.1
88.0	88.0	0.0	±1.1
87.0	87.0	0.0	±1.1
86.0	86.0	0.0	±1.1
85.0	85.0	0.0	±1.1
84.0	84.0	0.0	±1.1
83.0	83.0	0.0	±1.1
82.0	82.0	0.0	±1.1
81.0	81.0	0.0	±1.1
80.0	80.0	0.0	±1.1
79.0	79.0	0.0	±1.1
78.0	78.0	0.0	±1.1
77.0	77.0	0.0	±1.1
76.0	76.0	0.0	±1.1
75.0	75.0	0.0	±1.1
74.0	74.0	0.0	±1.1
73.0	73.0	0.0	±1.1
72.0	72.0	0.0	±1.1
71.0	71.0	0.0	±1.1
70.0	70.0	0.0	±1.1
69.0	69.0	0.0	±1.1
68.0	68.0	0.0	±1.1
67.0	67.0	0.0	±1.1
66.0	66.0	0.0	±1.1
65.0	65.0	0.0	±1.1
64.0	64.0	0.0	±1.1
63.0	63.0	0.0	±1.1
62.0	62.0	0.0	±1.1
61.0	61.0	0.0	±1.1
60.0	60.0	0.0	±1.1
59.0	59.0	0.0	±1.1
58.0	58.0	0.0	±1.1
57.0	57.0	0.0	±1.1
56.0	56.0	0.0	±1.1
55.0	55.0	0.0	±1.1
54.0	54.0	0.0	±1.1
53.0	53.0	0.0	±1.1
52.0	52.0	0.0	±1.1
51.0	51.0	0.0	±1.1
50.0	50.0	0.0	±1.1
49.0	49.0	0.0	±1.1
48.0	48.0	0.0	±1.1
47.0	47.0	0.0	±1.1
46.0	46.0	0.0	±1.1
45.0	45.0	0.0	±1.1
44.0	44.0	0.0	±1.1
43.0	43.0	0.0	±1.1
42.0	42.0	0.0	±1.1
41.0	41.0	0.0	±1.1
40.0	40.0	0.0	±1.1
39.0	39.0	0.0	±1.1
38.0	38.0	0.0	±1.1
37.0	37.0	0.0	±1.1
36.0	36.0	0.0	±1.1
35.0	35.0	0.0	±1.1
34.0	34.0	0.0	±1.1
33.0	33.0	0.0	±1.1
32.0	32.0	0.0	±1.1
31.0	31.0	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	25.0	0.0	±1.1

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Continuous	123.6	123.6	0.0	±3.0
One	126.4	126.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Continuous	123.6	123.6	0.0	±2.0
Positive half cycle	123.4	123.2	-0.2	±2.0
Negative half cycle	123.4	123.2	-0.2	±2.0

Measured value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	0.0	±3.0
Negative one-half cycle	0.0	±3.0

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviation Value (dB)	Acceptance Limits
A-weight	127.0	127.0	0.0	±0.3

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

End of Calibration Certificate

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
25	-0.1	0.1	-0.1	±7.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	0.0	±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	±5.0
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	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Imp	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
130	79.0	79.8	0.8	±1.1

9. Time burst response

Time Weighting	Time burst duration, 1b	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	100.0	107.9	7.9	1.5 - 5.0
	2	8	117.0	117.0	0.0	1.0 - 2.5
Slow	200	800	134.0	134.0	0.0	1.0 - 2.5
	2	8	100.0	100.0	0.0	1.5 - 5.0
SIL	200	800	127.8	127.8	0.0	1.0 - 2.5
	0.25	1	99.0	99.9	0.9	1.5 - 5.0
SIL	2	8	100.0	100.0	0.0	1.0 - 2.5
	200	800	124.0	124.1	0.1	1.0 - 2.5

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

403-00311 (Sarnam Road Bangkok) - Bangkok, 10250 Thailand
Tel: +66 (0)2 242 1000 Email: sathiporn@satiporn.com



Cert. No.: ACL24266
Job No.: VC67ACB10
Page: 1 of 8

Calibration Certificate

Equipment: SOUND LEVEL METER
Manufacturer: RION
Model: NL-42 / Microphone LC-52 / Pre-amplifier NH-24
Serial No.: 00724225 / 143272 / 14370
ID No.: RYG / 55039

Condition As Found: GOOD

Customer: ALS-LABORATORY GROUP (THAI) AND CO., LTD.
156 PHATTHANAKAN, 16 PHATTHANAKAN ROAD,
KIWAENG PHATTHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location: (25.0 ± 3.3) °C
Ambient Temperature: (101.3 ± 3.3) kPa
Pressure: (50.0 ± 2.0) %
Relative Humidity:

Received Date: 19 JANUARY 2024
Calibration Date: 25-26 JANUARY 2024
Date of Issue: 29 JANUARY 2024

Calibrated by: Subhane Phasiporn

Approved by: T. Petch
(Thasakul Petchai)

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.

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 1 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by Reference to IEC-60318-1 (2013) Standard for sound level meter (SLM).

The SLM test units to Acoustical and Electrical signal tests of frequency weighting with acoustic chamber and Reference Standard Instruments.

For some results of each item were made by observation of each instrument 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	MY0017076	ET-0009-21	07-FEB-24
Waveform Generator	33511B	MY5262142	ET-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5322004	ET-0010-23	14-FEB-24
Digital Multimeter	33461A	MY5322004	ET-0010-23	14-FEB-24
Digital Multimeter	34461A	MY0064273	ET-0011-23	08-FEB-24
Programmable Attenuator	MAF-1070	62100014	ET-0011-23	08-FEB-24
Condenser Microphone	4130	297500	AA-1001-21	14-FEB-24
Measuring Amplifier	NA-42CAI	34540095	AA-1002-21	14-FEB-24

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 units maintained as :

3.1 National Institute of Metrology (Thailand).

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

T. Pichai

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 1 of 8

Summary of Measurement Result :

Parameter	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		
120 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	0.3
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 cutoff	0.1	0.1

T. Pichai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 1 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.0)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
21.4

2.2 The measurement of the sound level range was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.9
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from reference frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.2	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.1	0.0	0.0	±5.0

T. Pichai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 1 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from reference frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
80	-0.1	0.0	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	0.0	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	±3.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Log	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at start (dB)	SLM Display at final (dB)	Deviation (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.1

