

Continuation of Calibration Certificate

Cert. No. : ACL23155

Job No. : VC66AC0052

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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23155
Job No. : VC66AC0052
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** —————

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn 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. : ACL23285

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01173614 / 172176 / 74026
ID No.: NKH_FS0027

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 28 AUGUST 2023
Calibration Date : 06 SEPTEMBER 2023
Date of Issue : 13 SEPTEMBER 2023

| | |
|----------------|--------------|
| VIEW BY | Nathakorn P. |
| APPROVED BY | [Signature] |
| NEXT CAL. DATE | 6/9/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23285

Job No. : VC66AC0098

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23285
Job No. : VC66AC0098
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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23285

Job No. : VC66AC0098

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 24.0 |

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 | 0.0 | 0.0 | 0.0 | ± 1.5 |
| 1000 | -0.1 | -0.1 | -0.1 | ± 1.0 |
| 8000 | 0.3 | 0.4 | 0.4 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23285

Job No. : VC66AC0098

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 | 0.1 | 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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23285

Job No. : VC66AC0098

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 |
| 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, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23285

Job No. : VC66AC0098

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

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Certificate No : 24-SLM-021

Request No : Req-2023-2674

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : RION
Model : NL-42
Serial Number : 00900087
ID : NNG_FS0014
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : UC-52
Microphone S/N : 188481
Preamplifier Model : NH-24
Preamplifier S/N : 01749
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 December 2023
Calibrated Date : 29 January 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic





Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Tracebility |
|---------------------------|---------|-----------|-----------|-----------------|-------------|
| Standard Microphone | GRAS | 40AN | 188273 | 21 August 2024 | GRAS |
| Multifrequency Calibrator | Quest | Quest-cal | EFA000234 | 26 July 2024 | TSI |
| Audio Generator | Svantek | Svan401 | 131 | 9 October 2024 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 29 January 2024

Certificate No : 24-SLM-021

Request No : Req-2023-2674

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | | After Adjust | | UNCERTAINTY | Acceptance |
|--------------------|---------|---------------|-------|--------------|------|-------------|------------|
| FAST / A / 30-130 | Level | UUC | ERR | UUC | ERR | (± dB) | Limit |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) | | (± dB) |
| 1000 Hz 114 dB | 113.78 | 113.7 | -0.08 | 113.8 | 0.02 | 0.20 | 0.30 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | (dB) | (± dB) |
| UUC Weighting | | |
| A | 14.9 | 0.10 |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | (dB) | (± dB) |
| UUC Weighting | | |
| A | 11.1 | 0.10 |
| C | 15.5 | 0.10 |
| Z | 19.4 | 0.10 |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting | Deviation from various Frequency Weighting Responce curve | | | UNCERTAINTY | Acceptance Limit |
|---------------|---|------|------|-------------|------------------|
| FAST / 30-130 | A | C | Z | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (dB) | | |
| 125 Hz | 0.4 | 0.5 | 0.5 | 0.60 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.0 | 0.60 | 1.0 |
| 4000 Hz | 0.0 | 0.1 | 0.0 | 0.60 | 3.0 |
| 8000 Hz | -0.8 | -0.9 | -0.9 | 0.70 | 5.0 |

Certificate No : 24-SLM-021

Request No : Req-2023-2674

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency | | | UNCERTAINTY | Acceptance |
|---------------|----------------------------------|--------|--------|-------------|------------|
| FAST / 30-130 | Weighting Response curve | | | | Limit |
| STD Setting | A (dB) | C (dB) | Z (dB) | (± dB) | (± dB) |
| 63 Hz | -0.2 | -0.1 | 0.0 | 0.20 | 2.0 |
| 125 Hz | -0.1 | 0.0 | 0.0 | | 1.5 |
| 250 Hz | -0.1 | 0.0 | 0.0 | | 1.5 |
| 500 Hz | 0.0 | 0.0 | 0.0 | | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.0 | | 1.0 |
| 2000 Hz | 0.0 | 0.0 | 0.0 | | 2.0 |
| 4000 Hz | 0.0 | 0.0 | 0.0 | | 3.0 |
| 8000 Hz | 0.1 | 0.1 | 0.0 | | 5.0 |
| 16000 Hz | -1.3 | -1.4 | 0.0 | | +5, -INF. |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|---------------|--------|----------|------|------------------------|--------------------------------|
| FAST / 30-130 | REF | UUC | ERR | | |
| UUC Weighting | (dB) | (dB) | (dB) | 0.20 | |
| A | 114.00 | 114.0 | 0.0 | | |
| C | 114.00 | 114.0 | 0.0 | | |
| Z | 114.00 | 114.0 | 0.0 | | |

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|-------------------|--------|----------|------|------------------------|--------------------------------|
| 30-130 / A | REF | UUC | ERR | | |
| UUC Time Response | (dB) | (dB) | (dB) | 0.20 | |
| Fast | 114.00 | 114.0 | 0.0 | | |
| Slow | 114.00 | 114.0 | 0.0 | | |
| Leq | 114.00 | 114.0 | 0.0 | | |

Certificate No : 24-SLM-021

Request No : Req-2023-2674

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|----------|----------------------------|------------------------------------|
| FAST / A / 30-130 | UUC | | |
| STD Setting | (dB) | | |
| Initial | 114.0 | | |
| Final | 114.0 | | |
| Deviated | 0.0 | 0.10 | 0.30 |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|-------------|-----------|------|----------------------------|------------------------------------|
| FAST / A / 30-130 | REF | UUC | ERR | | |
| STD dB | (dB) | (dB) | (dB) | | |
| 138.00 | 138 | 137.9 | -0.1 | 0.30 | 1.1 |
| 134.00 | 134 | 133.9 | -0.1 | | 1.1 |
| 129.00 | 129 | 128.9 | -0.1 | | 1.1 |
| 124.00 | 124 | 123.9 | -0.1 | | 1.1 |
| 119.00 | 119 | 119.0 | 0.0 | | 1.1 |
| 114.00 | 114 | 114.0 | 0.0 | | 1.1 |
| 109.00 | 109 | 108.9 | -0.1 | | 1.1 |
| 104.00 | 104 | 104.0 | 0.0 | | 1.1 |
| 99.00 | 99 | 99.0 | 0.0 | | 1.1 |
| 94.00 | 94 | 93.9 | -0.1 | | 1.1 |
| 89.00 | 89 | 89.0 | 0.0 | | 1.1 |
| 84.00 | 84 | 84.0 | 0.0 | | 1.1 |
| 79.00 | 79 | 79.0 | 0.0 | | 1.1 |
| 74.00 | 74 | 74.0 | 0.0 | | 1.1 |
| 69.00 | 69 | 69.0 | 0.0 | | 1.1 |
| 64.00 | 64 | 64.0 | 0.0 | | 1.1 |
| 59.00 | 59 | 59.0 | 0.0 | | 1.1 |
| 54.00 | 54 | 53.9 | -0.1 | | 1.1 |
| 49.00 | 49 | 49.0 | 0.0 | | 1.1 |
| 44.00 | 44 | 44.0 | 0.0 | | 1.1 |
| 39.00 | 39 | 39.0 | 0.0 | | 1.1 |
| 34.00 | 34 | 34.0 | 0.0 | | 1.1 |
| 29.00 | 29 | 29.0 | 0.0 | | 0.8 |
| 24.00 | 24 | 23.9 | -0.1 | | 1.1 |

Certificate No : 24-SLM-021

Request No : Req-2023-2674

9. Level linearity including the level range control

| UUC Setting | STD | Measured | | UNCERTAINTY | Acceptance |
|-------------|-------|----------|------|-------------|-------------|
| FAST / A | REF | UUC | ERR | | Limit |
| UUC Range | (dB) | (dB) | (dB) | (\pm dB) | (\pm dB) |
| 30-130 | 29.50 | 29.6 | 0.1 | 0.30 | 1.1 |
| | 114 | 114.0 | 0.0 | | 1.1 |

10. Tone burst response

| UUC Setting | STD | Anticipated | Measured | | UNCERTAINTY | Acceptance |
|-------------------|-----------|-------------|----------|------|-------------|-------------|
| A / 30-130 | Toneburst | Ref | UUC | ERR | | Limit |
| UUC Time Response | (ms) | (dB) | (dB) | (dB) | (\pm dB) | (\pm dB) |
| Fast | 200 | 126.0 | 126.0 | 0.0 | 0.20 | 1.0 |
| | 2 | 109.0 | 109.0 | 0.0 | | +1.0, -2.5 |
| | 0.25 | 100.0 | 99.9 | -0.1 | | +1.5, -5.0 |
| Slow | 200 | 119.6 | 119.6 | 0.0 | | 1.0 |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -5.0 |
| SEL | 200 | 120.0 | 120.0 | 0.0 | | 1.0 |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -2.5 |
| | 0.25 | 91.0 | 90.9 | -0.1 | | +1.5, -5.0 |

11. Peak C Sound level

| UUC Setting | Anticipated | Measured | | UNCERTAINTY | Acceptance |
|---------------------|-------------|----------|-------|-------------|-------------|
| FAST / C / 55-141 | REF | UUC | ERR | | Limit |
| STD Setting | (dB) | (dB) | (dB) | (\pm dB) | (\pm dB) |
| Complete cycle | 136.4 | 136.4 | 0.00 | 0.20 | 3.0 |
| Positive half cycle | 135.4 | 135.2 | -0.20 | | 2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.20 | | 2.0 |

Certificate No : 24-SLM-021

Request No : Req-2023-2674

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|-------------|
| FAST / A / 30-130 | UUC | | Limit |
| STD Setting | (dB) | (\pm dB) | (\pm dB) |
| Positive one-half cycle | 139.6 | | |
| Negative one-half cycle | 139.6 | | |
| Deviated | 0.0 | 0.20 | 1.5 |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|-------------|
| FAST / A / 30-130 | UUC | | Limit |
| STD Setting | (dB) | (\pm dB) | (\pm dB) |
| Initial | 129.0 | | |
| Final | 129.0 | | |
| Deviated | 0.0 | 0.10 | 0.30 |

Note :

| Function | Maximum-permitted Uncertainty of measurement |
|--|---|
| 1. Indication at the calibration check frequency | Not applicable |
| 2. Self-generated noise, Microphone installed | Not applicable |
| 3. Self-generated noise, Microphone replaced by the electrical input signal device | Not applicable |
| 4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz | 0.60 dB |
| 4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz | 0.70 dB |
| 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz | 0.20 dB |
| 6. Frequency and time weightings at 1kHz | 0.20 dB |
| 7. Long Term Stability | 0.10 dB |
| 8. Level linearity on the reference level range | 0.30 dB |
| 9. Level linearity including the level range control | 0.30 dB |
| 10. Tone burst response | 0.30 dB |
| 11. Peak C Sound level | 0.35 dB |
| 12. Overload indication | 0.25 dB |
| 13. High Level Stability | 0.10 dB |

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

Cert. No. : ACL24127

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00371923 / 169100 / 72245
ID No.: NKH_FS0005

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 12 APRIL 2024
Calibration Date : 02-03 MAY 2024
Date of Issue : 06 MAY 2024

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 1/5/25 |

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.

SITHIPHORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

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Cert. No. : ACL24127

Job No. : VC67AC0079

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-4 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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).

T. L. L.

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Cert. No. : ACL24127
Job No. : VC67AC0079
Pages : 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 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 |

G. Petch

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Cert. No. : ACL24127

Job No. : VC67AC0079

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 16.3 |
| Flat | 22.2 |

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 | 0.5 | 0.5 | ± 1.5 |
| 1000 | -0.1 | -0.1 | -0.1 | ± 1.0 |
| 8000 | -2.1 | -2.1 | -2.1 | ±5.0 |

G. Pichan

Cert. No. : ACL24127

Job No. : VC67AC0079

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 | -0.1 | ±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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

T. Pichan

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Cert. No. : ACL24127

Job No. : VC67AC0079

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 | 28.1 | 0.1 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.0 | 0.0 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

G. Katan

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24127
Job No. : VC67AC0079
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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{peak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

T. Retam

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Cert. No. : ACL24127
Job No. : VC67AC0079
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

G. Ketan

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23281

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472122 / 169435 / 72456
ID No.: NKH_FS0006

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 28 AUGUST 2023
Calibration Date : 06 SEPTEMBER 2023
Date of Issue : 13 SEPTEMBER 2023

| | |
|----------------|--------------------|
| REVIEW BY | <i>Nathakorn P</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 6/9/24 |

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23281

Job No. : VC66AC0098

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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 17.9 |
| Flat | 23.7 |

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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.0 | 0.0 | 0.0 | ± 1.5 |
| 1000 | -0.1 | -0.1 | -0.1 | ± 1.0 |
| 8000 | 0.4 | 0.5 | 0.5 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 | 0.0 | ±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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 | 43.9 | -0.1 | ± 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 | 26.3 | 0.3 | ± 1.1 |
| 25.0 | 25.2 | 0.2 | ± 1.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23281
Job No. : VC66AC0098
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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{peak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23281
Job No. : VC66AC0098
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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23282

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472123 / 142962 / 22541
ID No.: NKH_FS0007

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 28 AUGUST 2023
Calibration Date : 06 SEPTEMBER 2023
Date of Issue : 13 SEPTEMBER 2023

| | |
|----------------|-----------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 6/9/23 ^{WPK} |

24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23282

Job No. : VC66AC0098

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23282

Job No. : VC66AC0098

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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23282

Job No. : VC66AC0098

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 13.8 |
| C - weight | 20.1 |
| Flat | 25.7 |

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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.0 | 0.1 | 0.0 | ± 1.5 |
| 1000 | -0.1 | -0.1 | -0.1 | ± 1.0 |
| 8000 | 0.1 | 0.2 | 0.2 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23282
Job No. : VC66AC0098
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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23282

Job No. : VC66AC0098

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 | 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 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.0 | 0.0 | ± 1.1 |
| 25.0 | 25.0 | 0.0 | ± 1.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23282
Job No. : VC66AC0098
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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23282

Job No. : VC66AC0098

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

Cert. No. : ACL23331

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00222553 / 195865 / 15385
ID No.: NKH_FS0116

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 1/11/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23331
Job No. : VC67AC0013
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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.2 |

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 | 16.4 |
| Flat | 22.3 |

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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.1 | 0.1 | 0.1 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.8 | 0.9 | 0.9 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

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 | 0.0 | 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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

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 | 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 | 24.9 | -0.1 | ± 1.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

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 |
| 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, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23331

Job No. : VC67AC0013

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23281

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472122 / 169435 / 72456
ID No.: NKH_FS0006

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 28 AUGUST 2023
Calibration Date : 06 SEPTEMBER 2023
Date of Issue : 13 SEPTEMBER 2023

| | |
|----------------|--------------------|
| REVIEW BY | <i>Nathakorn P</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 6/9/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23281

Job No. : VC66AC0098

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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 17.9 |
| Flat | 23.7 |

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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.0 | 0.0 | 0.0 | ± 1.5 |
| 1000 | -0.1 | -0.1 | -0.1 | ± 1.0 |
| 8000 | 0.4 | 0.5 | 0.5 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23281
Job No. : VC66AC0098
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 | 0.0 | ±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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 | 43.9 | -0.1 | ± 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 | 26.3 | 0.3 | ± 1.1 |
| 25.0 | 25.2 | 0.2 | ± 1.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23281

Job No. : VC66AC0098

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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{peak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23281
Job No. : VC66AC0098
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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23329

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00222528 / 195374 / 15360
ID No.: NKH_FS0114

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 11/11/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23329

Job No. : VC67AC0013

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23329

Job No. : VC67AC0013

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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23329

Job No. : VC67AC0013

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 10.8 |
| C - weight | 17.2 |
| 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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.2 | 0.2 | 0.2 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.8 | 0.9 | 0.9 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
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 | 0.0 | ±2.0 |
| 125 | 0.1 | 0.1 | 0.1 | ±1.5 |
| 250 | 0.1 | 0.0 | 0.0 | ±1.5 |
| 500 | 0.1 | 0.1 | 0.0 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.1 | 0.1 | ±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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.1 | 0.1 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
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 | 119.1 | 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 | 29.1 | 0.1 | ± 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 | 25.2 | 0.2 | ± 1.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
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 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.5 | -0.1 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.8 | -0.2 | 1.5 ; -5.0 |
| | 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, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| One | 136.4 | 135.8 | -0.6 | ±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 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23329

Job No. : VC67AC0013

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23156

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00371923 / 169100 / 72245
ID No.: NKH_FS0005

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 05 MAY 2023
Calibration Date : 10-16 MAY 2023
Date of Issue : 17 MAY 2023

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 10/5/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23156
Job No. : VC66AC0052
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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23156
Job No. : VC66AC0052
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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23156

Job No. : VC66AC0052

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.2 |

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 | 16.7 |
| Flat | 22.5 |

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) | | | Acceptance Limits |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.5 | 0.6 | 0.6 | ± 1.5 |
| 1000 | 0.1 | 0.1 | 0.1 | ± 1.0 |
| 8000 | -2.0 | -2.0 | -2.0 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23156
Job No. : VC66AC0052
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 | 0.0 | ±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 | 0.0 | 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 | Anticipated Value (dB) | Measured Value (dB) | Deviated 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

Continuation of Calibration Certificate

Cert. No. : ACL23156
Job No. : VC66AC0052
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 | 28.0 | 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 |

Continuation of Calibration Certificate

Cert. No. : ACL23156
Job No. : VC66AC0052
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 |
| 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 | 128.0 | 0.0 | ±1.0 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±3.0 |
| 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 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23156
Job No. : VC66AC0052
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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn 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. : ACL23215

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00531293 / 23025 / 32969
ID No.: - NVH.FS0129

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 21 JUNE 2023
Calibration Date : 04-05 JULY 2023
Date of Issue : 06 JULY 2023

| | |
|----------------|--------------------|
| REVIEW BY | <i>Manakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 4/7/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23215

Job No. : VC66AC0071

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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23215
Job No. : VC66AC0071
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 | ✓ | - | 0.3 | 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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23215
Job No. : VC66AC0071
Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 94.0 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 13.4 |

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

| Frequency Weighting | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 7.8 |
| C - weight | 13.2 |
| Flat | 19.2 |

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 | ± 1.0 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 0.7 |
| 8000 | 0.0 | 0.1 | 0.1 | + 1.5, - 2.5 |

Continuation of Calibration Certificate

Cert. No. : ACL23215
Job No. : VC66AC0071
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 | 0.0 | ±1.0 |
| 125 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 500 | 0.0 | 0.0 | -0.1 | ±1.0 |
| 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 | + 1.5, - 2.5 |
| 16000 | -0.1 | -1.3 | -1.2 | + 2.5, -16.0 |

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 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23215
Job No. : VC66AC0071
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 | ±0.8 |
| 136.0 | 136.1 | 0.1 | ±0.8 |
| 135.0 | 135.1 | 0.1 | ±0.8 |
| 134.0 | 134.1 | 0.1 | ±0.8 |
| 133.0 | 133.0 | 0.0 | ±0.8 |
| 132.0 | 132.0 | 0.0 | ±0.8 |
| 131.0 | 131.0 | 0.0 | ±0.8 |
| 129.0 | 129.0 | 0.0 | ±0.8 |
| 124.0 | 124.0 | 0.0 | ±0.8 |
| 119.0 | 119.0 | 0.0 | ±0.8 |
| 114.0 | 114.0 | 0.0 | ±0.8 |
| 109.0 | 109.0 | 0.0 | ±0.8 |
| 104.0 | 104.1 | 0.1 | ±0.8 |
| 99.0 | 99.0 | 0.0 | ±0.8 |
| 94.0 | 94.0 | 0.0 | ±0.8 |
| 89.0 | 89.0 | 0.0 | ±0.8 |
| 84.0 | 84.0 | 0.0 | ±0.8 |
| 79.0 | 79.0 | 0.0 | ±0.8 |
| 74.0 | 74.0 | 0.0 | ±0.8 |
| 69.0 | 69.0 | 0.0 | ±0.8 |
| 64.0 | 64.0 | 0.0 | ±0.8 |
| 59.0 | 59.0 | 0.0 | ±0.8 |
| 54.0 | 54.0 | 0.0 | ±0.8 |
| 49.0 | 49.0 | 0.0 | ±0.8 |
| 44.0 | 44.0 | 0.0 | ±0.8 |
| 39.0 | 39.0 | 0.0 | ±0.8 |
| 34.0 | 34.0 | 0.0 | ±0.8 |
| 30.0 | 30.0 | 0.0 | ±0.8 |
| 29.0 | 29.0 | 0.0 | ±0.8 |
| 28.0 | 28.0 | 0.0 | ±0.8 |
| 27.0 | 27.0 | 0.0 | ±0.8 |
| 26.0 | 26.0 | 0.0 | ±0.8 |
| 25.0 | 25.0 | 0.0 | ±0.8 |

Continuation of Calibration Certificate

 Cert. No. : ACL23215
 Job No. : VC66AC0071
 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 | ±0.8 |

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 | 1.0 ; -3.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -1.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±0.5 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -3.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±0.5 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.0 ; -3.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -1.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±0.5 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| One | 136.4 | 136.2 | -0.2 | ±2.0 |

| 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 | ±1.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23215

Job No. : VC66AC0071

Pages : 8 of 8

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.8 | 89.6 | -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 | ±0.1 |

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23216

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00531294 / 23043 / 32970
ID No.: - NKHLFS0130

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 21 JUNE 2023
Calibration Date : 04-05 JULY 2023
Date of Issue : 06 JULY 2023

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 4/7/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23216
Job No. : VC66AC0071
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 :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 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 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. : ACL23216
Job No. : VC66AC0071
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 | ✓ | - | 0.3 | 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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23216
Job No. : VC66AC0071
Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 94.0 | 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 | 9.9 |
| C - weight | 14.5 |
| Flat | 20.4 |

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 | ± 1.0 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 0.7 |
| 8000 | -0.5 | -0.4 | -0.4 | + 1.5, - 2.5 |

Continuation of Calibration Certificate

Cert. No. : ACL23216

Job No. : VC66AC0071

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 | 0.0 | ±1.0 |
| 125 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 500 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 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 | 0.1 | 0.1 | + 1.5, - 2.5 |
| 16000 | 0.0 | -1.2 | -1.2 | + 2.5, -16.0 |

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 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) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 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 Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.1 |

Continuation of Calibration Certificate

Cert. No. : ACL23216

Job No. : VC66AC0071

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 | ±0.8 |
| 136.0 | 136.0 | 0.0 | ±0.8 |
| 135.0 | 135.0 | 0.0 | ±0.8 |
| 134.0 | 134.0 | 0.0 | ±0.8 |
| 133.0 | 133.0 | 0.0 | ±0.8 |
| 132.0 | 132.0 | 0.0 | ±0.8 |
| 131.0 | 131.0 | 0.0 | ±0.8 |
| 129.0 | 129.0 | 0.0 | ±0.8 |
| 124.0 | 124.0 | 0.0 | ±0.8 |
| 119.0 | 119.0 | 0.0 | ±0.8 |
| 114.0 | 114.0 | 0.0 | ±0.8 |
| 109.0 | 109.0 | 0.0 | ±0.8 |
| 104.0 | 104.0 | 0.0 | ±0.8 |
| 99.0 | 99.0 | 0.0 | ±0.8 |
| 94.0 | 94.0 | 0.0 | ±0.8 |
| 89.0 | 89.0 | 0.0 | ±0.8 |
| 84.0 | 84.0 | 0.0 | ±0.8 |
| 79.0 | 79.0 | 0.0 | ±0.8 |
| 74.0 | 74.0 | 0.0 | ±0.8 |
| 69.0 | 69.0 | 0.0 | ±0.8 |
| 64.0 | 64.0 | 0.0 | ±0.8 |
| 59.0 | 59.0 | 0.0 | ±0.8 |
| 54.0 | 54.0 | 0.0 | ±0.8 |
| 49.0 | 49.0 | 0.0 | ±0.8 |
| 44.0 | 44.0 | 0.0 | ±0.8 |
| 39.0 | 39.0 | 0.0 | ±0.8 |
| 34.0 | 34.0 | 0.0 | ±0.8 |
| 30.0 | 30.0 | 0.0 | ±0.8 |
| 29.0 | 29.0 | 0.0 | ±0.8 |
| 28.0 | 28.0 | 0.0 | ±0.8 |
| 27.0 | 27.0 | 0.0 | ±0.8 |
| 26.0 | 26.0 | 0.0 | ±0.8 |
| 25.0 | 25.0 | 0.0 | ±0.8 |

Continuation of Calibration Certificate

Cert. No. : ACL23216
Job No. : VC66AC0071
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 | ±0.8 |

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 | 1.0 ; -3.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -1.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±0.5 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -3.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±0.5 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.0 ; -3.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -1.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±0.5 |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|---|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| One | 136.4 | 135.6 | -0.8 | ±2.0 |

| 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 | ±1.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23216

Job No. : VC66AC0071

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 | ±0.1 |

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

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 23 May 2023 CERTIFICATE NUMBER 192437

REVIEW BY *Monakom P.*

APPROVED BY *[Signature]*

NEXT CAL. DATE 22/6/24

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1

Test engineer:

Nigel Smith

Electronically signed:

[Signature]

doseBadge Reader

Instrument

Manufacturer: Cirrus Research plc
Model Number: RC:110A

Serial Number: 95969
Notes:

Calibration Procedure

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Date of Calibration: 22 May 2023

Functionality Results

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

Calibration Results

| | Level (dB) | Frequency (Hz) | Distortion (% THD + Noise) |
|-------------|------------|----------------|----------------------------|
| Initial | 114.45 | 998.8 | 0.49 |
| Adjusted | 114.00 | 998.8 | 1.14 |
| Uncertainty | ± 0.11 | ± 0.14 | ± 0.10 |
| Tolerances | ± 0.60 | ± 2.00 | ± 4.00 |

Environmental Conditions

Pressure: 101.51 kPa
Temperature: 21.9 °C
Humidity: 43.3 %

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. 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

ISSUED BY **Cirrus Research plc**DATE OF ISSUE **10 November 2023**CERTIFICATE NUMBER **202607**

REVIEW BY

M. M. P.

APPROVED BY

[Signature]

NEXT CAL DATE

9/11/24



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

N. Smith

Electronically signed:

[Signature]

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc**Notes:****Model:** RC:110A**Serial number:** 79625**Class:** 2

Test summary

Date of calibration: 10 November 2023

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 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(s) and frequency(ies) stated, 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 evaluation 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:

CERTIFICATE OF CALIBRATION

Certificate Number:

202607

Page 2 of 2

Environmental conditions

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

| | | | |
|---------------|---------------------|----------------------|------------------|
| Before | Pressure: 98.74 kPa | Temperature: 21.8 °C | Humidity: 40.4 % |
| After | Pressure: 98.75 kPa | Temperature: 22.7 °C | Humidity: 37.5 % |

Test equipment

| Equipment | Manufacturer | Model | Serial number |
|-----------------------|-----------------|-------|---------------|
| Distortion Meter | Keithley | 2015 | 0994818 |
| Acoustic Calibrator | Bruel and Kjaer | 4231 | 2610257 |
| Environmental Monitor | Comet | T7510 | 21962628 |

Acoustic Results

| | Expected | Sample 1 | Sample 2 | Sample 3 | Average | Deviation | Tolerance | Uncertainty |
|----------------|----------|----------|----------|----------|---------------|-----------|-----------|-------------|
| Level (dB) | 114.00 | 114.00 | 114.00 | 114.00 | 114.00 | 0.00 | ±0.75 | 0.11 dB |
| Distortion (%) | < 4.00 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | +4.00 | 0.13 % |
| Frequency (Hz) | 1000.0 | 1005.0 | 1005.0 | 1005.0 | 1005.0 | 5.0 | ±20.0 | 0.1 Hz |

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

Functionality Results

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

End of results

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-011-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 22016415
ID No: NKH_FS0108

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: 20 Jun 2023

Calibration date: 5 Jul 2023

Issue date: 7 Jul 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: $(23 \pm 3)^\circ\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0038-23, Certificate number: ER-0092-
22

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

| | |
|----------------|--------------------|
| REVIEW BY | <i>Naraleem P.</i> |
| APPROVED BY | <i>Wichon</i> |
| NEXT CAL. DATE | <i>7/7/24</i> |

Calibrated by

- ☐ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol
☒ Miss Ruangrumpai Phoommit



Approved Signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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: 22015688.
Dimension: Diameter 14 mm. Length 170 mm.

| Immersion Depth (mm) | Standard Reading (°C) | UUC Reading (°C) | Error (°C) | Uncertainty (°C) |
|----------------------------|-----------------------------|------------------------|---------------|---------------------|
| 80 | 20.039 | 20.0 | 0.0 | 0.099 |
| 80 | 25.051 | 25.0 | -0.1 | 0.099 |
| 80 | 30.046 | 30.0 | 0.0 | 0.099 |
| 80 | 35.040 | 35.0 | 0.0 | 0.099 |
| 80 | 40.035 | 40.0 | 0.0 | 0.099 |

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023940.
Dimension: Diameter 3.3 mm. Length 205 mm.

| Immersion Depth (mm) | Standard Reading (°C) | UUC Reading (°C) | Error (°C) | Uncertainty (°C) |
|----------------------------|-----------------------------|------------------------|---------------|---------------------|
| 110 | 20.039 | 20.1 | 0.1 | 0.099 |
| 110 | 25.051 | 25.1 | 0.0 | 0.099 |
| 110 | 30.045 | 30.1 | 0.1 | 0.099 |
| 110 | 35.039 | 35.1 | 0.1 | 0.099 |
| 110 | 40.034 | 40.1 | 0.1 | 0.099 |

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025032.
Dimension: Diameter 14 mm. Length 150 mm.