T. Pichai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.7
118.0	118.0	0.0	±0.7
100.0	100.0	0.0	±0.7
82.0	82.0	0.0	±0.7
64.0	64.0	0.0	±0.7
46.0	46.0	0.0	±0.7
28.0	28.0	0.0	±0.7
10.0	10.0	0.0	±0.7
-8.0	-8.0	0.0	±0.7
-26.0	-26.0	0.0	±0.7
-44.0	-44.0	0.0	±0.7
-62.0	-62.0	0.0	±0.7
-80.0	-80.0	0.0	±0.7
-98.0	-98.0	0.0	±0.7
-116.0	-116.0	0.0	±0.7
-134.0	-134.0	0.0	±0.7
-152.0	-152.0	0.0	±0.7
-170.0	-170.0	0.0	±0.7
-188.0	-188.0	0.0	±0.7
-206.0	-206.0	0.0	±0.7
-224.0	-224.0	0.0	±0.7
-242.0	-242.0	0.0	±0.7
-260.0	-260.0	0.0	±0.7
-278.0	-278.0	0.0	±0.7
-296.0	-296.0	0.0	±0.7
-314.0	-314.0	0.0	±0.7
-332.0	-332.0	0.0	±0.7
-350.0	-350.0	0.0	±0.7
-368.0	-368.0	0.0	±0.7
-386.0	-386.0	0.0	±0.7
-404.0	-404.0	0.0	±0.7
-422.0	-422.0	0.0	±0.7
-440.0	-440.0	0.0	±0.7
-458.0	-458.0	0.0	±0.7
-476.0	-476.0	0.0	±0.7
-494.0	-494.0	0.0	±0.7
-512.0	-512.0	0.0	±0.7
-530.0	-530.0	0.0	±0.7
-548.0	-548.0	0.0	±0.7
-566.0	-566.0	0.0	±0.7
-584.0	-584.0	0.0	±0.7
-602.0	-602.0	0.0	±0.7
-620.0	-620.0	0.0	±0.7
-638.0	-638.0	0.0	±0.7
-656.0	-656.0	0.0	±0.7
-674.0	-674.0	0.0	±0.7
-692.0	-692.0	0.0	±0.7
-710.0	-710.0	0.0	±0.7
-728.0	-728.0	0.0	±0.7
-746.0	-746.0	0.0	±0.7
-764.0	-764.0	0.0	±0.7
-782.0	-782.0	0.0	±0.7
-800.0	-800.0	0.0	±0.7
-818.0	-818.0	0.0	±0.7
-836.0	-836.0	0.0	±0.7
-854.0	-854.0	0.0	±0.7
-872.0	-872.0	0.0	±0.7
-890.0	-890.0	0.0	±0.7
-908.0	-908.0	0.0	±0.7
-926.0	-926.0	0.0	±0.7
-944.0	-944.0	0.0	±0.7
-962.0	-962.0	0.0	±0.7
-980.0	-980.0	0.0	±0.7
-998.0	-998.0	0.0	±0.7

T. Pichai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY401-4021 (Srinakharinwirot Road) Bangkok, Bangkok 10110, Thailand
Tel: +66 2452 8221 Email: sithiporn@stiporn.comCert. No. : ACL24093
Job No. : VC87AC0058
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.2

9. Tone burst response

Weighting	Time	Tone burst duration, T_b (ms)	Cycle	Anticipated Value (dB)		Measured Value (dB)		Deviation (dB)		Acceptance Limits (dB)	
				1	2	1	2	1	2	1	2
Fast	2	0.25	1	100.0	107.0	-0.1	1.5	-0.0	1.0	-2.5	0.0
		250	800	134.0	134.0	0.0	0.0	0.0	0.0	0.0	0.0
Slow	2	2	2	100.0	108.0	0.0	1.5	-0.0	1.0	-2.5	0.0
		200	800	127.6	127.6	0.0	0.0	0.0	0.0	0.0	0.0
SEL	2	0.25	1	99.0	98.9	-0.1	1.5	-0.0	1.0	-2.5	0.0
		250	800	128.0	128.0	0.0	0.0	0.0	0.0	0.0	0.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	130.4	130.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	133.4	133.2	-0.2	±2.0
Negative half cycle	133.4	133.2	-0.2	±2.0

T. Pichai

11. Overall indication

Measured value (dB)	Revised Value (dB)	Acceptance Limit (dB)
Positive one-half cycle	Negative one-half cycle	
89.6	89.8	0.2
		1.5

12. High level stability

Frequency (Hz)	SIM Display at initial (dB)	SIM Display at final (dB)	Deviation Value (dB)	Acceptance Limit (dB)
A-weight	157.9	157.0	0.9	+0.3

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

End of Calibration Certificate

Signature



THAILAND INSTITUTE FOR METROLOGICAL RESEARCH (TIR)

Request No. 21-07-0232

MTC No. EEL-IP, 172-0167

- Power Amplifier BredaKjor 2300 S/N 187559
- Speaker Tannoy Limited, Great Britain British Patent No. 213790
- Digital Multimeter Agilent 34411A S/N MY4005506
- Programmable Attenuator Tannoy TPA-903A S/N 2312

Calibration Procedure

This instrument was calibrated by using calibration procedures in CP-102-02 and CP-102-03, which were based on IEC 61672-2 (Electroacoustics - Sound Level Meters - Part 2 - Periodic tests (2013)). These calibration procedures were related to the electrical and acoustic signal test. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration: 22-29 Feb. 2024

2 of 8

Head Office: 453/1533 (accredited) 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com
Branch Office: 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com



THAILAND INSTITUTE FOR METROLOGICAL RESEARCH (TIR)

Request No. 21-07-0232

MTC No. EEL-IP, 172-0167

3. Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
125	0.1	-0.2	0.2	0.45
1000	0.1	-0.1	0.1	0.45
4000	0.0	0.0	0.0	0.45

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
50	-0.1	0.0	0.0	0.20
125	-0.1	0.0	0.0	0.20
250	-0.1	0.0	0.0	0.20
500	0.0	0.0	0.0	0.20
1000	0.0	0.0	0.0	0.20
2000	0.0	0.0	0.0	0.20
4000	0.0	0.0	0.0	0.20
8000	0.0	0.0	0.0	0.20

Date of Calibration: 22-29 Feb. 2024

4 of 8

Head Office: 453/1533 (accredited) 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com
Branch Office: 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com



THAILAND INSTITUTE FOR METROLOGICAL RESEARCH (TIR)

Request No. 21-07-0232

MTC No. EEL-IP, 172-0167

CALIBRATION CERTIFICATE

Submitted by: ALST Laboratory Group (Thailand) Co., Ltd.
Address: 101, Rajabhat, Bangkok 10500
Calibrated at: Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Center
Set 10, Bangpoo Industrial Estate, Sukhumburi Rd., A-Mong, Saraphut, 10780

Instrument Calibrated: Sound Level Meter
Description: SLM Level Meter
Manufacturer: Rion
Model: SL-42
Serial No: 90296515 (ID: RVG, PS0422)
Microphone: Type UC-2 No. 179119
Pre-amplifier: Type M-14 No. 87526

Ambient Environment
Temperature: $23 \pm 0.5^\circ\text{C}$
Relative Humidity: $50 \pm 15\%$
Ambient Pressure: $(101.325 \pm 1.3) \text{ kPa}$

- Standards used:
- Hand Pans Filter Wavesh 752A S/N 9006494
 - Condenser Microphone BredaKjor 4100 S/N 284981
 - Decade Attenuator Anala A1-205 S/N 0048403
 - Form and Auxiliary Waveform Generator Agilent 33250A S/N MY404566
 - Digital Function Synthesizer NF Electronic Instruments DB-193A S/N 123817
 - Digital Multimeter Fluke 8506A S/N 499597
 - Photophone Rion TC-72 S/N 0012446
 - Measuring Amplifier BredaKjor 2400 S/N 133744

Date of Receipt: 24 Jan. 2024
Date of Calibration: 22 Feb. 2024

1 of 8

Head Office: 453/1533 (accredited) 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com
Branch Office: 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com



THAILAND INSTITUTE FOR METROLOGICAL RESEARCH (TIR)

Request No. 21-07-0232

MTC No. EEL-IP, 172-0167

1. Absolute Sensitivity

Reference Analysis	Measured value (dB)	Deviation (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Signal (dB)	114.2	113.9	-0.3	0.30	N/A

Note: The external calibration adjustment was fully performed. The internal calibration adjustment was then performed at the display of 123.4 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
19.1	0.10	N/A

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

Frequency (Hz)	Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
A-weight	11.9	0.10	N/A
C-weight	17.4	0.20	N/A
Flat	23.2	0.10	N/A

Date of Calibration: 22-29 Feb. 2024

3 of 8

Head Office: 453/1533 (accredited) 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com
Branch Office: 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com