| Immersion Depth (mm) | Standard Reading (°C) | UUC Reading (°C) | Error (°C) | Uncertainty (°C) |
|----------------------------|-----------------------------|------------------------|---------------|---------------------|
| 75 | 20.039 | 20.1 | 0.1 | 0.099 |
| 75 | 25.052 | 25.0 | -0.1 | 0.099 |
| 75 | 30.045 | 29.9 | -0.1 | 0.099 |
| 75 | 35.040 | 34.8 | -0.2 | 0.099 |
| 75 | 40.035 | 39.8 | -0.2 | 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. : CT-009-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 22016409
ID No: NKH_FS0102

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: 29 May 2023
Calibration date: 05 Jun 2023
Issue date: 08 Jun 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

| | |
|----------------|-------------|
| REVIEW BY | Marakorn P. |
| APPROVED BY | [Signature] |
| NEXT CAL. DATE | 5/6/24 |

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-0038-23, Certificate number: ER-0092-22

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

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Certificate No. : CT-009-66
Page 2 of 2

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: 22025578.
Dimension: Diameter 14 mm. Length 170 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 80 | 20.008 | 19.8 | -0.2 | 0.099 |
| 80 | 25.009 | 24.8 | -0.2 | 0.099 |
| 80 | 29.999 | 29.8 | -0.2 | 0.099 |
| 80 | 34.999 | 34.8 | -0.2 | 0.099 |
| 80 | 39.997 | 39.8 | -0.2 | 0.099 |

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023953.
Dimension: Diameter 3.3 mm. Length 205 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 110 | 20.008 | 20.0 | 0.0 | 0.099 |
| 110 | 25.009 | 25.0 | 0.0 | 0.099 |
| 110 | 29.999 | 30.0 | 0.0 | 0.099 |
| 110 | 34.999 | 35.0 | 0.0 | 0.099 |
| 110 | 40.000 | 40.0 | 0.0 | 0.099 |

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025039.
Dimension: Diameter 14 mm. Length 150 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 75 | 20.008 | 20.0 | 0.0 | 0.099 |
| 75 | 25.009 | 24.9 | -0.1 | 0.099 |
| 75 | 29.999 | 29.8 | -0.2 | 0.099 |
| 75 | 34.999 | 34.7 | -0.3 | 0.099 |
| 75 | 40.000 | 39.7 | -0.3 | 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. : CDT-044-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 18006593
ID No: NKH_FS0032

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: 07 Aug 2023
Calibration date: 09 Aug 2023
Issue date: 10 Aug 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0038-23, Certificate number: ER-0092-
22

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

REVIEW BY Marakorn P.
APPROVED BY [Signature]
NEXT CAL. DATE 9/8/24

Calibrated by

- ☐ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol
☒ Miss Ruangrumpai Phoommit



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

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: 18005276.
Dimension: Diameter 14 mm. Length 170 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 80 | 20.039 | 20.1 | 0.1 | 0.099 |
| 80 | 25.033 | 25.0 | 0.0 | 0.099 |
| 80 | 30.024 | 30.0 | 0.0 | 0.099 |
| 80 | 35.016 | 35.0 | 0.0 | 0.099 |
| 80 | 40.013 | 40.0 | 0.0 | 0.099 |

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18009543.
Dimension: Diameter 3.3 mm. Length 205 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 110 | 20.039 | 20.0 | 0.0 | 0.099 |
| 110 | 25.033 | 25.0 | 0.0 | 0.099 |
| 110 | 30.023 | 30.0 | 0.0 | 0.099 |
| 110 | 35.016 | 35.0 | 0.0 | 0.099 |
| 110 | 40.014 | 40.0 | 0.0 | 0.099 |

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18007689.
Dimension: Diameter 14 mm. Length 150 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 75 | 20.039 | 20.1 | 0.1 | 0.099 |
| 75 | 25.032 | 25.0 | 0.0 | 0.099 |
| 75 | 30.023 | 29.9 | -0.1 | 0.099 |
| 75 | 35.016 | 34.8 | -0.2 | 0.099 |
| 75 | 40.013 | 39.8 | -0.2 | 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. : CDT-043-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 18006592
ID No: NKH_FS0031

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: 07 Aug 2023
Calibration date: 09 Aug 2023
Issue date: 10 Aug 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0038-23, Certificate number: ER-0092-
22

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

| | |
|----------------|--------------------|
| REVIEW BY | <i>Narakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | <i>9/8/24</i> |

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

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: 18007973.
Dimension: Diameter 14 mm. Length 170 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 80 | 20.017 | 20.0 | 0.0 | 0.099 |
| 80 | 25.028 | 25.0 | 0.0 | 0.099 |
| 80 | 30.025 | 30.0 | 0.0 | 0.099 |
| 80 | 35.018 | 35.0 | 0.0 | 0.099 |
| 80 | 40.009 | 40.0 | 0.0 | 0.099 |

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18009531.
Dimension: Diameter 3.3 mm. Length 205 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 110 | 20.017 | 20.1 | 0.1 | 0.099 |
| 110 | 25.027 | 25.1 | 0.1 | 0.099 |
| 110 | 30.025 | 30.1 | 0.1 | 0.099 |
| 110 | 35.018 | 35.1 | 0.1 | 0.099 |
| 110 | 40.009 | 40.1 | 0.1 | 0.099 |

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18003397.
Dimension: Diameter 14 mm. Length 150 mm.

| <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Reading</u> (°C) | <u>UUC</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--|---|--------------------------------------|----------------------|----------------------------|
| 75 | 20.017 | 20.2 | 0.2 | 0.099 |
| 75 | 25.027 | 25.0 | 0.0 | 0.099 |
| 75 | 30.025 | 29.9 | -0.1 | 0.099 |
| 75 | 35.018 | 34.8 | -0.2 | 0.099 |
| 75 | 40.009 | 39.7 | -0.3 | 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 ***





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23PH67

Page : 1 of 2

Equipment : Lux Meter
Manufacturer: Delta OHM
Model : HD 2102.2
Serial No.: 20032151
ID No.: NNG_FS0015
Condition As-Received: Used Item
Received Date: 30 January 2023
Calibration Date: 06 February 2023

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.

Reference: 2301-0978WSC
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 15) %

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-PH01 by measuring against
luminous-intensity standard lamp (source-based method) According to the inverse square law measurement
method.

Condition of this result of calibration

1.Reference standards instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|-------------------------------------|---------------|------------|-----------------|-------------|
| 1) Photometry & Encorder | LMguide 9,6 m | 120RC003 | DL-0064-22 | 20 Jul 2025 |
| 2) Luminous intensity standard lamp | OL FEL-U | F-1543 | TP-1022-22 | 01 May 2023 |

2.This result of calibration was made on requested at the point specified by customer.

3.Test Equipment : Programmable Voltage/Current Source (Model : OL83A, S/N : 16221394).

4.Test Equipment : Illuminance Meter (Model : 51002, S/N : 080129).

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

6.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

| | |
|----------------|--------------------|
| REVIEW BY | <i>Nantawat P</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 6/2/24 |

Calibrated by : Nivat Nitas
Issue Date : 08 February 2023

Approved Signatory :

- ☐ Phalinee Prabpaipal
☐ Chatchawan Khunpiluek
☒ Nuntawat Khamchai

B 0307762



Cert. No.: 23PH67

Page.: 2 of 2

Result of calibration:-

(*) Without adjustment () After adjustment

Function : Illuminance Measurement

Range : Autorange

| <u>Standard Value</u> | <u>UUC* Reading</u> | <u>Error</u> | <u>Uncertainty</u> |
|-----------------------|---------------------|--------------|--------------------|
| (lx) | (lx) | (lx) | (± lx) |
| 0 | 0.00 | 0.00 | 0.060 |
| 15 | 15.28 | 0.28 | 0.39 |
| 100 | 100.76 | 0.76 | 2.6 |
| 500 | 501.3 | 1.3 | 13 |
| 1000 | 1001.8 | 1.8 | 26 |
| 2000 | 1987.4 | -12.6 | 52 |
| 3000 | 2955 | -45 | 78 |
| 4000 | 3906 | -94 | 0.11 klx |
| 5000 | 4856 | -144 | 0.14 klx |

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 %

Calibration with Probe S/N.: 20027124

UUC* = Unit Under Calibration.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 24PH23

Page : 1 of 2

Equipment : Lux Meter
Manufacturer: PEAKMETER
Model : PM6612L
Serial No.: H12A-K20123
ID No.: NKH_FS0086
Condition As-Received: Used Item
Received Date: 11 January 2024
Calibration Date: 16 January 2024
Reference: 2401-0335WSC
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 15) %

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.

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

Procedure used: Calibration were conducted using calibration procedure No. CP-PH01 based on inverse square law technique.

Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------------------------|---------------|-------------------|------------------------|-----------------|
| 1) Photometry & Encorder | LMguide 9,6 m | 120RC003 | DL-0064-22 | 20 Jul 2025 |
| 2) High-accuracy Irradiance Standard | OL-FEL-U | F-1473 | TP-1028-23 | 14 Feb 2024 |

2.This result of calibration was made on requested at the point specified by customer.

3.Test Equipment : Programmable Voltage/Current Source (Model : OL83A, S/N : 16221394).

4.Test Equipment : Illuminance Meter (Model : 51002, S/N : 080129).

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

6.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144



Calibrated by : Nivat Nitas
Issue Date : 18 January 2024

Approved Signatory :

[] Phalinee Prabpaipal
[] Chatchawan Khunpiluek
☒ Nuntawat Khamchai

B 0332885



Cert. No.: 24PH23

Page.: 2 of 2

Result of calibration:- () Without adjustment (*) After adjustment

Function : Illuminance Measurement

Range : Autorange

| <u>Standard Value</u> | <u>Before Adjust</u> | <u>After Adjust</u> | <u>Error</u> | <u>Uncertainty</u> |
|-----------------------|----------------------|---------------------|--------------|--------------------|
| | <u>UUC* Reading</u> | <u>UUC* Reading</u> | | |
| (lx) | (lx) | (lx) | (lx) | (± lx) |
| 0 | 0.00 | 0.00 | 0.00 | - |
| 15 | - | 14.95 | -0.05 | 0.20 |
| 100 | - | 99.6 | -0.4 | 1.3 |
| 500 | - | 499 | -1 | 6.5 |
| 1000 | 899 | 1002 | 2 | 13 |
| 2000 | - | 2030 | 30 | 26 |
| 3000 | - | 3070 | 70 | 39 |
| 4000 | - | 4110 | 110 | 52 |
| 5000 | 4640 | 5170 | 170 | 65 |

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 %

Before adjustment light source factor setting mode : $L0 = 1.042$

After adjustment light source factor setting mode : $L0 = 1.162$

UUC* = Unit Under Calibration.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH1369
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Hach
Model : HQ411d
Serial No. : 200100031163
ID No. : BKK_EN0342
Condition As-Received: Used Item
Received Date : 26 October 2023
Calibration Date : 27 October 2023
Reference : 2310-0865DSC-3
Submitted by :

| | |
|----------------|------------|
| REVIEW BY | Siriluk B. |
| APPROVED BY | Kd. A. |
| NEXT CAL. DATE | 27/10/24 |

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-CH8 by comparison with standard thermometer
Calibrated by : Warakorn Lerngagtrakul

Approved by :

Saithip

Approved Signatory

- (✓) Saithip Meangmai
() Warakorn Lerngagtrakul
() Ponpan Paipim

Issue Date :

31 October 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.



Cert.No.: 23CH1369

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

| <u>Instrument</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|------------------------------|-------------------|---------------|------------------|-----------------|
| 1) Ref. Standard Thermometer | 4982054 | 110RC044 | 23I908 | 26 Jul 2024 |

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

- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008 | CPA chem | 913598 | 14 July 2025 |
| pH 6.985 | CPA chem | 913599 | 14 July 2024 |
| pH 9.997 | CPA chem | 931961 | 30 Sep 2024 |

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

| <u>Unit Under Calibration</u> | <u>Standard pH Buffer Solution</u> | <u>Actual pH Reading</u> | <u>Actual mV Reading (mV)</u> | <u>Uncertainty of pH measurement (±)</u> | <u>Coverage factor k</u> |
|-----------------------------------|------------------------------------|--------------------------|---------------------------------|--|--------------------------|
| pH Electrode S/N.:230473042902 | 4.008 | 4.002 | 166.5 | 0.0044 | 2.00 |
| | 6.985 | 6.987 | -10.4 | 0.0084 | 2.00 |
| | 9.997 | 10.005 | -189.3 | 0.0071 | 2.00 |

Remark - Can not connect the BNC because the plug does not match with the socket.

Saithip

a 1187344



Cert.No.: 23CH1369

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PHC281
- Serial No. : 230473042902

Dimension of probe;

- Length : 103 mm
- Diameter : 12 mm
- Immersion Depth : 90 mm

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor <i>k</i> |
|--------------------------------|-----------------------------------|---------------------------|-----------------|---|--------------------------------|
| 25.0 | 25.002 | 25.1 | 0.098 | 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 %.

-o0o-

Saithip



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด
DOUBLE S DIAGNOSTICS CO., LTD.

4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10260 โทรศัพท์: (02) 747-7009 โทรสาร: (02) 747-7008
4 Soi Udomsuk 14, Bangna, Bangkok 10260 Tel. (02) 747-7009 Fax: (02) 747-7008

Maintenance Plan YEAR : 2023

| เดือน | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|
| รวม | | | | | | | 12/7 OK | | | | | |

Periodical maintenance check list for Konelab

| | 6M | 12M | Note! |
|---|-------------------------------------|-------------------------------------|-------|
| 1.Diluent-wash tubing change | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 2.ISE tubing change | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | none |
| 3.Syringe check/change | | <input checked="" type="checkbox"/> | |
| 4.Dispensing check/ change | | <input checked="" type="checkbox"/> | |
| 5.Waste tubing change when necessary | | <input checked="" type="checkbox"/> | |
| 6.Lamp check/change | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 7.Mixer paddle/paddle change(not Konelab20) | | <input checked="" type="checkbox"/> | |
| 8.ISE needles check/change | | <input checked="" type="checkbox"/> | none |
| 9.Pump tubing check/ chance | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 10.Broken/worn out part check /change | | <input checked="" type="checkbox"/> | |
| 11.Peristaltic pump check /cleaning/ lubrication | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 12.Heating check | | <input checked="" type="checkbox"/> | |
| 13.Cooling check | | <input checked="" type="checkbox"/> | |
| 14.Dispenser mechanic check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 15.Cuvette transfer mechanic check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 16.Dispenser movement check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 17.Sample/reagent register check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 18.Dispensing tubing tightness check | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 19.Photometer and optics cleaning/check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 20.Workstation PC cleaning if necessary | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 21.Mechanic cleaning/lubrication | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 22.Instrument cleaning if necessary | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 23.Complete analyzer testing with waterblank/QC or sample | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 24.Test parameters/Adjustment/config. Save to USB key | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 25.UPS Test | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

Place: ALS LAB Instrument: k90 Aquakem
Date/Time: 12/7/66 Serial no: 22781
Service done by: ๒๓๖๕ Install date:
Signature of customer: ๒๓๖๕ Date/Time: 12/7/66

Laboratory
Analyzer User

7/12/2023 21:21

Performed 7/12/2023
Lot W166

=====

ACCEPTANCE CRITERIA

=====

| | Result | Limit | Warning |
|--------------------------------|--------|--------------|---------|
| Temperature (?C) | 37.7 | 37.0 +/- 1.0 | |
| Dispensing ratio | 16.4 | 14.8 - 17.2 | |
| CV% | 1.17 | <1.7 | |
| Photometric noise | | | |
| Max SD L340_2 (mA) | 0.19 | <2.0 | |
| Max SD L340_4 (mA) | 1.06 | <3.0 | |
| Linearity of photometer | | | |
| Slope | 1.0188 | 0.94 - 1.06 | |
| Curvature | 0.0035 | +/- 0.02 | |
| Max bias from linear fit (mA) | 3.2 | <15.0 | |
| Max delta % | -2.0 | +/- 6.0 | |
| Linearity of sample dispensing | | | |
| Proport. volume XDISP2 (?l) | 2.06 | 1.96 - 2.16 | |
| Proport. volume XDISP4 (?l) | 4.13 | 3.85 - 4.40 | |
| XDISP2 CV% | 0.58 | <2.0 | |
| XDISP4 CV% | 0.70 | <2.0 | |
| XDISP10 CV% | 0.59 | <2.0 | |
| Needle 0 ?l volume | | | |
| Average (A) | 0.009 | <0.050 | |
| Standard deviation (A) | 0.002 | <0.005 | |
| Volume (?l) | 0.06 | <0.32 | |

=====

OTHER INFORMATION

=====

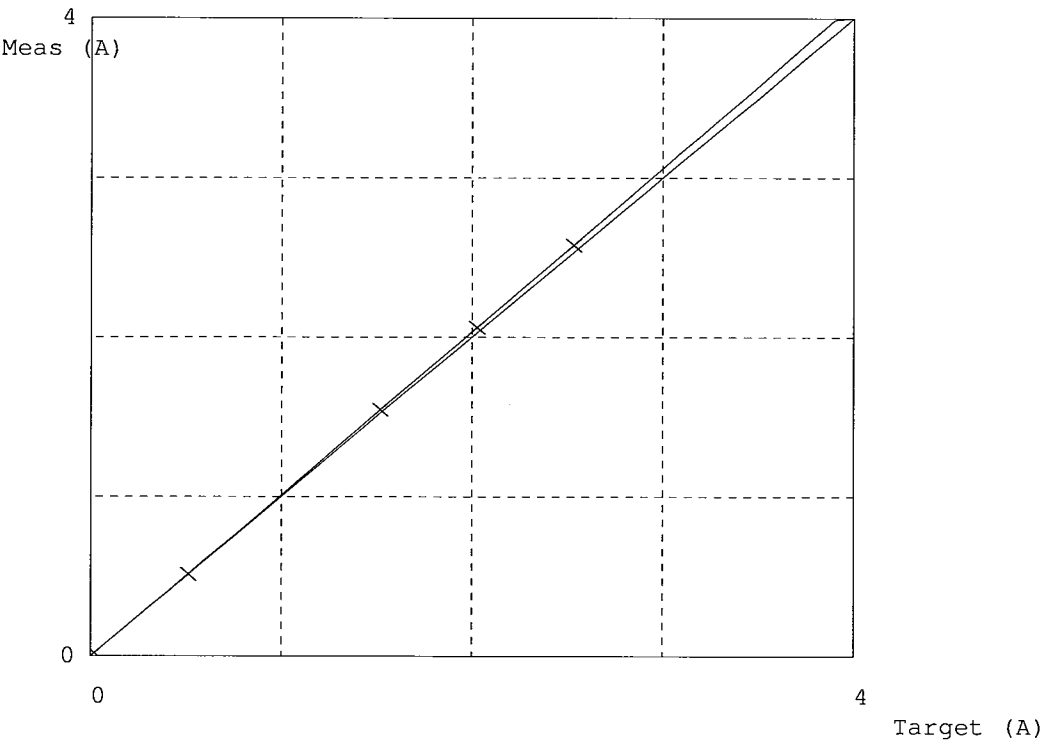
| Dispensing ratio | | Photom., noise: SD (mA) | |
|------------------|------------|-------------------------|---------------|
| Posit | Result (A) | Posit | L340_2 L340_4 |
| 1 | 0.1592 | 1 | 0.07 0.64 |
| 2 | 0.1624 | 2 | 0.09 1.06 |
| 3 | 0.1631 | 3 | 0.14 0.50 |
| 4 | 0.1631 | 4 | 0.13 0.53 |
| 5 | 0.1625 | 5 | 0.19 0.38 |
| 6 | 0.1650 | 6 | 0.02 0.64 |

Linearity of sample dispensing

| | |
|---------|----------------|
| Test | Absorbance (A) |
| XDISP2 | 0.311 |
| XDISP4 | 0.616 |
| XDISP10 | 1.478 |

Linearity of photometer

| | | | | |
|-------|------------|----------|-----------|---------|
| L340_ | Target (A) | Meas (A) | Delta (A) | Delta % |
| 1 | 0.001 | 0.005 | -0.004 | -394.7 |
| 2 | 0.512 | 0.519 | -0.007 | -1.5 |
| 3 | 1.523 | 1.550 | -0.027 | -1.8 |
| 4 | 2.027 | 2.066 | -0.039 | -1.9 |
| 5 | 2.532 | 2.582 | -0.050 | -2.0 |





REVIEW BY Autcharawan S.
APPROVED BY Tanyatorn M.
NEXT CAL. DATE 12 Jan 2025

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.



Operator Signature: Nutdanai

Date: Jan 12, 2024

(Mr. Nutdanai Laekhwan)

Application Chemist

Certificate No. T240742

Page 1 of 5

Certificate of Calibration

Equipment : Digestion Unit

Manufacturer : SCP Science

Model : DigiPRER HT

Serial No. : HTC1120480658

Customer Code : BKK_EN0366

ID No. : T2635A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

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



Customer Location : Wet Chemistry Lab 1

Date of Receipt : 11 April 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 02 MAY 2024

| | |
|----------------|---|
| REVIEW BY |  |
| APPROVED BY |  |
| NEXT CAL. DATE | 21/04/25 |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T240742

Page 2 of 5

Calibration Report

Equipment : Digestion Unit
Date of Calibration : 21 April 2024
Environment : Temperature : 23.9 - 26.3 °C
Line Voltage : 221.8 - 225.9 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.
was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|-------------------|-----------------|-------------|
| TC | Type S | M20A2-(CH11-CH14) | T230886 | 09 May 2024 |
| DATA LOGGER | 34970A | T47 | T230886 | 09 May 2024 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 6 Minute At 380 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

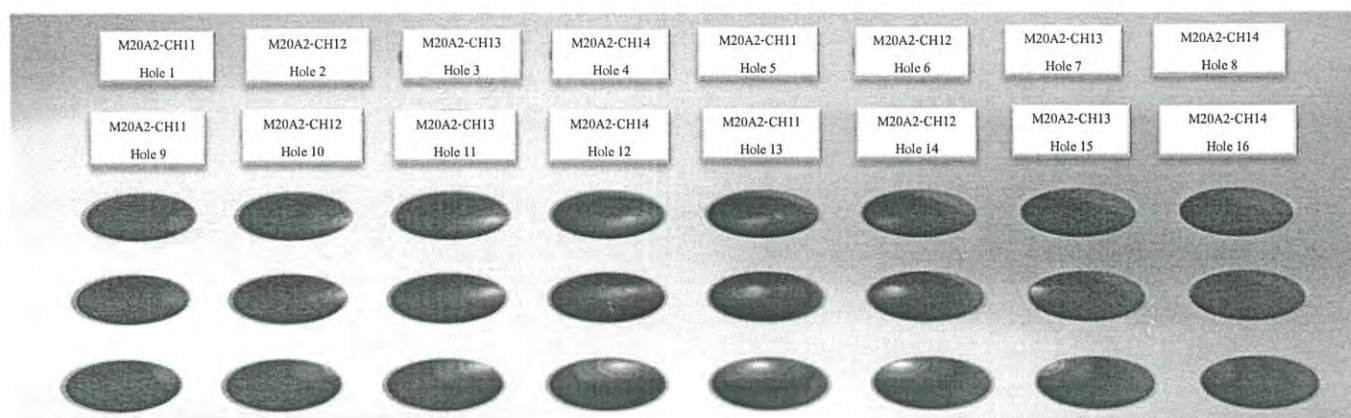
() after adjustment

Approved By. Forzan

Certificate No. T240742

Page 3 of 5

Calibration Report



FRONT

Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Standards at Block | | | | | | | |
|------------|---------|---------------|----------------|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| (°C) | (°C) | (°C) | Reading | M20A2-CH11 Hole 1 | M20A2-CH12 Hole 2 | M20A2-CH13 Hole 3 | M20A2-CH14 Hole 4 | M20A2-CH11 Hole 5 | M20A2-CH12 Hole 6 | M20A2-CH13 Hole 7 | M20A2-CH14 Hole 8 |
| 380.0 | 380.0 | 379.2 - 380.5 | Max °C | 378.7 | 378.9 | 377.9 | 378.7 | 380.5 | 379.8 | 378.7 | 377.4 |
| | | | Min °C | 378.2 | 378.5 | 377.5 | 378.2 | 380.1 | 379.3 | 378.3 | 376.9 |
| | | | Average °C | 378.4 | 378.7 | 377.7 | 378.4 | 380.3 | 379.6 | 378.5 | 377.2 |
| | | | Stability ± °C | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 |

| Cal. Point | Setting | Reading | STD. | Position of Standards at Block | | | | | | | |
|------------|---------|---------------|----------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C) | (°C) | (°C) | Reading | M20A2-CH11 Hole 9 | M20A2-CH12 Hole 10 | M20A2-CH13 Hole 11 | M20A2-CH14 Hole 12 | M20A2-CH11 Hole 13 | M20A2-CH12 Hole 14 | M20A2-CH13 Hole 15 | M20A2-CH14 Hole 16 |
| 380.0 | 380.0 | 379.2 - 380.5 | Max °C | 378.4 | 378.6 | 379.2 | 379.6 | 381.9 | 380.6 | 379.1 | 378.1 |
| | | | Min °C | 377.8 | 378.2 | 378.7 | 379.2 | 381.4 | 379.9 | 378.3 | 377.2 |
| | | | Average °C | 378.1 | 378.4 | 379.0 | 379.4 | 381.6 | 380.3 | 378.7 | 377.7 |
| | | | Stability ± °C | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 |

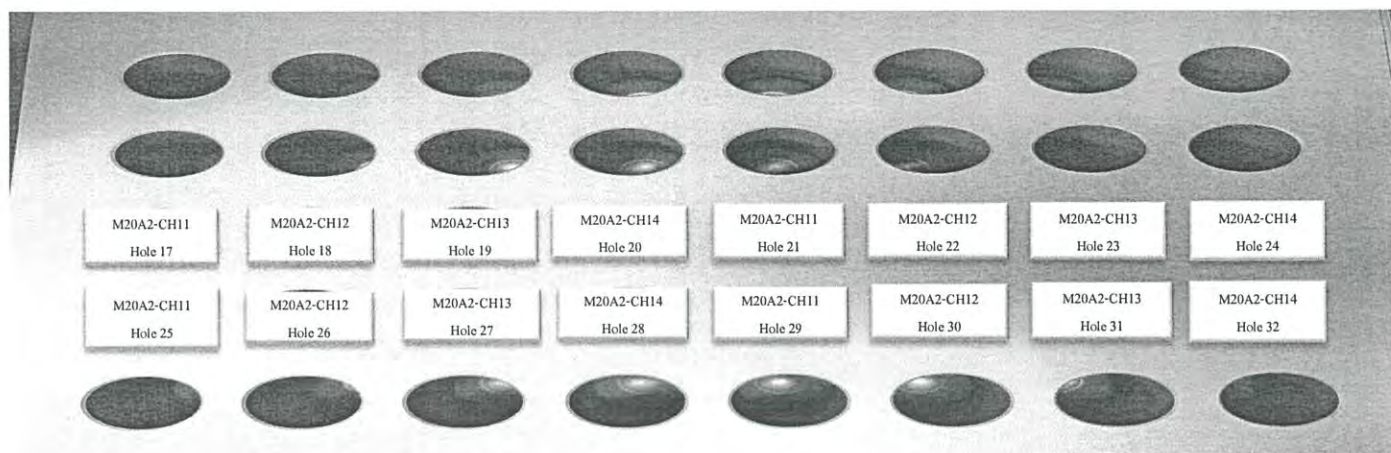
Approved By _____



Certificate No. T240742

Page 4 of 5

Calibration Report




FRONT

Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Standards at Block | | | | | | | |
|------------|---------|---------------|----------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C) | (°C) | (°C) | Reading | M20A2-CH11 Hole 17 | M20A2-CH12 Hole 18 | M20A2-CH13 Hole 19 | M20A2-CH14 Hole 20 | M20A2-CH11 Hole 21 | M20A2-CH12 Hole 22 | M20A2-CH13 Hole 23 | M20A2-CH14 Hole 24 |
| 380.0 | 380.0 | 379.2 - 380.5 | Max °C | 378.9 | 379.2 | 379.5 | 380.1 | 382.1 | 381.0 | 378.9 | 377.8 |
| | | | Min °C | 378.2 | 378.6 | 379.1 | 379.6 | 381.7 | 380.2 | 378.3 | 377.2 |
| | | | Average °C | 378.5 | 378.9 | 379.3 | 379.8 | 381.9 | 380.6 | 378.6 | 377.5 |
| | | | Stability ± °C | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.4 | 0.3 | 0.3 |

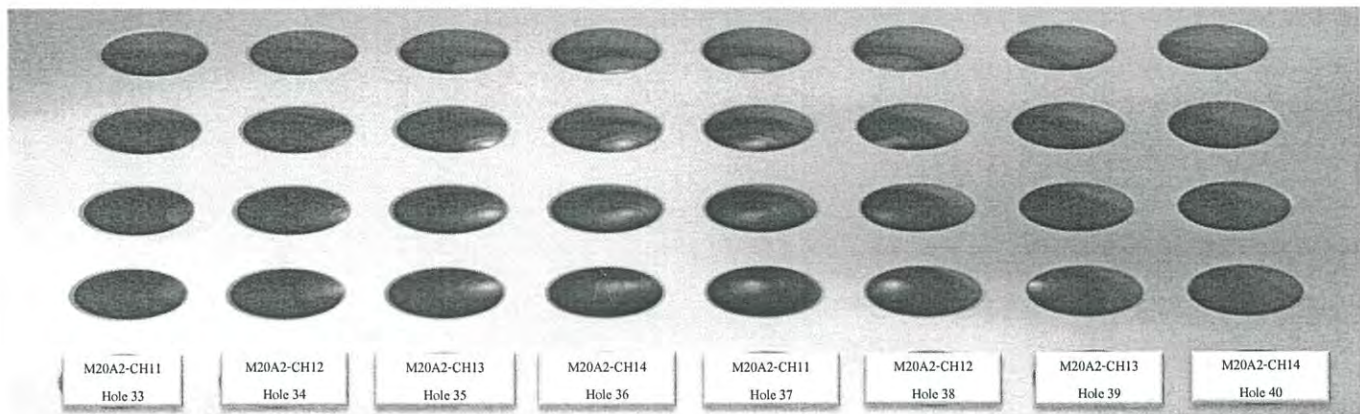
| Cal. Point | Setting | Reading | STD. | Position of Standards at Block | | | | | | | |
|------------|---------|---------------|----------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C) | (°C) | (°C) | Reading | M20A2-CH11 Hole 25 | M20A2-CH12 Hole 26 | M20A2-CH13 Hole 27 | M20A2-CH14 Hole 28 | M20A2-CH11 Hole 29 | M20A2-CH12 Hole 30 | M20A2-CH13 Hole 31 | M20A2-CH14 Hole 32 |
| 380.0 | 380.0 | 379.2 - 380.5 | Max °C | 378.5 | 378.1 | 378.0 | 378.6 | 380.7 | 379.7 | 377.7 | 380.9 |
| | | | Min °C | 378.2 | 377.8 | 377.7 | 378.1 | 380.3 | 379.0 | 377.2 | 380.4 |
| | | | Average °C | 378.4 | 378.0 | 377.9 | 378.4 | 380.5 | 379.4 | 377.5 | 380.6 |
| | | | Stability ± °C | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.3 |

Approved By. 