THAILAND INSTITUTE FOR METROLOGICAL RESEARCH (TIR)

Request No. 21-07-0232

MTC No. EEL-IP, 172-0167

5. Long-term stability

Time	Measured Value (dB)	Deviation value (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Begin	94.0	0.0	0.3	0.20	0.1
End	94.0	0.0	0.3	0.20	0.1

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency (Hz)	Measured Value (dB)	Deviation value (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2



6.2 Time weightings at 1 kHz

Frequency (Hz)	Measured Value (dB)	Deviation value (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Low	94.0	0.0	0.1	0.20	0.2

Date of Calibration: 22-29 Feb. 2024

4 of 8

Head Office: 453/1533 (accredited) 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com
Branch Office: 101, Rajabhat, Bangkok, Thailand 10500
Tel: +662 6486 8544 Email: sithiporn@calibration.com

THAILAND INSTITUTE OF SCIENCE AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67-032 MTC No. EEL-IP-172-017

1. Level linearity on the reference level range

Amplitude value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (class 2) (dB)	Uncertainty (1 dB)	Maximum permitted uncertainty of measurement (1 dB)
127	127.1	0.1	1.1	0.28	0.3
126	126.1	0.1	1.1	0.28	0.3
125	125.1	0.1	1.1	0.28	0.3
124	124.1	0.1	1.1	0.28	0.3
123	123.1	0.1	1.1	0.28	0.3
122	122.1	0.1	1.1	0.28	0.3
121	121.1	0.1	1.1	0.28	0.3
120	120.1	0.1	1.1	0.28	0.3
119	119.1	0.1	1.1	0.28	0.3
118	118.1	0.1	1.1	0.28	0.3
117	117.1	0.1	1.1	0.28	0.3
116	116.1	0.1	1.1	0.28	0.3
115	115.1	0.1	1.1	0.28	0.3
114	114.1	0.1	1.1	0.28	0.3
113	113.1	0.1	1.1	0.28	0.3
112	112.1	0.1	1.1	0.28	0.3
111	111.1	0.1	1.1	0.28	0.3
110	110.1	0.1	1.1	0.28	0.3
109	109.1	0.1	1.1	0.28	0.3
108	108.1	0.1	1.1	0.28	0.3
107	107.1	0.1	1.1	0.28	0.3
106	106.1	0.1	1.1	0.28	0.3
105	105.1	0.1	1.1	0.28	0.3
104	104.1	0.1	1.1	0.28	0.3
103	103.1	0.1	1.1	0.28	0.3
102	102.1	0.1	1.1	0.28	0.3
101	101.1	0.1	1.1	0.28	0.3
100	100.1	0.1	1.1	0.28	0.3
99	99.1	0.1	1.1	0.28	0.3
98	98.1	0.1	1.1	0.28	0.3
97	97.1	0.1	1.1	0.28	0.3
96	96.1	0.1	1.1	0.28	0.3
95	95.1	0.1	1.1	0.28	0.3
94	94.1	0.1	1.1	0.28	0.3
93	93.1	0.1	1.1	0.28	0.3
92	92.1	0.1	1.1	0.28	0.3
91	91.1	0.1	1.1	0.28	0.3
90	90.1	0.1	1.1	0.28	0.3
89	89.1	0.1	1.1	0.28	0.3
88	88.1	0.1	1.1	0.28	0.3
87	87.1	0.1	1.1	0.28	0.3
86	86.1	0.1	1.1	0.28	0.3
85	85.1	0.1	1.1	0.28	0.3
84	84.1	0.1	1.1	0.28	0.3
83	83.1	0.1	1.1	0.28	0.3
82	82.1	0.1	1.1	0.28	0.3
81	81.1	0.1	1.1	0.28	0.3
80	80.1	0.1	1.1	0.28	0.3
79	79.1	0.1	1.1	0.28	0.3
78	78.1	0.1	1.1	0.28	0.3
77	77.1	0.1	1.1	0.28	0.3
76	76.1	0.1	1.1	0.28	0.3
75	75.1	0.1	1.1	0.28	0.3
74	74.1	0.1	1.1	0.28	0.3
73	73.1	0.1	1.1	0.28	0.3
72	72.1	0.1	1.1	0.28	0.3
71	71.1	0.1	1.1	0.28	0.3
70	70.1	0.1	1.1	0.28	0.3
69	69.1	0.1	1.1	0.28	0.3
68	68.1	0.1	1.1	0.28	0.3
67	67.1	0.1	1.1	0.28	0.3
66	66.1	0.1	1.1	0.28	0.3
65	65.1	0.1	1.1	0.28	0.3
64	64.1	0.1	1.1	0.28	0.3
63	63.1	0.1	1.1	0.28	0.3
62	62.1	0.1	1.1	0.28	0.3
61	61.1	0.1	1.1	0.28	0.3
60	60.1	0.1	1.1	0.28	0.3
59	59.1	0.1	1.1	0.28	0.3
58	58.1	0.1	1.1	0.28	0.3
57	57.1	0.1	1.1	0.28	0.3
56	56.1	0.1	1.1	0.28	0.3
55	55.1	0.1	1.1	0.28	0.3
54	54.1	0.1	1.1	0.28	0.3
53	53.1	0.1	1.1	0.28	0.3
52	52.1	0.1	1.1	0.28	0.3
51	51.1	0.1	1.1	0.28	0.3
50	50.1	0.1	1.1	0.28	0.3
49	49.1	0.1	1.1	0.28	0.3
48	48.1	0.1	1.1	0.28	0.3
47	47.1	0.1	1.1	0.28	0.3
46	46.1	0.1	1.1	0.28	0.3
45	45.1	0.1	1.1	0.28	0.3
44	44.1	0.1	1.1	0.28	0.3
43	43.1	0.1	1.1	0.28	0.3
42	42.1	0.1	1.1	0.28	0.3
41	41.1	0.1	1.1	0.28	0.3
40	40.1	0.1	1.1	0.28	0.3
39	39.1	0.1	1.1	0.28	0.3
38	38.1	0.1	1.1	0.28	0.3
37	37.1	0.1	1.1	0.28	0.3
36	36.1	0.1	1.1	0.28	0.3
35	35.1	0.1	1.1	0.28	0.3
34	34.1	0.1	1.1	0.28	0.3
33	33.1	0.1	1.1	0.28	0.3
32	32.1	0.1	1.1	0.28	0.3
31	31.1	0.1	1.1	0.28	0.3
30	30.1	0.1	1.1	0.28	0.3
29	29.1	0.1	1.1	0.28	0.3
28	28.1	0.1	1.1	0.28	0.3
27	27.1	0.1	1.1	0.28	0.3
26	26.1	0.1	1.1	0.28	0.3
25	25.1	0.1	1.1	0.28	0.3
24	24.1	0.1	1.1	0.28	0.3
23	23.1	0.1	1.1	0.28	0.3
22	22.1	0.1	1.1	0.28	0.3
21	21.1	0.1	1.1	0.28	0.3
20	20.1	0.1	1.1	0.28	0.3
19	19.1	0.1	1.1	0.28	0.3
18	18.1	0.1	1.1	0.28	0.3
17	17.1	0.1	1.1	0.28	0.3
16	16.1	0.1	1.1	0.28	0.3
15	15.1	0.1	1.1	0.28	0.3
14	14.1	0.1	1.1	0.28	0.3
13	13.1	0.1	1.1	0.28	0.3
12	12.1	0.1	1.1	0.28	0.3
11	11.1	0.1	1.1	0.28	0.3
10	10.1	0.1	1.1	0.28	0.3
9	9.1	0.1	1.1	0.28	0.3
8	8.1	0.1	1.1	0.28	0.3
7	7.1	0.1	1.1	0.28	0.3
6	6.1	0.1	1.1	0.28	0.3
5	5.1	0.1	1.1	0.28	0.3
4	4.1	0.1	1.1	0.28	0.3
3	3.1	0.1	1.1	0.28	0.3
2	2.1	0.1	1.1	0.28	0.3
1	1.1	0.1	1.1	0.28	0.3
0	0.1	0.1	1.1	0.28	0.3
-1	-0.1	0.1	1.1	0.28	0.3
-2	-1.1	0.1	1.1	0.28	0.3
-3	-2.1	0.1	1.1	0.28	0.3
-4	-3.1	0.1	1.1	0.28	0.3
-5	-4.1	0.1	1.1	0.28	0.3
-6	-5.1	0.1	1.1	0.28	0.3
-7	-6.1	0.1	1.1	0.28	0.3
-8	-7.1	0.1	1.1	0.28	0.3
-9	-8.1	0.1	1.1	0.28	0.3
-10	-9.1	0.1	1.1	0.28	0.3
-11	-10.1	0.1	1.1	0.28	0.3
-12	-11.1	0.1	1.1	0.28	0.3
-13	-12.1	0.1	1.1	0.28	0.3
-14	-13.1	0.1	1.1	0.28	0.3
-15	-14.1	0.1	1.1	0.28	0.3
-16	-15.1	0.1	1.1	0.28	0.3
-17	-16.1	0.1	1.1	0.28	0.3
-18	-17.1	0.1	1.1	0.28	0.3
-19	-18.1	0.1	1.1	0.28	0.3
-20	-19.1	0.1	1.1	0.28	0.3
-21	-20.1	0.1	1.1	0.28	0.3
-22	-21.1	0.1	1.1	0.28	0.3
-23	-22.1	0.1	1.1	0.28	0.3
-24	-23.1	0.1	1.1	0.28	0.3
-25	-24.1	0.1	1.1	0.28	0.3
-26	-25.1	0.1	1.1	0.28	0.3
-27	-26.1	0.1	1.1	0.28	0.3
-28	-27.1	0.1	1.1	0.28	0.3
-29	-28.1	0.1	1.1	0.28	0.3
-30	-29.1	0.1	1.1	0.28	0.3
-31	-30.1	0.1	1.1	0.28	0.3
-32	-31.1	0.1	1.1	0.28	0.3
-33	-32.1	0.1	1.1	0.28	0.3
-34	-33.1	0.1	1.1	0.28	0.3
-35	-34.1	0.1	1.1	0.28	0.3
-36	-35.1	0.1	1.1	0.28	0.3
-37	-36.1	0.1	1.1	0.28	0.3
-38	-37.1	0.1	1.1	0.28	0.3
-39	-38.1	0.1	1.1	0.28	0.3
-40	-39.1	0.1	1.1	0.28	0.3
-41	-40.1	0.1	1.1	0.28	0.3
-42	-41.1	0.1	1.1	0.28	0.3
-43	-42.1	0.1	1.1	0.28	0.3
-44	-43.1	0.1	1.1	0.28	0.3
-45	-44.1	0.1	1.1	0.28	0.3
-46	-45.1	0.1	1.1	0.28	0.3
-47	-46.1	0.1	1.1	0.28	0.3
-48	-47.1	0.1	1.1	0.28	0.3
-49	-48.1	0.1	1.1	0.28	0.3
-50	-49.1	0.1	1.1	0.28	0.3
-51	-50.1	0.1	1.1	0.28	0.3
-52	-51.1	0.1	1.1	0.28	0.3
-53	-52.1	0.1	1.1	0.28	0.3
-54	-53.1	0.1	1.1	0.28	0.3
-55	-54.1	0.1	1.1	0.28	0.3
-56	-55.1	0.1	1.1	0.28	0.3
-57	-56.1	0.1	1.1	0.28	0.3
-58	-57.1	0.1	1.1	0.28	0.3
-59	-58.1	0.1	1.1	0.28	0.3
-60	-59.1	0.1	1.1	0.28	0.3
-61	-60.1	0.1	1.1	0.28	0.3
-62	-61.1	0.1	1.1	0.28	0.3
-63	-62.1	0.1	1.1	0.28	0.3
-64	-63.1	0.1	1.1	0.28	0.3
-65	-64.1	0.1	1.1	0.28	0.3
-66	-65.1	0.1	1.1	0.28	0.3
-67	-66.1	0.1	1.1	0.28	0.3
-68	-67.1	0.1	1.1	0.28	0.3
-69	-68.1	0.1	1.1	0.28	0.3
-70	-69.1	0.1	1.1	0.28	0.3
-71	-70.1	0.1	1.1	0.28	0.3
-72	-71.1	0.1	1.1	0.28	0.3
-73	-72.1	0.1	1.1	0.28	0.3
-74	-73.1	0.1	1.1	0.28	0.3
-75	-74.1	0.1	1.1	0.28	0.3
-76	-75.1	0.1	1.1	0.28	0.3
-77	-76.1	0.1	1.1	0.28	0.3
-78	-77.1	0.1	1.1	0.28	0.3
-79	-78.1	0.1	1.1	0.28	0.3
-80	-79.1	0.1	1.1	0.28	0.3
-81	-80.1	0.1	1.1	0.28	0.3
-82	-81.1	0.1	1.1	0.28	0.3
-83	-82.1	0.1	1.1	0.28	0.3
-84	-83.1	0.1	1.1	0.28	0.3
-85	-84.1	0.1	1.1	0.28	0.3
-86	-85.1	0.1	1.1	0.28	0.3
-87	-86.1	0.1	1.1	0.28	0.3
-88	-87.1	0.1	1.1	0.28	0.3
-89	-88.1	0.1	1.1	0.28	0.3
-90	-89.1	0.1	1.1	0.28	0.3
-91	-90.1	0.1	1.1	0.28	0.3
-92	-91.1	0.1	1.1	0.28	0.3
-93	-92.1	0.1	1.1	0.28	0.3
-94	-93.1	0.1	1.1	0.28	0.3
-95	-94.1	0.1	1.1	0.28	0.3
-96	-95.1	0.1	1.1	0.2	