Certificate No. T240742

Page 5 of 5

Calibration Report



FRONT

Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Standards at Block | | | | | | | |
|------------|---------|---------------|----------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C) | (°C) | (°C) | Reading | M20A2-CH11 Hole 33 | M20A2-CH12 Hole 34 | M20A2-CH13 Hole 35 | M20A2-CH14 Hole 36 | M20A2-CH11 Hole 37 | M20A2-CH12 Hole 38 | M20A2-CH13 Hole 39 | M20A2-CH14 Hole 40 |
| 380.0 | 380.0 | 379.2 - 380.5 | Max °C | 378.3 | 377.9 | 378.7 | 379.5 | 381.6 | 380.5 | 378.4 | 378.0 |
| | | | Min °C | 378.0 | 377.6 | 378.4 | 379.1 | 381.2 | 380.0 | 378.1 | 377.6 |
| | | | Average °C | 378.2 | 377.8 | 378.6 | 379.3 | 381.4 | 380.3 | 378.2 | 377.8 |
| | | | Stability ± °C | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |

The expanded uncertainty of temperature measurement was ± 1.87 °C

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By. _____





บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด
DOUBLE S DIAGNOSTICS CO., LTD.

4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10260 โทรศัพท์: (02) 747-7009 โทรสาร: (02) 747-7008
4 Soi Udomsuk 14, Bangna, Bangkok 10260 Tel. (02) 747-7009 Fax: (02) 747-7008

Maintenance Plan YEAR : 2023

| เดือน | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|
| รวม | | | | | | | 12/7 ck | | | | | |

Periodical maintenance check list for Konelab

| | 6M | 12M | Note! |
|---|-------------------------------------|-------------------------------------|------------|
| 1.Diluent-wash tubing change | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 2.ISE tubing change | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | none |
| 3.Syringe check/change | | <input checked="" type="checkbox"/> | |
| 4.Dispensing check/ change | | <input checked="" type="checkbox"/> | |
| 5.Waste tubing change when necessary | | <input checked="" type="checkbox"/> | |
| 6.Lamp check/change | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 7.Mixer paddle/paddle change(not Konelab20) | | <input checked="" type="checkbox"/> | |
| 8.ISE needles check/change | | <input checked="" type="checkbox"/> | none |
| 9.Pump tubing check/ chance | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 10.Broken/worn out part check /change | | <input checked="" type="checkbox"/> | |
| 11.Peristaltic pump check /cleaning/ lubrication | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 12.Heating check | | <input checked="" type="checkbox"/> | |
| 13.Cooling check | | <input checked="" type="checkbox"/> | |
| 14.Dispenser mechanic check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 15.Cuvette transfer mechanic check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 16.Dispenser movement check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 17.Sample/reagent register check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 18.Dispensing tubing tightness check | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 19.Photometer and optics cleaning/check/adjustment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 20.Workstation PC cleaning if necessary | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 21.Mechanic cleaning/lubrication | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 22.Instrument cleaning if necessary | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 23.Complete analyzer testing with waterblank/QC or sample | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 24.Test parameters/Adjustment/config. Save to USB key | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 25.UPS Test | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

Place: ALS LAB Instrument: k90 Aquakem
Date/Time: 12/7/66 Serial no: 22781
Service done by: ๒๓๖๕ Install date:
Signature of customer: ๒๓๖๕ Date/Time: 12/7/66

Laboratory
Analyzer User

7/12/2023 21:21

Performed 7/12/2023
Lot W166

=====

ACCEPTANCE CRITERIA

=====

| | Result | Limit | Warning |
|--------------------------------|--------|--------------|---------|
| Temperature (?C) | 37.7 | 37.0 +/- 1.0 | |
| Dispensing ratio | 16.4 | 14.8 - 17.2 | |
| CV% | 1.17 | <1.7 | |
| Photometric noise | | | |
| Max SD L340_2 (mA) | 0.19 | <2.0 | |
| Max SD L340_4 (mA) | 1.06 | <3.0 | |
| Linearity of photometer | | | |
| Slope | 1.0188 | 0.94 - 1.06 | |
| Curvature | 0.0035 | +/- 0.02 | |
| Max bias from linear fit (mA) | 3.2 | <15.0 | |
| Max delta % | -2.0 | +/- 6.0 | |
| Linearity of sample dispensing | | | |
| Proport. volume XDISP2 (?l) | 2.06 | 1.96 - 2.16 | |
| Proport. volume XDISP4 (?l) | 4.13 | 3.85 - 4.40 | |
| XDISP2 CV% | 0.58 | <2.0 | |
| XDISP4 CV% | 0.70 | <2.0 | |
| XDISP10 CV% | 0.59 | <2.0 | |
| Needle 0 ?l volume | | | |
| Average (A) | 0.009 | <0.050 | |
| Standard deviation (A) | 0.002 | <0.005 | |
| Volume (?l) | 0.06 | <0.32 | |

=====

OTHER INFORMATION

=====

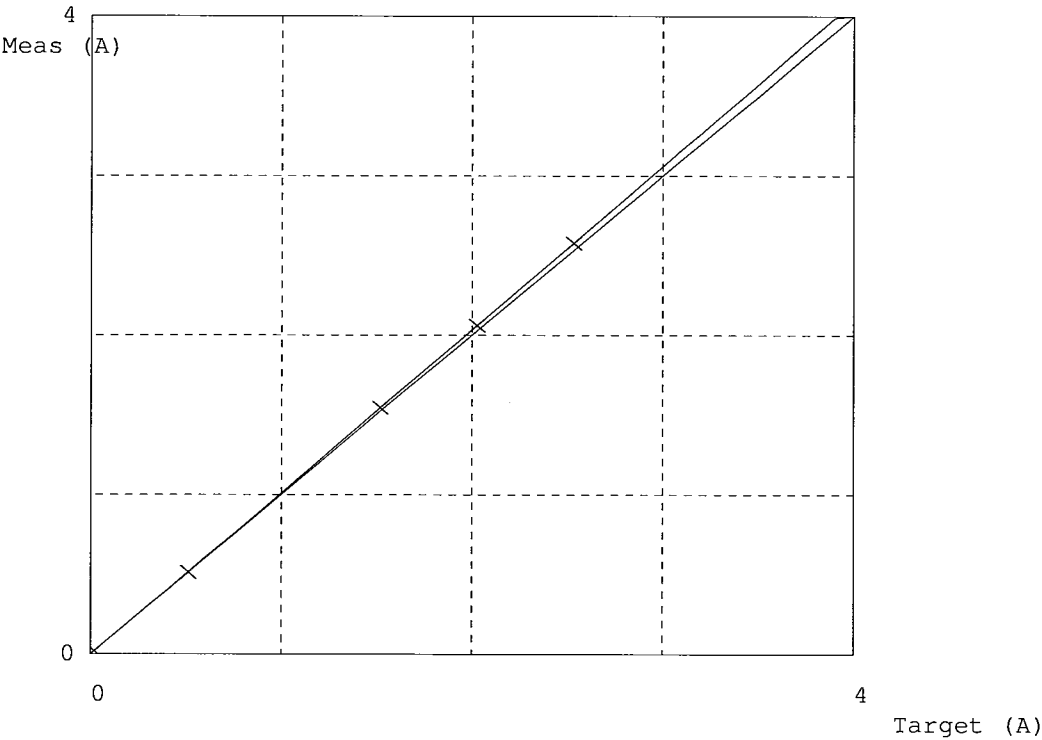
| Dispensing ratio | | Photom., noise: SD (mA) | |
|------------------|------------|-------------------------|---------------|
| Posit | Result (A) | Posit | L340_2 L340_4 |
| 1 | 0.1592 | 1 | 0.07 0.64 |
| 2 | 0.1624 | 2 | 0.09 1.06 |
| 3 | 0.1631 | 3 | 0.14 0.50 |
| 4 | 0.1631 | 4 | 0.13 0.53 |
| 5 | 0.1625 | 5 | 0.19 0.38 |
| 6 | 0.1650 | 6 | 0.02 0.64 |

Linearity of sample dispensing

| | |
|---------|----------------|
| Test | Absorbance (A) |
| XDISP2 | 0.311 |
| XDISP4 | 0.616 |
| XDISP10 | 1.478 |

Linearity of photometer

| | | | | |
|-------|------------|----------|-----------|---------|
| L340_ | Target (A) | Meas (A) | Delta (A) | Delta % |
| 1 | 0.001 | 0.005 | -0.004 | -394.7 |
| 2 | 0.512 | 0.519 | -0.007 | -1.5 |
| 3 | 1.523 | 1.550 | -0.027 | -1.8 |
| 4 | 2.027 | 2.066 | -0.039 | -1.9 |
| 5 | 2.532 | 2.582 | -0.050 | -2.0 |



Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com



NSC-TISI-TIS 17025

CALIBRATION 0426

SARTORIUS

Certificate

of Calibration

| | |
|----------------|-----------|
| REVIEW BY | Sinluk P. |
| APPROVED BY | KLAL |
| NEXT CAL. DATE | 09/08/24 |

Model Number : MSE224S-100-DU

Certificate No. : 23BCI0310

Description : Analytical Balance

Issued Date : Friday, August 11, 2023

Serial Number : 27405555

Reference No. : 216011

ID No.: BKK_EN0003

Manufacturer : Sartorius

Page No. : 1 Of 2

Customer Name : ALS Laboratory Group (Thailand)Co., Ltd.

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

Calibrated Place : Lab Room

Calibrated By : Mr.Chonchai Inthana

Calibration Date : Wednesday, August 09, 2023

Calibration

Procedure No. : This calibration was conducted by

Using in-house calibration procedure number (WI-003)

Based on UKAS LAB 14 : 2019

Metrological data :

Capacity : 220 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 22.8 °C ± 5.0 °C

Humidity : 59.0 % RH ± 10.0 % RH

Pressure : ±

Reasons for calibration☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance**Equipment Condition:** ☒ Good Operate ☐ Fair**Measurement Method UKAS Publication Ref :Lab 14**

The measurement uncertainty stated is the expended 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 form list of Sartorius Metrological Specifications.

Traceability:

| Model Number | Description | Traceability | Certificate No. | Due Date |
|---------------|---|--------------|-----------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2,YCS011-522-00 | SPC-RT | C02212565 | 14-Sep-2023 |
| MHB-382SD | Humidity/Barometer/Temp Lutron MHB-382SD | DKSH | C19220444 | 5-Sep-2023 |

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.

Mr.chonchai Inthana(Technical Manager)

S
T
A
M
P

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DUDescription : Analytical BalanceSerial Number : 27405555ID No. : BKK_EN0003Manufacturer : SartoriusCertificate No. : 23BCI0310Issued Date : Friday, August 11, 2023Reference No. : 216011Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

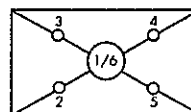
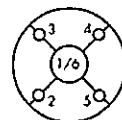
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

| | | |
|-----------------------------|---------|----------|
| Nominal Value : (Low Load) | 20.0000 | 200.0000 |
| 20 g | 20.0000 | 200.0000 |
| Tolerance | 20.0000 | 200.0000 |
| 0.0001 g | 20.0000 | 200.0001 |
| | 20.0000 | 200.0001 |
| Nominal Value : (High Load) | 19.9999 | 200.0001 |
| 200 g | 20.0000 | 200.0000 |
| Tolerance | 20.0000 | 200.0001 |
| 0.0001 g | 20.0000 | 200.0001 |
| | 20.0000 | 200.0001 |
| | 20.0000 | 200.0000 |
| Standard Deviation | 0.00003 | 0.00005 |

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : 100 g
Tolerance 0.0004 g



Difference

| | |
|---|--------|
| 1 | — |
| 2 | 0.0001 |
| 3 | 0.0000 |
| 4 | 0.0000 |
| 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 | 0.00014 |
| 0.1 | 0.1000 | 0.1000 | 0.0000 | 0.00014 |
| 1 | 1.0000 | 1.0000 | 0.0000 | 0.00014 |
| 2 | 2.0000 | 2.0000 | 0.0000 | 0.00014 |
| 5 | 5.0000 | 5.0000 | 0.0000 | 0.00014 |
| 10 | 10.0000 | 10.0000 | 0.0000 | 0.00014 |
| 20 | 20.0000 | 20.0000 | 0.0000 | 0.00014 |
| 50 | 50.0000 | 50.0001 | 0.0001 | 0.00015 |
| 100 | 100.0000 | 100.0000 | 0.0000 | 0.00019 |
| 200 | 200.0000 | 200.0001 | 0.0001 | 0.00030 |

End of Report.