Summary of Measurement Result :

Parameter	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	0.2	0.6
8000 Hz	0.3	0.7
4. Mechanical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.2	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	0.2
8. Level linearity including the level range control	0.2	0.2
9. Time burst response	0.2	0.2
10. Peak C sound level	0.2	0.2
11. Overload indication	0.2	0.2
12. High level stability	0.1	0.1

T. Petch

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (125 Hz)	93.9	0.0	-0.3

2. Self-generated noise

Measured Value (dB)
14.6

2.2 The acceptance of the sound level meter was replaced by a test signal input device.

Frequency Weighting	Weighting (dB)
A-weight	9.9
C-weight	16.7
Flat	22.4

3. Acoustical signal tests of frequency weightings

Notes: For field acoustic response as a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)	Acceptance Limit
125	0.4	0.4
1000	-0.1	-0.1
8000	-0.2	-0.2

T. Petch

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limit
63	-0.1	-0.1	-0.1	-0.2
125	0.0	0.0	-0.1	-0.2
250	0.0	0.0	-0.1	-0.2
500	0.0	0.0	-0.1	-0.2
1000	0.0	0.0	0.0	-0.2
2000	0.0	0.0	0.0	-0.2
4000	0.0	0.0	0.0	-0.2
8000	0.0	0.0	0.0	-0.2

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	99.0	99.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Long	94.0	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 Limit (dB)
A-weight	94.0	94.0	0.0	±0.2

T. Petch

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
117.0	117.1	0.1	±0.1
116.0	116.1	0.1	±0.1
115.0	115.1	0.1	±0.1
114.0	114.1	0.1	±0.1
113.0	113.0	0.0	±0.1
112.0	112.0	0.0	±0.1
111.0	111.0	0.0	±0.1
110.0	110.1	0.1	±0.1
109.0	109.1	0.1	±0.1
108.0	108.1	0.1	±0.1
107.0	107.1	0.1	±0.1
106.0	106.1	0.1	±0.1
105.0	105.1	0.1	±0.1
104.0	104.1	0.1	±0.1
103.0	103.1	0.1	±0.1
102.0	102.1	0.1	±0.1
101.0	101.1	0.1	±0.1
100.0	100.1	0.1	±0.1
99.0	99.1	0.1	±0.1
98.0	98.1	0.1	±0.1
97.0	97.1	0.1	±0.1
96.0	96.1	0.1	±0.1
95.0	95.1	0.1	±0.1
94.0	94.1	0.1	±0.1
93.0	93.1	0.1	±0.1
92.0	92.1	0.1	±0.1
91.0	91.1	0.1	±0.1
90.0	90.1	0.1	±0.1
89.0	89.1	0.1	±0.1
88.0	88.1	0.1	±0.1
87.0	87.1	0.1	±0.1
86.0	86.1	0.1	±0.1
85.0	85.1	0.1	±0.1
84.0	84.1	0.1	±0.1
83.0	83.1	0.1	±0.1
82.0	82.1	0.1	±0.1
81.0	81.1	0.1	±0.1
80.0	80.1	0.1	±0.1
79.0	79.1	0.1	±0.1
78.0	78.1	0.1	±0.1
77.0	77.1	0.1	±0.1
76.0	76.1	0.1	±0.1
75.0	75.1	0.1	±0.1
74.0	74.1	0.1	±0.1
73.0	73.1	0.1	±0.1
72.0	72.1	0.1	±0.1
71.0	71.1	0.1	±0.1
70.0	70.1	0.1	±0.1
69.0	69.1	0.1	±0.1
68.0	68.1	0.1	±0.1
67.0	67.1	0.1	±0.1
66.0	66.1	0.1	±0.1
65.0	65.1	0.1	±0.1
64.0	64.1	0.1	±0.1
63.0	63.1	0.1	±0.1
62.0	62.1	0.1	±0.1
61.0	61.1	0.1	±0.1
60.0	60.1	0.1	±0.1
59.0	59.1	0.1	±0.1
58.0	58.1	0.1	±0.1
57.0	57.1	0.1	±0.1
56.0	56.1	0.1	±0.1
55.0	55.1	0.1	±0.1
54.0	54.1	0.1	±0.1
53.0	53.1	0.1	±0.1
52.0	52.1	0.1	±0.1
51.0	51.1	0.1	±0.1
50.0	50.1	0.1	±0.1
49.0	49.1	0.1	±0.1
48.0	48.1	0.1	±0.1
47.0	47.1	0.1	±0.1
46.0	46.1	0.1	±0.1
45.0	45.1	0.1	±0.1
44.0	44.1	0.1	±0.1
43.0	43.1	0.1	±0.1
42.0	42.1	0.1	±0.1
41.0	41.1	0.1	±0.1
40.0	40.1	0.1	±0.1
39.0	39.1	0.1	±0.1
38.0	38.1	0.1	±0.1
37.0	37.1	0.1	±0.1
36.0	36.1	0.1	±0.1
35.0	35.1	0.1	±0.1
34.0	34.1	0.1	±0.1
33.0	33.1	0.1	±0.1
32.0	32.1	0.1	±0.1
31.0	31.1	0.1	±0.1
30.0	30.1	0.1	±0.1
29.0	29.1	0.1	±0.1
28.0	28.1	0.1	±0.1
27.0	27.1	0.1	±0.1
26.0	26.1	0.1	±0.1
25.0	25.1	0.1	±0.1

T. Petch

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Auto	94.0	94.0	0.0	±0.1

9. Time burst response

Time Weighting	Time burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Fast	32.3	1	100.0	107.9	-4.1	1.5; -5.0
		8	117.0	117.0	0.0	1.0; -2.5
		200	134.0	134.0	0.0	-4.0
		8	100.0	100.0	0.0	1.5; -5.0
Slow	32.3	1	99.0	99.9	-0.1	1.5; -5.0
		8	100.0	100.0	0.0	1.0; -2.5
		200	127.0	127.0	0.0	-4.0
		8	100.0	100.0	0.0	1.0; -2.5
SEL	32.3	1	99.0	99.9	-0.1	1.5; -5.0
		8	100.0	100.0	0.0	1.0; -2.5
		200	128.0	128.0	0.0	-4.0
		8	100.0	100.0	0.0	1.0; -2.5

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Continuous	133.0	133.0	0.0	±0.0
Positive half cycle	133.3	133.1	-0.2	±0.0
Negative half cycle	135.4	135.1	-0.3	±0.0

T. Petch

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limit (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 valid following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

CERTIFICATE OF CALIBRATION

ISSUED BY: Cirrus Research plc

DATE OF ISSUE: 29 January 2024 CERTIFICATE NUMBER: 287437

Cirrus Research plc
Acoustic House
Bridlington Road
Humby
North Yorkshire
YO14 3PH
United Kingdom

Page 1 of 2
Approved signature
M. Smith
Electronically signed

doseBadge Reader : IEC 60942:2003

Instrument Information

Manufacturer: Cirrus Research plc

Model: RC-110A

Serial number: 73729

Class: 2

Test summary

Date of calibration: 29 January 2024

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the full in-house configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B - Periodic Tests and the determinations of the sound pressure level, frequency and total dose were made.

The sound pressure level was measured using a WS227 condenser microphone type MK224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.3 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level and frequency (Hz) states, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern approval described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

Notes:

This certificate provides traceability of measurement to the SI system of units under the scope of measurement realised at the National Physical Laboratory or other recognised national metrology institute. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate were only in the metrology laboratory. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number: 287437

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test.

Before Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 36.9 %
After Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 36.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Oscillator Meter	Kelley	3015	0054818
Acoustic Calibrator	Brüel and Kjær	4231	2810257
Environmental Monitor	Comel	77510	21940628

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.31	114.31	114.29	114.36	0.30	±0.75	0.11 dB
Distortion (%)	< 4.00	0.32	0.30	0.40	0.33	0.33	±4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.3	998.3	998.3	+1.7	±20.0	0.1 Hz

The measured quantities or corrections (as applicable) obtained by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.01	114.01	114.03	114.01	0.01	±0.75	0.11 dB
Distortion (%)	< 4.00	0.30	0.34	0.34	0.33	0.23	±4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.3	998.3	998.2	+1.6	±20.0	0.1 Hz

Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2-way IR ops	Pass
Clock	Pass

End of results



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
13/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2711-3006-79 FAX 0-2719-1444



Certificate of Calibration

Cert.No.: 24LM81

Page.: 1 of 2

Equipment: pH Meter with Sensor

Manufacturer: Mettler Toledo

Model: SevenGo 52

Serial No.: 8851952376

ID No.: RYG_FS0425

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

(Rayong Branch)

616/10 Moo 5, T.Muenam Khu, A.Pluakdaeng,

Rayong 21140, Thailand

Location: TPA Chemistry Calibration Laboratory

Received Order: 30 May 2024

Calibrated Date: 30 May 2024

Ambient Temperature: (20 ± 1) °C

Relative Humidity: (50 ± 20) %

AC Line Voltage: (220 ± 22) V

Calibrated by: Prascha Rikabi

Approved by: Kunchit Promrat

Issue Date: 7 June 2024

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 issuing laboratory.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
13/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2711-3006-79 FAX 0-2719-1444