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T232009

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF110

Serial No. : B423.1549

Customer Code : BKK_EN0425

ID No. : T4671A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250


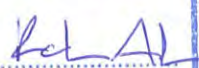
Customer Location : Oven Room

Date of Receipt : 1 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 NOV 2023

| | |
|----------------|---|
| REVIEW BY |  |
| APPROVED BY |  |
| NEXT CAL. DATE | 06/11/24 |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T232009

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 6 November 2023
Environment : Temperature : 27.6-28.1 °C
Line Voltage : 222.7-227.4 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber, the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|---------|----------------|-----------------|---------------|
| RTD | 100 ohm | 31-(CH1-10) | T230504 | 24 March 2024 |
| DATA LOGGER | 34970A | T114 | T230504 | 24 March 2024 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 50 Minute At 104 °C
Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available

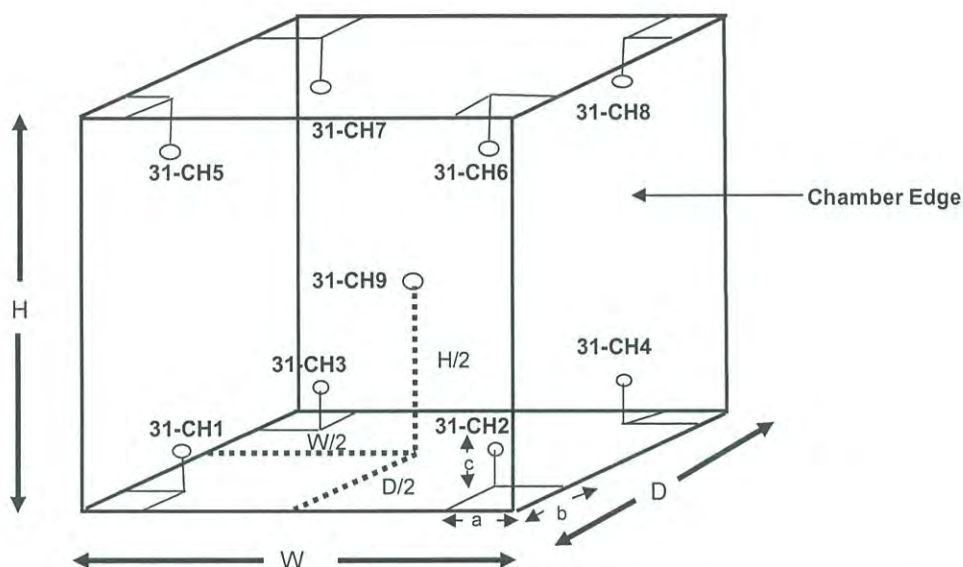
5. Adjustment :

(X) without adjustment

() after adjustment

Approved By. 

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 56 cm. H(Height)=41 cm. and D(Depth)=48 cm.

Size of Installed Standard sensor number 31-CH1 to number 31-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 31-CH9 : W/2=56 cm./2 H/2=41 cm./2 and D/2=48 cm./2

| Measurement Results | Average Standard Reading at each position (° C) | | | | | | | | |
|---------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point | 31-CH1 | 31-CH2 | 31-CH3 | 31-CH4 | 31-CH5 | 31-CH6 | 31-CH7 | 31-CH8 | 31-CH9 |
| 104 | 103.82 | 104.10 | 103.74 | 104.26 | 103.95 | 104.31 | 103.87 | 104.00 | 103.81 |
| 180 | 180.04 | 180.21 | 179.44 | 180.31 | 179.02 | 180.13 | 180.17 | 180.35 | 179.69 |

| Chamber (Oven) | | | Temperature Distribution | | | | |
|------------------|-----------------|---------|--------------------------|---------------------|--------------------|-----------------------|-------------------|
| Setting (° C) | Reading (° C) | | Average (° C) | Stability (± ° C) | Uniformity (° C) | Uncertainty (± ° C) | Coverage Factor k |
| | Min , Max | Average | | | | | |
| 104.0 | - | 104.0 | 103.98 | 0.14 | 0.60 | 0.42 | 2.00 |
| 180.0 | - | 180.0 | 179.93 | 0.35 | 0.78 | 0.53 | 2.00 |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 



Certificate of Calibration

| | | | |
|----------------------|--------------------|------------------|-------------------|
| Equipment: | CONDUCTIVITY METER | Certificate No.: | C24230292 |
| Model: | ORION STAR A215 | Issued Date: | 25 December 2023 |
| Serial No. (or ID.): | X58031 | Job No.: | WO-00012682 |
| Manufacturer: | Thermo Scientific | Page: | 1 of 2 |
| Electrode Serial No. | YV1-18416 | Model : | ORION 013005MD |
| Condition: | In Condition | Brand : | Thermo Scientific |

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

REVIEW BY Simluk P.
APPROVED BY AL AL
NEXT CAL DATE 25/12/24

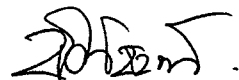
Environment Condition: Temperature 21.7 °C ± 0.1 °C
Humidity 53.7 %RH ± 0.1 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.. (Wet Chemistry Lab 2)
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Siwapan Srijan
Calibration Date: 25 December 2023
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 890590, 890591, 890592



(Mr.Siwapan Srijan)
Person in charge



(Mr.Nitinun Srihawan)
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 DKSH Technology Limited.

Calibration Results:
Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|-----------------------------------|-----------------------------------|-------------------------|--------------------------|-----------------------|
| 84.000 $\mu\text{S/cm}$ | 92.64 $\mu\text{S/cm}$ | -8.640 $\mu\text{S/cm}$ | 2.00 | 0.68 $\mu\text{S/cm}$ |
| 1413.0 $\mu\text{S/cm}$ | 1423 $\mu\text{S/cm}$ | -10.0 $\mu\text{S/cm}$ | 2.00 | 11 $\mu\text{S/cm}$ |
| 12.880 mS/cm | 12.81 mS/cm | 0.070 mS/cm | 2.00 | 0.10 mS/cm |

After Adjustment ; at 84.0 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$, 12.88 mS/cm

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|-----------------------------------|-----------------------------------|-------------------------|--------------------------|-----------------------|
| 84.000 $\mu\text{S/cm}$ | 84.03 $\mu\text{S/cm}$ | -0.030 $\mu\text{S/cm}$ | 2.00 | 0.68 $\mu\text{S/cm}$ |
| 1413.0 $\mu\text{S/cm}$ | 1414 $\mu\text{S/cm}$ | -1.0 $\mu\text{S/cm}$ | 2.00 | 11 $\mu\text{S/cm}$ |
| 12.880 mS/cm | 12.86 mS/cm | 0.020 mS/cm | 2.00 | 0.098 mS/cm |

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00012682

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|-------------------------------------|--------------------------|---|-------------------------------------|--------------------------|----------|
| 25 Dec 2023 | | | 25 Dec 2023 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | General | | | |
| <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 (ซองใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth) | <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"/> | |
| | | Spectrophotometer | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. ซองวัดหลายตัวอย่าง (Carousel Module) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | pH Meter and Conductivity Meter | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. อิเล็กโทรด (Electrode and Connection Cable) | <input checked="" 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. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Turbidimeter | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Automatic titrator | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 18. สภาพ 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"/> | |

ข้อแนะนำ :

Mr.Siwapan Srijan

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.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 24CG952

Page.: 1 of 2

| | |
|-------------------------|--|
| Equipment : | Burette |
| Capacity : | 50 mL |
| Serial No. : | - |
| ID. No. : | BKK_EN0171 |
| Manufacturer : | Witeg |
| Made in : | Germany |
| Submitted by : | ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand |
| Ambient Temperature : | (20 ± 2.5) °C |
| Relative Humidity : | (50 ± 10) % |
| Barometric Pressure : | 760 mmHg |
| Calibration Procedure : | ASTM E 542 - 01 |
| Calibrated by : | Natcha Chayyingcheiw |

Approved by :

Approved Signatory

- () Unnopphol Harachai
(✓) Srisuda Khamtha
() Sa-ngeunkam Wongsu

Issue Date :

27 February 2024

REVIEW BY *Siriluk P.*
APPROVED BY *Kank Auk.*
NEXT CAL DATE..... **27/08/25**

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 : 23 February 2024
Condition As-Received : New Item
Calibration Date : 27 February 2024
Reference : 2402-0757DSC-1

Cert.No.: 24CG952

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

| <u>Instruments</u> | <u>Model</u> | <u>Serial No.</u> | <u>ID. No.</u> | <u>Certificate No.</u> | <u>Traceability</u> | <u>Due date</u> |
|----------------------|--------------|-------------------|----------------|------------------------|---------------------|-----------------|
| 1) Balance | XP205DR | 1126143764 | 140RC004 | 23MM538 | TPA | 15 Sep 2024 |
| 2) Thermo-Hygrograph | THDX-CE | 00016540 | 140EC001 | 23H1275 | TPA | 09 June 2024 |
| 3) Thermometer | - | 0834181 | 140EC005 | 23I948 | TPA | 10 Aug 2024 |

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 |
|------------------------------------|---------------------------|---------------------------------|---------------------|
| 50 | 50.0032 | 0.010 | 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 %.

-o0o-



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024

| | |
|----------------|-------------------|
| REVIEW BY | <u>Kank Auk</u> |
| APPROVED BY | <u>Siriluk P.</u> |
| NEXT CAL. DATE | <u>06/06/25</u> |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|---------------|
| TC | TYPE T | TN161-TN170 | T230773 | 10 April 2024 |
| TC | TYPE T | TN171-TN180 | T230773 | 10 April 2024 |
| DATA LOGGER | 34970A | T149 | T230773 | 10 April 2024 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

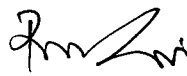
Time Constant 1 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

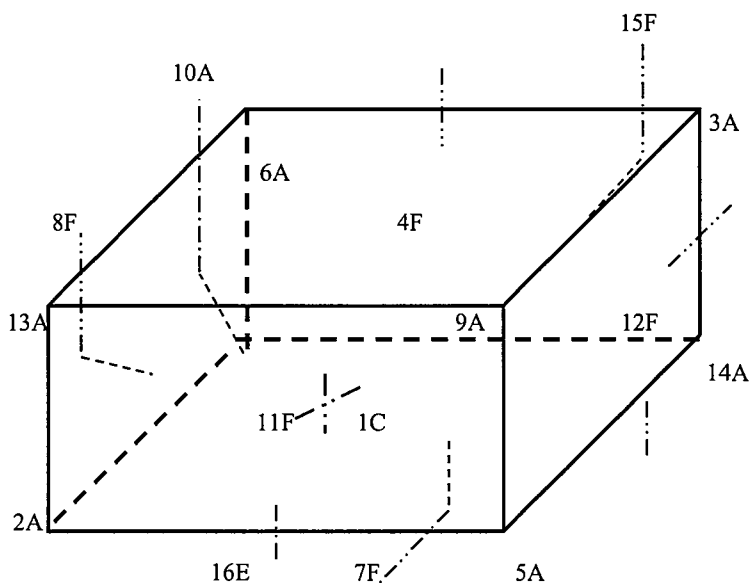
(X) without adjustment

() after adjustment

Approved By. _____



Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

| | | |
|-----|---|-------|
| 1C | = | TN161 |
| 2A | = | TN162 |
| 3A | = | TN163 |
| 4F | = | TN164 |
| 5A | = | TN165 |
| 6A | = | TN166 |
| 7F | = | TN167 |
| 8F | = | TN168 |
| 9A | = | TN169 |
| 10A | = | TN170 |
| 11F | = | TN171 |

| | | |
|-----|---|-------|
| 12F | = | TN172 |
| 13A | = | TN173 |
| 14A | = | TN174 |
| 15F | = | TN175 |
| 16E | = | TN176 |

Approved By. 

Certificate No. T232160

Page 4 of 4

Calibration Report

Measurement Results


| Calibration Point | Average Standard Reading at each position (°C) | | | | | | | | | | | |
|-------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | TN161 | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 | TN171 | TN172 |
| 3.0 | 2.83 | 3.34 | 2.95 | 3.46 | 3.45 | 3.76 | 3.25 | 3.46 | 3.39 | 3.50 | 3.58 | 3.42 |
| | TN173 | TN174 | TN175 | TN176 | | | | | | | | |
| | 3.33 | 3.39 | 3.15 | 3.43 | | | | | | | | |

| Chamber (Cooling Room) | | | Temperature Distribution | | | | |
|--------------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|--------------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
| | Min , Max | Average | | | | | |
| 3.0 | 2.8 , 4.1 | 3.5 | 3.36 | 1.10 | 2.00 | 1.90 | 2.09 |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

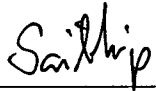
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250



TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW243

Page.: 1 of 2

Certificate of Testing

| | |
|---|--|
| Equipment : | DO Meter |
| Manufacturer : | YSI |
| Model : | 5000-230V |
| Serial No. : | 09J101147 |
| ID No. : | BKK_EN0017 |
| Received Date : | 15 November 2023 |
| Test Date : | 16 November 2023 |
| Reference : | 2311-0505DSC-4 |
| Submitted by : | ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand |
| Laboratory Condition : | Temperature (25 ± 5) °C Humidity (50 ± 20) % |
| Test Procedure : | In - house method : CP-CH9 by Comparison Technique with Azide Modification Method |
| Tested by : | Walalak Sirithean |
| Approved by : |  Approved Signatory |
| (<input checked="" type="checkbox"/>) Saithip Meangmai (<input type="checkbox"/>) Warakorn Lerngagtrakul (<input type="checkbox"/>) Ponpan Paipim | |
| Issue Date : | 17 November 2023 |

| | |
|----------------|---|
| REVIEW BY |  |
| APPROVED BY |  |
| NEXT CAL. DATE | 16/05/25 |



Cert.No.: 23TW243

Page.: 2 of 2

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).

| <u>Instruments</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------|-------------------|---------------|------------------------|-----------------|
| 1) Burette | - | 130BU10 | 23CG1172 | 22 Mar 2025 |
| 2) Balance | 1124013382 | 140RC006 | 23MM18 | 20 Feb 2024 |

2. Standard Material :-

| <u>Material</u> | <u>Manufacturer</u> | <u>Lot.No.</u> | <u>Assay</u> |
|---------------------------------|---------------------|----------------|--------------|
| Sodium Thiosulfate pentahydrate | Merck | AM1763316 | 100.2% |

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 16K100498

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|--|--|--------------------------------------|
| 8.18 | 8.18 | 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

-o0o-

Saitthip

a 1190297



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM192

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-230V

Serial No. : 09J101147

ID No. : BKK_EN0017

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : TPA Chemistry Calibration Laboratory

Received Order : 15 November 2023

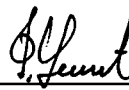
Calibrated Date : 16 November 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Kunchit Promprat

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 17 November 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 0060730



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2311-0505DSC-10

Cert. No.: 23LM192

Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 3240076 | 231305 | TPA | 15 Mar 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 16K100498

| <u>Calibration Point</u> (°C) | <u>Immersion Depth</u> (mm) | <u>Standard Temperature</u> (°C) | <u>UUC* Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage Factor</u> <i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 20.0 | 60 | 19.997 | 19.93 | -0.067 | 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 %.