Certificate of Calibration

Cert.No.: 24CH22

Page.: 1 of 2

Equipment: pH Meter

Manufacturer: Mettler Toledo

Model: SevenGo 52

Serial No.: 8851952376

ID No.: RYG_FS0425

Condition As-Received: Used Item

Received Date: 29 May 2024

Calibration Date: 30 May 2024

Reference: 2405-0993DSC-3

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

(Rayong Branch)

616/10 Moo 5, T.Muenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature: (25 ± 2.5) °C

Relative Humidity: (50 ± 15) %

Calibration Procedure:

In-house method:

- CP-CMS by direct measurement with DC voltage

standard and direct measurement with

certified reference material (CRM)

Calibrated by: Warakorn Lempragrat

Approved by: Suthip

Issue Date: 31 May 2024

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 issuing laboratory.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
13/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2711-3006-79 FAX 0-2719-1444



Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54033040	120RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4922054	110RC044	23E068	26 July 2024

This certification is traceable to the International System of Unit maintained through:

- Technology Promotion Association (Thailand-Japan)

The measurement results are traceable to SI through CPA chem LIS.

ANAS-ASQ National Accreditation Board, Accredited No. AN-1835

Butter Solution

Butter Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2025
pH 6.868	CPA chem	970852	25 Apr 2025
pH 9.597	CPA chem	970853	25 Apr 2025

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 Document Process Calibrator at pH (4.7, 10)

Unit Under Calibration	Nominal Value	Standard Voltage	Actual Reading	Uncertainty of Measurement	Coverage factor
		mV	pH	(mV)	k
pH Meter	4.00	177.48	178	0.58	2.00
	7.00	0.00	0	0.56	2.00
	10.00	-177.48	-178	0.56	2.00

End User: 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	Uncertainty of Measurement	Coverage factor
			(mV)	(pH)	k
pH Electrode	4.008	4.01	172	0.0071	2.00
	6.868	6.89	-2	0.0089	2.00
	9.597	9.59	-178	0.0085	2.00

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 %.

End

TECHNOLOGICAL PROMOTION ASSOCIATION (THAILAND) JSC.
CERTIFICATE OF CALIBRATION

Cert. No.: ZJC3224
Page: 1 of 3

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact
Serial No.: 0554291445
ID No.: RY01_0240-02
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 10 December 2023
Reference: 2312-01-01C9D-9
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
619/10 Moo 5, T. Maenam Khu, A. Phukdeeng, Rayong 21140, Thailand
Ambient Temperature: (23 ± 0.5) °C
Relative Humidity: (50 ± 10) %
Procedure used: Calibration was conducted using calibration procedure No. ZJC-R07 according to GUM/ANCI 1st/2.

Condition of this result of calibration
1. Reference standard: Instrument
2. 1 M, pH 7.00 Buffer Solution
3. The result of calibration was checked and approved by the calibration officer.
4. The performance of the instrument is stable and reliable for use.
5. The calibration is traceable to the International System of Units (SI) maintained through the National Institute of Metrology (NIM) of Thailand.

Calibrated by: [Signature]
Issue Date: 10 December 2023
Approved Signature: [Signature]
1. [Signature]
2. [Signature]
3. [Signature]

Calibration Results
Function: pH Measurement
Performing standard curve by using buffer nominal pH (4.7, 7.0)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement (k)	Coverage factor A
pH Electrode	4.008	4.613	184.1	0.0045	2.00
	6.866	6.856	9.7	0.0084	2.00
	9.987	10.002	-164.7	0.0086	2.11

Function: Temperature Measurement
(*) Without adjustment
This equipment was connected with Temperature Probe.
Model: InLabExpert Pro-GM
Serial No.: 3225263
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 (k=2)	Coverage factor A
25.0	25.000	24.2	-0.103	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=2, providing a level of confidence of approximately 95 %.

TECHNOLOGICAL PROMOTION ASSOCIATION (THAILAND) JSC.
CERTIFICATE OF CALIBRATION

Cert. No.: ZJC3224
Page: 2 of 3

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	-199.8	0.2	48
-100.0000	-100.0	0.0	60
-50.0000	-50.0	0.0	63
0.0000	0.0	0.0	81
50.0000	50.0	0.0	98
100.0000	100.0	0.0	91
150.0000	150.0	0.0	65
200.0000	199.6	-0.4	81

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.

TECHNOLOGICAL PROMOTION ASSOCIATION (THAILAND) JSC.
CERTIFICATE OF CALIBRATION

Cert. No.: ZJC31574
Page: 1 of 3

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact
Serial No.: 0554291445
ID No.: RY01_0240-02
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 10 December 2023
Reference: 2312-01-01C9D-9
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
619/10 Moo 5, T. Maenam Khu, A. Phukdeeng, Rayong 21140, Thailand
Ambient Temperature: (23 ± 0.5) °C
Relative Humidity: (50 ± 10) %
Calibration Procedure:
- CP-CMS by direct measurement with standard voltage reference cell (direct measurement with certified reference material (CRM))
- CP-CMS by comparison with standard cell

Calibrated by: [Signature]
Approved Signature: [Signature]
1. [Signature]
2. [Signature]
3. [Signature]

Calibration Results
Function: pH Measurement
Performing standard curve by using buffer nominal pH (4.7, 7.0)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement (k)	Coverage factor A
pH Electrode	4.008	4.613	184.1	0.0045	2.00
	6.866	6.856	9.7	0.0084	2.00
	9.987	10.002	-164.7	0.0086	2.11

Function: Temperature Measurement
(*) Without adjustment
This equipment was connected with Temperature Probe.
Model: InLabExpert Pro-GM
Serial No.: 3225263
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 (k=2)	Coverage factor A
25.0	25.000	24.2	-0.103	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=2, providing a level of confidence of approximately 95 %.

TECHNOLOGICAL PROMOTION ASSOCIATION (THAILAND) JSC.
CERTIFICATE OF CALIBRATION

Cert. No.: ZJC31574
Page: 2 of 3

Condition of this calibration result
1. Reference Standard Instrument
2. 1 M, pH 7.00 Buffer Solution
3. The result of calibration was checked and approved by the calibration officer.
4. The performance of the instrument is stable and reliable for use.
5. The calibration is traceable to the International System of Units (SI) maintained through the National Institute of Metrology (NIM) of Thailand.

Calibrated by: [Signature]
Approved Signature: [Signature]
1. [Signature]
2. [Signature]
3. [Signature]

Calibration Results
Function: pH Measurement
Performing standard curve by using buffer nominal pH (4.7, 7.0)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement (k)	Coverage factor A
pH Electrode	4.008	4.613	184.1	0.0045	2.00
	6.866	6.856	9.7	0.0084	2.00
	9.987	10.002	-164.7	0.0086	2.11

Function: Temperature Measurement
(*) Without adjustment
This equipment was connected with Temperature Probe.
Model: InLabExpert Pro-GM
Serial No.: 3225263
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 (k=2)	Coverage factor A
25.0	25.000	24.2	-0.103	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=2, providing a level of confidence of approximately 95 %.

TECHNOLOGICAL PROMOTION ASSOCIATION (THAILAND) JSC.
CERTIFICATE OF CALIBRATION

Cert. No.: ZJC31574
Page: 3 of 3

Calibration Results
Function: pH Measurement
Performing standard curve by using buffer nominal pH (4.7, 7.0)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement (k)	Coverage factor A
pH Electrode	4.008	4.613	184.1	0.0045	2.00
	6.866	6.856	9.7	0.0084	2.00
	9.987	10.002	-164.7	0.0086	2.11

Function: Temperature Measurement
(*) Without adjustment
This equipment was connected with Temperature Probe.
Model: InLabExpert Pro-GM
Serial No.: 3225263
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 (k=2)	Coverage factor A
25.0	25.000	24.2	-0.103	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=2, providing a level of confidence of approximately 95 %.

Sartorius (Thailand) Co., Ltd.
CERTIFICATE of Calibration

Model Number: MSE2245-100-01
Description: Analytical Balance
Serial Number: 0280207039
ID No.: RY01_0240-02
Manufacturer: Sartorius

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
619/10 Moo 5, T. Maenam Khu, A. Phukdeeng, Rayong 21140, Thailand

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
619/10 Moo 5, T. Maenam Khu, A. Phukdeeng, Rayong 21140, Thailand

Calibrated by: Mr. Chonchai Inthana
Calibration Date: Thursday, February 22, 2024

Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number: 01-005, based on UKAS LAB 14: 2013

Metrolological data:
Capacity: 220 g Readability: 0.0001 g
Temperature: 24.2 °C ± 0.5 °C
Humidity: 57.0 % RH ± 10.0 % RH
Pressure: 1013.25 hPa ± 0.1 hPa

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

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, providing a level of confidence of approximately 95 %.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-422-00	Sartorius weight set, 100g, 10g, 1g, 0.1g, 0.01g, 0.001g	TGS	MC1081978	23-Aug-2025
MH-36250	Humidity/temperature/Lab. Lutron MH-36250	DNB	C10231945	23-Aug-2024

Signature: [Signature]
Stamp: [Stamp]
Page: 1 of 2

Certificate of Calibration

Model Number : MS82245-100-01
Description : Analytical Balance
Serial Number : 303697028
ID No. : RYD_EN0003
Manufacturer : Sartorius

Certificate No. : 24TM0369
Issued Date : Friday, February 23, 2024
Reference No. : 229196
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

The repeatability is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same test with a measurement series is repeated immediately on the weighing pan at the same position. The standard deviation is used to assess reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	199.9999
20 g	20.0000	200.0000
Tolerance	0.0001 g	0.0001 g
Standard Deviation	0.00001	0.00006

Eccentricity (Off-center loading error)

The off-center loading error is caused by the difference between the position of the load, i.e. 10 or 100 of specimen capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to DIN 5102).

Nominal value :	100 g	0
Tolerance	0.0004 g	0
Difference	1	-
	2	-0.0001
	3	-0.0001
	4	0.0000
	5	-0.0001
	6	-

Linearity

The linearity, with stated linearity 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	
1g	0.0000	0.0000	0.0000	0.0001g	
0.05	0.0500	0.0500	0.0000	0.0001g	
0.1	0.1000	0.1000	0.0000	0.0001g	
0.5	0.5000	0.5000	0.0000	0.0001g	
1	1.0000	1.0000	0.0000	0.0001g	
5	5.0000	5.0000	0.0000	0.0001g	
10	10.0000	10.0000	0.0000	0.0001g	
20	20.0000	20.0000	0.0000	0.0001g	
50	50.0000	49.9999	-0.0001	0.0001g	
100	100.0000	100.0000	0.0000	0.0001g	
200	200.0000	199.9999	-0.0001	0.0001g	

SOP PM-03 03 February 2022



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-05030C-1

Cert. No. : 24TM032
Page : 2 of 3

Procedure Used :

Calibration was conducted using calibration procedure CP-0702 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 : Serial No. : Cert. No. : Traceable : Due Date :
1) Data Acquisition : MYS7013711 : 23LM115 : TPA : 11 Jul 2024

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 Units.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : (*) Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Close



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

Environment during calibration	Beginning	Finished
Temp. (°C)	27	27
REL Humid. (%)	52	52
AC Supply (Vrms)	220	220

Ref. Std. ID No. @ Calibration Point	Position : (180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	23-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Certificate of Calibration

Cert. No. : 24TM032
Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UFE 500
Serial No. : 0611.1572
ID No. : RYD_EN0010

REVIEW BY : *Thantak*
APPROVED BY : *Dharm*
NEXT CAL DATE : 21/09/25

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rajay Branch)
618/10 Moo 5 T. Maenam Kru,
A. Phukdang,
Location : Rayong 21140 Thailand
Oven Room

Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 1) °C
Relative Humidity : (50 ± 3) %

Calibrated by : Man Pattanapongpaloon

Approved by : *Man Pattanapongpaloon*
Approved Signature

() Ponthipha Tanayaratul

() Ummaphol Harsachai

(x) Suwit Inpa

Issue Date : 22 March 2024

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 3: Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-05030C-1

Cert. No. : 24TM032
Page : 3 of 3

Procedure Used :

Calibration was conducted using calibration procedure CP-0702 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 : Serial No. : Cert. No. : Traceable : Due Date :
1) Data Acquisition : MYS7013711 : 23LM115 : TPA : 11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

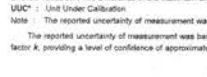
3. This certification is traceable to the International System of Units.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : (*) Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Close



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

Environment during calibration	Beginning	Finished
Temp. (°C)	27	27
REL Humid. (%)	52	52
AC Supply (Vrms)	220	220

Ref. Std. ID No. @ Calibration Point	Position : (180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	23-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2403-05630C-3
Result of Calibration: (*) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

Cert. No.: 24TM034
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (°C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.508	103.884	103.712	103.772	103.730	104.289	103.800	103.788	0.42
180.0	180.791	179.230	179.896	179.080	180.127	180.138	180.835	179.315	180.211	1.1

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 %.

-o0o-



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2403-05630C-4

Cert. No.: 24TM035
Page: 2 of 3

Procedure Used: Calibration was conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 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 **Serial No.** **Cert. No.** **Traceable** **Due Date**
(1) Data Acquisition M17513711 23.M115 TPA 11 Jul 2024
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.

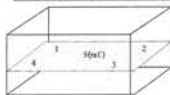
Remark: TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration: (*) Without Adjustment

Function of UUC*: Temperature Source

Heat transfer medium used: Water

	Environmental		AC Voltage Supply	
	(°C)	(%R.H.)	(Volt)	(Volt)
Beginning of Calibration	25	55	222	
Finished of Calibration	25	57	223	



Front

Position	Ref. Std. ID No.
1	480388-001
2	480388-002
3	480388-003
4	480388-004
5(ref.)	480388-005



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD 501/18 SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3890-28 FAX: 0-2719-9484



Certificate of Calibration

Cert. No.: 24TM035
Page: 1 of 3

Equipment:

Water Bath

Manufacturer:

Mannett

Model:

WB22

Serial No.:

LS13-0848

ID No.:

RYQ_EN0061

Submitted by:

ALS Laboratory Group (Thailand) Co., Ltd. (Playing Branch)
819/10 Moo 5, T. Mueang Khro, A. Phakding
Rayong 21140, Thailand

Location:

Wet Chemistry Lab

Received Order:

21 March 2024

Calibration Date:

21 March 2024

Ambient Temperature:

(28 ± 1) °C

Relative Humidity:

(50 ± 10) %

Calibrated by:

Man Pattanapongsaloon

Approved by:

Approved Signature

() Pongthipa Tanwattul

() Pongthipa Tanwattul

(✓) Suwit Injai

Issue Date:

23 March 2024

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 3: Equipment Calibration and Testing Services.