-o0o-

Yeast

a 1190298

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 24T2852

REFERENCE No : 72619-8

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COOLED INCUBATOR

MANUFACTURER : MEMMERT

MODEL : ICP750

SERIAL No : F819.0021

ID No : BKK_EN0304

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN
RD., KHWANG PHATTHANAKAN, Khet Suan
LUANG, BANGKOK 10250, THAILAND

| | |
|----------------|-------------------|
| REVIEW BY | <i>finda K</i> |
| APPROVED BY | <i>Siriluk P.</i> |
| NEXT CAL. DATE | <i>30/03/25</i> |

CALIBRATED BY : CHAICHARN CH.CALIBRATION DATE : 20-Mar-24APPROVED BY : *[Signature]*
PONGSAK J.ISSUED DATE : 21-Mar-24RECEIVED DATE : 20-Mar-24



CERTIFICATE No : 24T2852

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COOLED INCUBATOR
MANUFACTURER : MEMMERT
MODEL : ICP750
ID No : BKK_EN0304
RECEIVED DATE : 20-Mar-24
AMBIENT TEMPERATURE : 26 °C ± 1 °C

S/N : F819.0021
CALIBRATION DATE : 20-Mar-24
RELATIVE HUMIDITY : 54 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

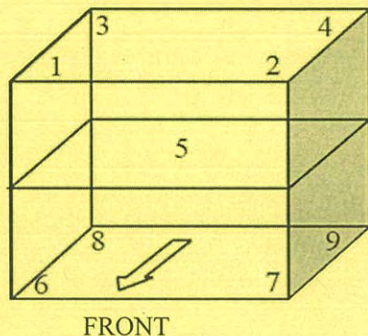
| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH TC TYPE K | HYDRA 2635A | 7286308 | 23T6641 | 14-Jul-24 |

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1

Overall Line Voltage (V) variation : 5

Instrument Condition : Normal

CHAMBER PERFORMANCE

| Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| 20.0 | 20.0 | 0.16 | 0.21 | 0.41 |

TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations | | | | | | | | | Uncertainty (±°C) |
|----------------------|----------------------|---|-------|-------|-------|--------|-------|-------|-------|-------|-------------------|
| | | #1 | #2 | #3 | #4 | Ref. 5 | #6 | #7 | #8 | #9 | |
| 20.0 | 20.0 | 19.88 | 19.93 | 19.87 | 19.86 | 19.98 | 19.94 | 19.94 | 19.89 | 19.91 | 0.42 |

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T232157

Page 1 of 4

Certificate of Calibration

Equipment : Hot Block
Manufacturer : Environmental Express
Model : B3000-240
Serial No. : 2021CODW148
Customer Code : BKK_EN0370
ID No. : T2940A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

| | |
|----------------|-------------------|
| REVIEW BY | <u>Kaek Aek</u> |
| APPROVED BY | <u>Siriluk P.</u> |
| NEXT CAL. DATE | <u>06/12/24</u> |

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

Customer Location : Wet Chemistry Lab2
Date of Receipt : 29 November 2023
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Boonchai / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 18 DEC 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T232157

Page 2 of 4

Calibration Report

Equipment : Hot Block
Date of Calibration : 6 December 2023
Environment : Temperature : 20.1°C-23.°C
Line Voltage : 222.1-227.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 29 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|---------------|
| TC | TYPE T | TN221-TN230 | T230546 | 10 April 2024 |
| TC | TYPE T | TN231-TN240 | T230546 | 10 April 2024 |
| TC | TYPE T | TN261-TN270 | T230548 | 10 April 2024 |
| DATA LOGGER | 34970A | T149 | T230546 | 10 April 2024 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 6 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By _____



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

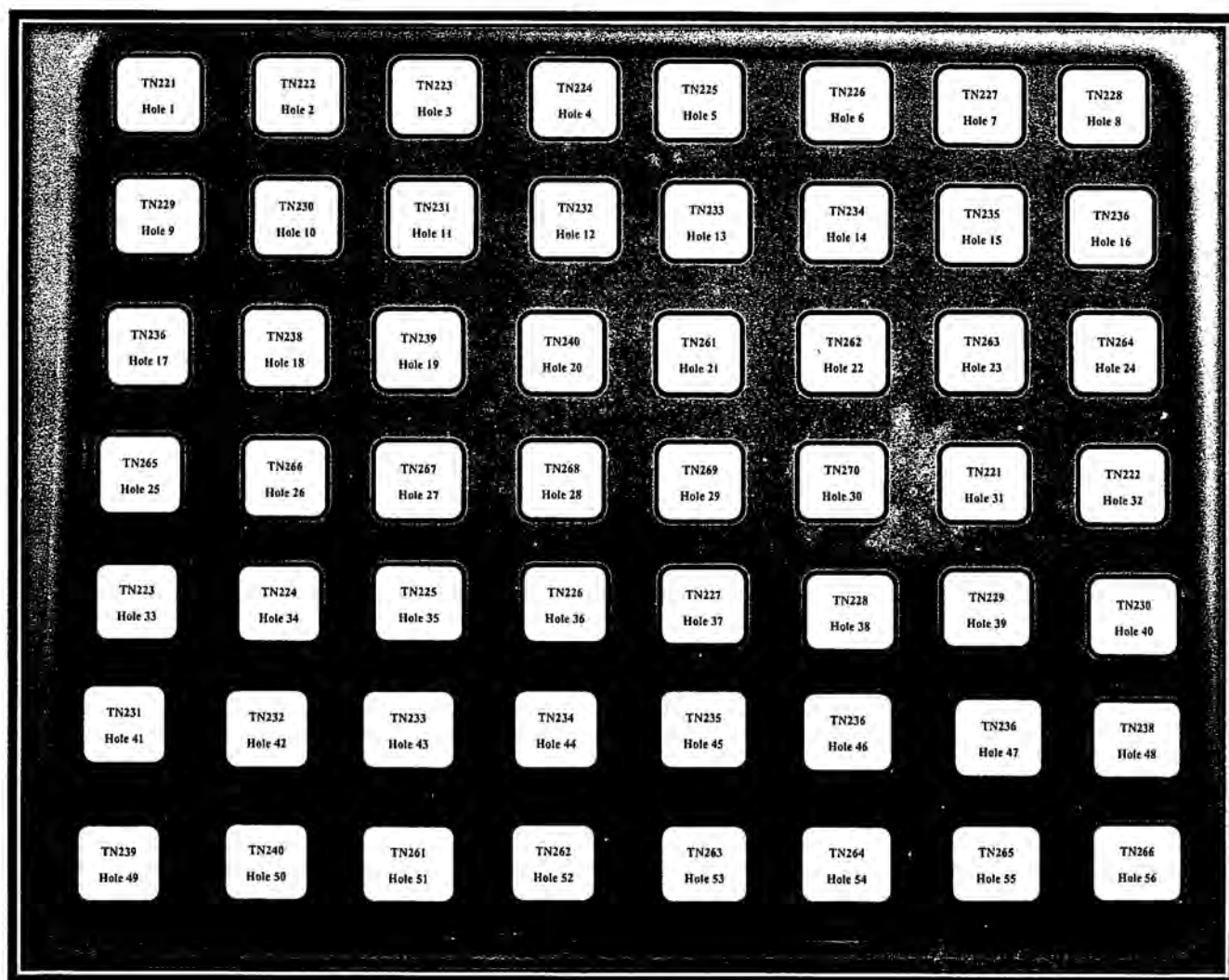
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th


Certificate No. T232157

Page 3 of 4

Calibration Report



FRONT CONTROL

Approved By 

Calibration Report

Measurement Results

| | | Average Standard Reading at each position (°C) | | | | | | | | | |
|-----------|---------|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | TN221 Hole 1 | TN222 Hole 2 | TN223 Hole 3 | TN224 Hole 4 | TN225 Hole 5 | TN226 Hole 6 | TN227 Hole 7 | TN228 Hole 8 | TN229 Hole 9 | TN230 Hole 10 |
| CAL POINT | Max | 150.32 | 150.09 | 149.98 | 150.99 | 150.95 | 150.44 | 149.89 | 150.22 | 150.53 | 150.88 |
| | Min | 150.10 | 149.85 | 149.69 | 150.71 | 150.66 | 150.21 | 149.67 | 150.06 | 150.30 | 150.66 |
| | Average | 150.09 | 150.49 | 150.49 | 150.44 | 150.26 | 150.24 | 150.36 | 150.32 | 150.38 | 150.77 |
| | | TN231 Hole 11 | TN232 Hole 12 | TN233 Hole 13 | TN234 Hole 14 | TN235 Hole 15 | TN236 Hole 16 | TN236 Hole 17 | TN238 Hole 18 | TN239 Hole 19 | TN240 Hole 20 |
| 150 | Max | 150.69 | 150.16 | 149.28 | 149.44 | 149.73 | 150.04 | 150.31 | 150.60 | 150.98 | 150.67 |
| | Min | 150.43 | 149.91 | 149.01 | 149.23 | 149.55 | 149.90 | 150.06 | 150.45 | 150.75 | 150.45 |
| | Average | 150.56 | 150.04 | 149.14 | 149.33 | 149.64 | 149.97 | 150.18 | 150.53 | 150.87 | 150.56 |
| | | TN261 Hole 21 | TN262 Hole 22 | TN263 Hole 23 | TN264 Hole 24 | TN265 Hole 25 | TN266 Hole 26 | TN267 Hole 27 | TN268 Hole 28 | TN269 Hole 29 | TN270 Hole 30 |
| | Max | 150.26 | 150.26 | 149.87 | 149.98 | 150.07 | 149.95 | 150.90 | 150.48 | 150.21 | 150.54 |
| | Min | 150.02 | 150.02 | 149.61 | 149.79 | 149.82 | 149.80 | 150.56 | 150.23 | 149.92 | 150.33 |
| | Average | 150.14 | 150.14 | 149.74 | 149.89 | 149.94 | 149.87 | 150.73 | 150.36 | 150.06 | 150.43 |
| | | TN221 Hole 31 | TN222 Hole 32 | TN223 Hole 33 | TN224 Hole 34 | TN225 Hole 35 | TN226 Hole 36 | TN227 Hole 37 | TN228 Hole 38 | TN229 Hole 39 | TN230 Hole 40 |
| | Max | 150.85 | 150.53 | 150.41 | 151.45 | 150.67 | 150.84 | 150.97 | 150.75 | 150.51 | 150.12 |
| | Min | 150.61 | 150.28 | 151.18 | 150.41 | 150.41 | 150.68 | 150.73 | 150.53 | 150.24 | 149.91 |
| | Average | 150.73 | 150.41 | 150.80 | 150.93 | 150.54 | 150.76 | 150.85 | 150.64 | 150.38 | 150.02 |
| | | TN231 Hole 41 | TN232 Hole 42 | TN233 Hole 43 | TN234 Hole 44 | TN235 Hole 45 | TN236 Hole 46 | TN236 Hole 47 | TN238 Hole 48 | TN239 Hole 49 | TN240 Hole 50 |
| | Max | 150.27 | 150.83 | 150.53 | 149.72 | 149.45 | 149.83 | 151.26 | 150.84 | 151.11 | 150.75 |
| | Min | 149.97 | 150.64 | 150.34 | 149.50 | 149.14 | 149.48 | 150.64 | 150.37 | 150.74 | 150.51 |
| | Average | 150.12 | 150.74 | 150.43 | 149.61 | 149.30 | 149.65 | 150.95 | 150.61 | 150.92 | 150.63 |
| | | TN261 Hole 51 | TN262 Hole 52 | TN263 Hole 53 | TN264 Hole 54 | TN265 Hole 55 | TN266 Hole 56 | | | | |
| | Max | 150.16 | 150.41 | 150.78 | 150.63 | 150.25 | 149.58 | | | | |
| | Min | 149.95 | 150.24 | 150.59 | 150.46 | 150.08 | 149.40 | | | | |
| | Average | 150.06 | 150.33 | 150.68 | 150.54 | 150.17 | 149.49 | | | | |

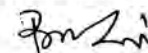
| Hot Block | | | Temperature Distribution | |
|--------------|---------------|---------|--------------------------|--------------------|
| Setting (°C) | Reading (°C) | | Stability (± °C) | Uncertainty (± °C) |
| | Min , Max | Average | | |
| 150.0 | 149.9 , 150.1 | 150.0 | 0.31' | 1.02 |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.



FM-L13 I08/30-05-57



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

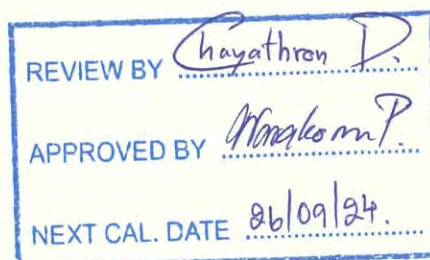


Cert.No.: 23CH1210

Page.: 1 of 2

Certificate of Calibration

| | |
|-------------------------|---|
| Equipment : | pH Meter |
| Manufacturer : | Mettler Toledo |
| Model : | Seven2Go S2 |
| Serial No. : | B647350528 |
| ID No. : | NKH_FS0028 |
| Condition As-Received: | Used Item |
| Received Date : | 25 September 2023 |
| Calibration Date : | 26 September 2023 |
| Reference : | 2309-0827DSC-2 |
| Submitted by : | ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand |
| 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) |



Calibrated by : Warakorn Lerngagtrakul

Approved by :

Saithip

Approved Signatory

- (☒) Saithip Meangmai
(☐) Warakorn Lerngagtrakul
(☐) Ponpan Paipim

Issue Date : 29 September 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 0058950



Cert. No.: 23CH1210

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

| <u>Instrument</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|--------------------------------|-------------------|---------------|------------------|-----------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 23E2802 | 27 Aug 2024 |

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

- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008 | CPA chem | 913598 | 14 July 2025 |
| pH 6.986 | CPA chem | 863833 | 28 Dec 2023 |
| pH 9.997 | CPA chem | 913600 | 14 July 2024 |

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 (\pm mV) | Coverage factor <i>k</i> |
|------------------------------|---------------|------------------------|----------------|-------|--|-----------------------------|
| | pH | mV | mV | pH | | |
| pH Meter S/N.: B647350528 | 4.00 | 177.48 | 177 | 4.00 | 0.58 | 2.00 |
| | 7.00 | 0.00 | 0 | 7.00 | 0.58 | 2.00 |
| | 10.00 | -177.48 | -178 | 10.00 | 0.58 | 2.00 |

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 (\pm) | Coverage factor <i>k</i> |
|-------------------------------|-----------------------------|-------------------|--------------------------|---|-----------------------------|
| pH Electrode S/N.: 2382803 | 4.008 | 4.01 | 192 | 0.0071 | 2.00 |
| | 6.986 | 6.99 | 20 | 0.011 | 2.00 |
| | 9.997 | 10.00 | -157 | 0.0095 | 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 %.

-o0o-

Saitlip



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM165

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor

Manufacturer : Metter Toledo

Model : Seven2Go S2

Serial No. : B647350528

ID No. : NKH_FS0028

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : TPA Chemistry Calibration Laboratory

Received Order : 25 September 2023

Calibrated Date : 29 September 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by :

Approved Signatory

() Pornthippa Tameyakul

() Ponpan Paipim

(☒) Suwit Imjai

Issue Date : 4 October 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.



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2309-0827DSC-4
Procedure Used :-

Cert. No.: 23LM165
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | A52847 | 22I1325 | TPA | 31 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 :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 2382303

| <u>Calibration Point</u> (°C) | <u>Immersion Depth</u> (mm) | <u>Standard Temperature</u> (°C) | <u>UUC* Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage Factor</u> <i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 25.0 | 100 | 24.999 | 25.0 | 0.001 | 0.16 | 2.00 |
| 30.0 | 100 | 29.998 | 30.0 | 0.002 | 0.16 | 2.00 |
| 40.0 | 100 | 39.999 | 40.1 | 0.101 | 0.16 | 2.00 |
| 50.0 | 100 | 50.001 | 50.1 | 0.099 | 0.16 | 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 %.

-o0o-



Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel. +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
Chanattagarn.lmchom@alsglobal.com
27603068

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

| | |
|--|--|
| Customer Purchase Order Number: | Customer Number: 70371013 |
| Service Request: | Service Request Date: |
| Service Order: 6006033911 | Service Confirmation: 6904800024 |

| | |
|---------------|-------------|
| REVIEW BY | Thitima B. |
| APPROVED BY | Sawitri M. |
| NEXT CAL DATE | 19 Sep 2024 |

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Agilent Technologies (Thailand) Limited, Head Office
U Chu Liang Bldg. 22/F Unit A,D
968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007 ,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6904800024

Service Confirmation Date: 20.03.2023

Service Instrument:

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|--------------|--|---------------|---------------|--------------|
| SYS-IO-5100 | ICP-OES 5100/5110 System | | | |
| G8010A | Agilent 5100 SVDV ICP-OES Spectrometer | MY16010005 | ICP OES 5100 | SYS-IO-5100 |
| G8410A | SPS 4 Autosampler | AU15440764 | ICP OES 5100 | SYS-IO-5100 |

Service Items:

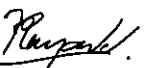

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 20.03.2023 | 20.03.2023 |

Additional Information:

Service Confirmation Number: 6904800024

Service Confirmation Date: 20.03.2023

Service Information:

| | | |
|--|--|-----------------------------|
| Problem Description: WU-S-OQ-IO-5100-5001143313 | | |
| Service Provided: Complete OQHW 5100ICPOES Equipment ID: BKK_EL0037, all tests passed | | |
| Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service | | |
| Reported Hours: 4.0 | Travel Hours: 2.0 | |
| Customer Field Service Representative Name: Kanyakorn Sukpathrajarern | Customer Field Service Representative Signature:  | Date: 20 Mar 2023 |
| Customer Name: Thitima Boonpeng | Customer Signature:  | Date: 20 Mar 2023 |
| Additional Comments: | | |

Certificate No. T231676

Page 1 of 6

Certificate of Calibration**Equipment : HEATING BLOCK****Manufacturer : Environmental Express****Model : SC 196****Serial No. : 6974CECW3285****Customer Code : BKK_EL0054****ID No. : T5306A3****Customer : ALS Laboratory Group (Thailand) Co.,Ltd.**

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab**Date of Receipt : 13 September 2023****Calibrated By : Sanee Musikawan (Site Calibration Manager)****Approved By :  / Sujjar Naknakred (Site Calibration Manager)****Date of Issue : 26 SEP 2023**

| | |
|----------------|--------------|
| REVIEW BY | Tattaporn C. |
| APPROVED BY | Saenit N. |
| NEXT CAL. DATE | 22/03/25 |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|-----------------|
| TC | TYPE T | TN21-TN30 | T230014 | 17 January 2024 |
| TC | TYPE T | TN31-TN40 | T230014 | 17 January 2024 |
| DATA LOGGER | 34970A | T151 | T230014 | 17 January 2024 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 20 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By _____





Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

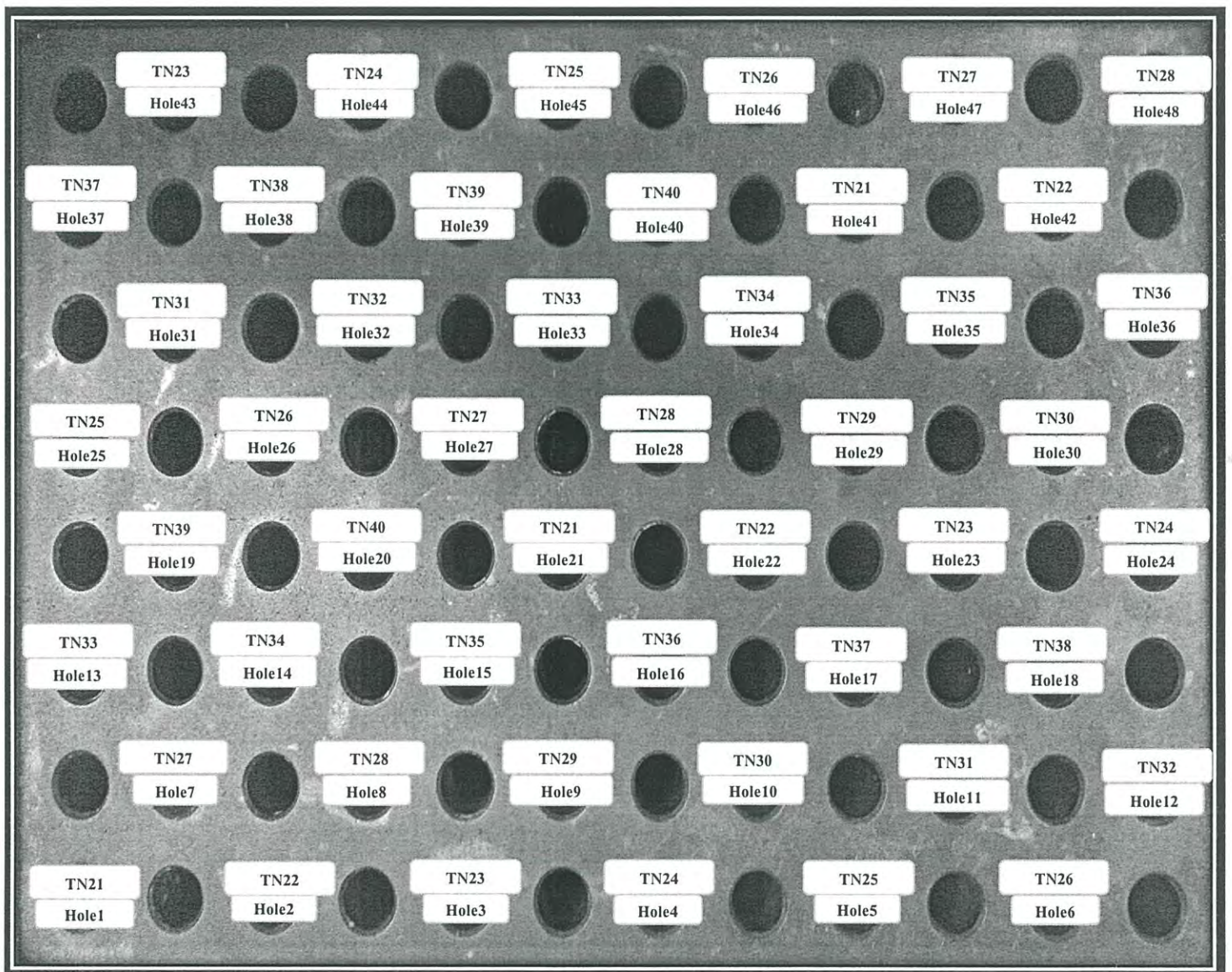
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 95.01 | 94.41 | 95.20 | 95.41 | 94.51 | 95.17 |
| 95 | Min | 94.57 | 93.95 | 94.75 | 94.92 | 94.00 | 94.72 |
| | Average | 94.79 | 94.18 | 94.98 | 95.17 | 94.26 | 94.95 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 95.36 | 95.43 | 95.19 | 95.16 | 95.35 | 94.97 |
| | Min | 94.94 | 94.95 | 94.72 | 94.71 | 94.90 | 94.57 |
| | Average | 95.15 | 95.19 | 94.96 | 94.94 | 95.13 | 94.77 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 95.37 | 95.50 | 95.22 | 95.21 | 95.33 | 95.31 |
| | Min | 94.99 | 95.09 | 94.78 | 94.82 | 94.88 | 94.96 |
| | Average | 95.18 | 95.30 | 95.00 | 95.02 | 95.11 | 95.13 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 95.59 | 94.42 | 94.52 | 94.24 | 94.63 | 94.67 |
| | Min | 95.21 | 94.06 | 94.13 | 93.88 | 94.28 | 94.27 |
| | Average | 95.40 | 94.24 | 94.33 | 94.06 | 94.45 | 94.47 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 95.19 | 95.38 | 92.93 | 95.30 | 95.14 | 95.03 |
| | Min | 94.83 | 95.03 | 92.56 | 94.95 | 94.79 | 94.70 |
| | Average | 95.01 | 95.20 | 92.75 | 95.12 | 94.96 | 94.87 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 94.63 | 94.90 | 94.77 | 94.31 | 94.24 | 93.87 |
| | Min | 94.24 | 94.55 | 94.44 | 93.98 | 93.92 | 93.56 |
| | Average | 94.43 | 94.72 | 94.60 | 94.14 | 94.08 | 93.71 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 94.30 | 94.44 | 94.04 | 93.81 | 94.89 | 95.35 |
| | Min | 93.95 | 94.05 | 93.67 | 93.48 | 94.39 | 94.90 |
| | Average | 94.13 | 94.24 | 93.86 | 93.65 | 94.64 | 95.12 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 95.99 | 95.63 | 95.28 | 95.29 | 95.45 | 94.87 |
| | Min | 95.57 | 95.15 | 94.82 | 94.84 | 94.99 | 94.48 |
| | Average | 95.78 | 95.39 | 95.05 | 95.07 | 95.22 | 94.68 |

Approved By. _____



Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 105.23 | 104.32 | 105.43 | 105.25 | 104.44 | 105.27 |
| 105 | Min | 104.94 | 103.95 | 105.15 | 105.04 | 104.11 | 104.96 |
| | Average | 105.09 | 104.13 | 105.29 | 105.15 | 104.28 | 105.12 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 105.30 | 105.12 | 105.18 | 105.22 | 105.12 | 105.16 |
| | Min | 105.11 | 104.92 | 104.96 | 105.00 | 104.92 | 104.97 |
| | Average | 105.20 | 105.02 | 105.07 | 105.11 | 105.02 | 105.06 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 105.37 | 105.63 | 105.02 | 104.80 | 104.69 | 105.19 |
| | Min | 105.17 | 105.37 | 104.75 | 104.59 | 104.50 | 105.00 |
| | Average | 105.27 | 105.50 | 104.88 | 104.69 | 104.60 | 105.09 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 105.31 | 104.43 | 106.41 | 104.71 | 105.63 | 105.82 |
| | Min | 105.08 | 104.22 | 106.15 | 104.41 | 105.37 | 105.56 |
| | Average | 105.19 | 104.33 | 106.28 | 104.56 | 105.50 | 105.69 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 104.95 | 106.26 | 103.34 | 105.78 | 105.59 | 105.87 |
| | Min | 104.67 | 105.96 | 103.08 | 105.56 | 105.36 | 105.68 |
| | Average | 104.81 | 106.11 | 103.21 | 105.67 | 105.48 | 105.77 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 104.75 | 104.86 | 104.80 | 105.20 | 104.50 | 104.39 |
| | Min | 104.54 | 104.63 | 104.59 | 105.00 | 104.32 | 104.18 |
| | Average | 104.65 | 104.75 | 104.69 | 105.10 | 104.41 | 104.28 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 104.30 | 104.90 | 104.85 | 104.65 | 104.88 | 104.85 |
| | Min | 104.09 | 104.72 | 104.66 | 104.49 | 104.63 | 104.52 |
| | Average | 104.19 | 104.81 | 104.75 | 104.57 | 104.76 | 104.68 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 105.71 | 105.85 | 105.39 | 105.61 | 105.42 | 105.19 |
| | Min | 105.45 | 105.61 | 105.14 | 105.27 | 105.18 | 104.94 |
| | Average | 105.58 | 105.73 | 105.27 | 105.44 | 105.30 | 105.07 |

Approved By. _____



Certificate No. T231676

Page 6 of 6

Calibration Report

Measurement Results:

| HEATING BLOCK | | | Temperature Distribution | |
|----------------|----------------|---------|--------------------------|----------------------|
| Setting (°C) | Reading (°C) | | Stability (± °C) | Uncertainty (± °C) |
| | Min , Max | Average | | |
| 100.0 | 100.3 , 100.5 | 100.4 | 0.26 | 0.81 |
| 107.0 | 107.0 , 107.1 | 107.1 | 0.19 | 0.78 |

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____



Agilent Technologies

Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel. +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
bounced-imchom.chanattagarn@alsglobal.com
227158760519

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

| | |
|--|--|
| Customer Purchase Order Number: | Customer Number: 70371013 |
| Service Request: | Service Request Date: |
| Service Order: 6006068207 | Service Confirmation: 6904837529 |

| | |
|----------------|-------------|
| REVIEW BY | Anchalee K. |
| APPROVED BY | Santana N. |
| NEXT CAL. DATE | 06/10/2024 |

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Agilent Technologies (Thailand) Limited, Head Office
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968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6904837529

Service Confirmation Date: 06.04.2023

Service Instrument:

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|--------------|-----------------------------------|---------------|---------------|--------------|
| SYS-IM-7900 | ICPMS 7900 System | | | |
| G8410A | SPS 4 Autosampler | AU15430722 | ICP MS 7900 | SYS-IM-7900 |
| G8411A | ISIS 3 for Agilent 7850/7900/8900 | JP15510227 | ICP MS 7900 | SYS-IM-7900 |
| G3292A | PSC 6106T Chiller | 2U15A1948 | ICP MS 7900 | SYS-IM-7900 |
| G8403A | Agilent 7900 ICP-MS | JP15471169 | ICP MS 7900 | SYS-IM-7900 |

Service Items:

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 06.04.2023 | 06.04.2023 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

Additional Information:

Service Confirmation Number: 6904837529

Service Confirmation Date: 06.04.2023

Service Information:

Problem Description:

WU-S-OQ-ICP MS 7900-5001143313

Service Provided:

Test OQ control of instrument ICPMS = BKK_EL0043. After done all instrument test all Pass.

Service Overview Code:

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

Reported Hours:

6.0

Travel Hours:

1.0

**Customer Field Service
Representative Name:**

Panthep Kurasathain

**Customer Field Service
Representative Signature:**



Date:

06 Apr 2023

Customer Name:

Anchalee Khamjan

Customer Signature:



Date:

06 Apr 2023

Additional Comments:



**Scientist
Instrument**

| | |
|----------------|------------|
| REVIEW BY | Chanath Y. |
| APPROVED BY | Sauntan N. |
| NEXT CAL. DATE | 6/12/24 |

Performance Verification Certificate for Mercury Analyzer

PRODUCT ID *Quicktrace M-8000 , Teledyne Leeman Labs*

Equipment ID *BKK_EL0128 Mercury Analyzer
S/N: US22133002*

*BKK_EL0129 Autosampler
S/N : 052222A560*

Customer Name *ALS Laboratory Group (Thailand) Co., Ltd.*

Address *104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang
Bangkok 10250 Thailand*

Date of Qualified *December 6, 2023*

Next Due date *December 6, 2024*

This certifies for products which was performed in acceptable criteria specifications

| | |
|--|---------------|
| Autosampler & Sample Introduction | PASSED |
| Analyzer | PASSED |
| Gas Liquid Separator & Dryer | PASSED |
| CVAFS Detector | PASSED |
| Electronics/Mechanical | PASSED |
| Data station/PC | PASSED |
| Analytical test | PASSED |

Provided by

Scientist Instrument Co.,Ltd.
113 Soi Ekachai 44, Ekachai Road
Khlong Bang Phran, Bangbon
Bangkok 10150 Thailand

Certified by *Thunraphol Sakdayos*
Thunraphol Sakdayos

Service Engineer