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2403-05630C-4
Result of Calibration: (*) Without Adjustment
Function of UUC*: Temperature Source

Cert. No.: 24TM035
Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (°C)
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point (°C)	Uniformity (°C)	Stability (°C)	Coverage Factor
85.0	0.19	0.11	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 %.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD 501/18 SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3890-28 FAX: 0-2719-9484

Cert. No.: 23TW108
Page: 1 of 2

Certificate of Testing

Equipment:

DO Meter

Manufacturer:

YSI

Model:

7000-115V

Serial No.:

15E102756

ID No.:

RYQ_EN0032

Received Date:

21 July 2023

Test Date:

25 July 2023

Reference:

2351-011309C-1

Submitted by:

ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
816/10 Moo 5, T. Mueang Khro, A. Phakding,
Rayong 21140, Thailand.

Laboratory Condition:

Temperature: (28 ± 1) °C
Humidity: (50 ± 20) %
In-house method: CHC249
by Comparison Technique with Aqua Modificator Method

Test Procedure:

Wetlab: Sathian

Tested by:

Wetlab: Sathian

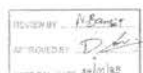
Approved by:

Approved Signature

() Mholu Butvisas
(✓) Sathian Mueangthai
() Wansum Longphithai

Issue Date:

28 July 2023



8 0340211



Condition of this result of calibration

1. Reference Standard instruments:
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments **Serial No.** **ID No.** **Certification No.** **Due Date**
(1) Balance 1120143764 14RC004 22MM09 20 Sep 2023

2. Standard Material:

Material **Manufacturer** **Lot No.** **Assay**
Sodium Thiosulfate pentahydrate Merck AM17533-8 100.2%

Result: Dissolved Oxygen Meter Adjustment: W0: Air 195 %

Dissolved Oxygen Probe No.: 10E10048

Titration Method (Acid Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.19	8.17	0.006

This report was certified only for the instrument we tested. It is not to be used for any other system efficiency. The environmental impact control and product to organization, it may concerned intend to use for advertising and related purpose is prohibited. This report may not be reproduced other than in full without written approval of the laboratory.

-o0o-

11712153



Cert. No.: 23/M125
Page: 1 of 2

Certificate of Calibration

Equipment: DO Meter with Sensor
Manufacturer: YSI
Model: 9005-15V
Serial No.: 15E102796
ID No.: RYG_EN0032
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
Rajong Branch
616/10 Moo 5, T. Maenam Khu, A. Phukdang
Rajong 21140 Thailand
Location: TPA On Site Calibration Laboratory
Received Order: 25 July 2023
Calibration Date: 27 July 2023
Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$
Relative Humidity: $(50 \pm 30) \%$
AC Line Voltage: $(220 \pm 22) \text{ V}$
Calibrated by: Prascha Hahli
Approved by:
() Pongthapa Tameyasil
() Maide Sukrute
() Sual Injai
Issue Date: 31 July 2023

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 3: Equipment Calibration and Testing Services

A 0055616



Equipment: DO Meter with Sensor
Condition As Received: Used Item
Reference: 2307-013050-2

Cert. No.: 23/M125
Page: 2 of 2

Procedure Used:

Calibration were conducted using in-house calibration procedure CP-0101 according to comparison with
Isolab Platinum Resistance Thermometer (PRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:

Instrument: Serial No. Cert. No. Traceable Due Date
1) Digital Thermometer 2190010 221285 TPA 21 Oct 2023

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.

Remark: TPA: Technology Promotion Association (Thailand - Japan)

Result of Calibration:

Function of UUC: Temperature measurement

Function: Temperature measurement

Calibration	Temperature	Standard	UUC	Traceable	Due Date
Point	Depth	Temperature	Reading	Error	Uncertainty
($^{\circ}\text{C}$)	(mm)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)
20.00	100	20.011	19.99	-0.01	0.15

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-

a 1159515



Cert. No.: 24/TM1663
Page: 1 of 3

Certificate of Calibration

Equipment: Low Temp. Incubator
Manufacturer: Memmert
Model: BPPT50
Serial No.: V818.0054
ID No.: RYG_EN0154
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rajong Branch
616/10 Moo 5, T. Maenam Khu, A. Phukdang
Rajong 21140, Thailand
Location: BOD Room
Received Order: 01 November 2024
Calibration Date: 01 November 2024
Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$
Relative Humidity: $(50 \pm 30) \%$
AC Line Voltage: $(220 \pm 22) \text{ V}$
Calibrated by: Kunchit Malee
Approved by:
() Pongpan Papiem
() Sual Injai
() Kunchit Pongpan
Issue Date: 07 November 2024

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 3: Equipment Calibration and Testing Services



Equipment: Low Temp. Incubator
Condition As Received: Used Item
Reference: 2411-00020C-1

Cert. No.: 24/TM1663
Page: 2 of 3

Procedure Used:

Calibration were conducted using calibration procedure CP-0102 based on TLAS G-20 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: Serial No. Cert. No. Traceable Due Date
1) Data Acquisition MV4402381 24LM73 TPA 16 May 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

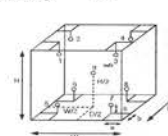
3. This certification is traceable to the International System of Unit.

Remark: TPA: Technology Promotion Association (Thailand - Japan)

Result of Calibration:

Function of UUC: Temperature Source

Fresh air setting: Close



Probe Installation Details:

Dimension of Chamber:
D = 0.60 m
W = 1.3 m
H = 1.2 m
Capacity = 9.72 m³

Environment during calibration	
Beginning	Finished
Temp. ($^{\circ}\text{C}$)	24 25
REL. Humid. (%)	55 53
AC Supply (V _{eff})	220 221

Position	Ref. Sht.
1	18TD-21
2	18TD-22
3	23-01RTD-03
4	18TD-24
5	18TD-25
6	18TD-26
7	23-01RTD-07
8	18TD-28
9 (ref.)	23-01RTD-09



Equipment: Low Temp. Incubator
Condition As Received: Used Item
Reference: 2411-00020C-1
Result of Calibration: (*) Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Close

Cert. No.: 24/TM1663
Page: 3 of 3

Calibration	UUC	UUC	Temperature	Temperature	Overall	Coverage
Point	Setting	Reading	stability	uniformity	Variation	Factor
($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	k
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.071	19.915	20.273	20.179	19.977	19.792	20.056	20.026	20.633	0.30

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 %.

-00-



Certificate of Calibration

Cert. No.: 24CG5711
Page: 1 of 2

Equipment: Burette
Capacity: 50 mL
Serial No.:
ID No.: RYG_EN0216
Manufacturer: Wigo
Made in: Germany
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
Rajong Branch
616/10 Moo 5, T. Maenam Khu, A. Phukdang
Rajong 21140, Thailand
Ambient Temperature: $(20 \pm 2.5) ^\circ\text{C}$
Relative Humidity: $(50 \pm 10) \%$
Barometric Pressure: 756 mmHg
Calibration Procedure: ASTM E 542-01
Calibrated by: Sangnuchorn Wongsa
Approved by:
() Srisuda Khunthia
() Pongpan Papiem
() Unnaphol Hanchai
Issue Date: 24 September 2024

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 3: Equipment Calibration and Testing Services



Equipment : Burette
Received Date : 19 September 2024
Condition As Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert No : 24C03711
Page : 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID No.	Certificate No.	Traceability	Due date
1) Balance	XP205	8134206712	140RC007	24MM318	TPA	15 July 2025
2) Data Logger	HC-200	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0269	0.0062	2.00
20	20.0214	0.0085	2.00
30	30.0008	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.6988	0.011	2.00

Remark : mL = cm³

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 %.

-000-